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BLOCK 5: A FUTURE BASED ON TECHNOLOGY

PAPER #5.01

MAPPING THE CITY: DATASCAPE AS A TOOL FOR REPRESENTING THE INVISIBLE

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ABSTRACT

Being an abstract system that translates and reconstructs the real phenomena, map had a long history of recording and interpreting the data. Practiced with different techniques in different periods and contexts, it has always been considered as a preeminent way of collecting, organizing and representing the data. However, map also inherits the potential of representing more than the reality and denotes new and unacknowledged conditions, which initiate the use of maps as generative tools that mediate between real and possible configurations.

Advances in technology and the use of digital design tools initiated a radical shift in communication and mapping techniques, which enabled to acquire, interpret and use complex data. Defining a shift in the conventional mapping practices, this contemporary approach of working with big and complex data engages with what is 'unknown', 'invisible' or 'discreet'. This shift necessitates the acknowledgement of alternative ways of examining and conveying information as well as its visualization. 'Datascapes' are considered as multilayered and multidimensional representations of complex data, which not only represent the data visually or numerically, but also inherit a particular 'eidetic argument'. Since they hold the data in an interpretative manner, they stimulate the designer's creativity and opens up new grounds for explorations. However, datascapes are not static representations confined with the two dimensional representation medium, rather may be configured and represented in various forms, which can be updated simultaneously and result in ephemeral maps of complex matters. These maps can represent the ever-changing relations and ever-expanding data, and can be used to map the visible and invisible data of the contemporary city.

KEYWORDS

Mapping; datascape; representation.

INTRODUCTION

Being an abstract system that translates and reconstructs the real phenomena, map had a long history of recording and interpreting the data. Practiced with different techniques in different periods and contexts, it has always been considered as a preeminent way of collecting, organizing and representing the data. Besides its conceptualization as a visual instrument (Corner, 2011) for annotating and exposing the information in an organized and readable manner, map is also embraced as a tool for reading the visible or invisible information.

Although associated mostly with the graphical representation of a city, maps are also used for understanding things, conditions, processes or events (Harley and Woodward, 1987), which facilitates their use as tools rather than mere graphical representations. Going beyond the reproduction of a bird eye view of the city that provide layers of geographical information, maps help to understand the complexity of the urban conditions and provide different layers of data. Mapping practices that achieve the graphical integrity and consistency of data interpretation enable the understanding of

existing relations and realities of the situation/site/event/processes through various layers of information sets.

However, a map also inherits the potential of representing more than the reality and denotes new and unacknowledged conditions, which initiate the use of maps as generative tools that mediate between real and possible configurations. James Corner identifies mapping as a creative activity, which both reveals and realizes the hidden potential through uncovering realities, even the unseen or unimagined ones (Corner, 2011). Practices that consider the map as a creative tool for reading and understanding the conditions, rather than an operational tool of measuring or defining the existing conditions has the potential of activating new readings. Corner differentiates these two approaches and in reference to the statements of Gilles Deleuze and Felix Guattari, he labels the maps that reproduce the already known and visible as *tracings* (Corner 2011). In his main reference for this differentiation Deleuze and Guattari states that: 'What distinguishes the map from the tracing is that it is entirely oriented toward an experimentation in contact with the real. The map does not reproduce an unconscious closed in upon itself; it constructs the unconscious' (Deleuze and Guattari, 2004)

Therefore, in order to reveal the potential of the map and to use it as a productive instrument, it is necessary to go beyond the routine of collecting, recording, assembling and representing the visible conditions and to appreciate the reading of the invisibles. Overcoming the limitations of the tracings and activating the new readings that reveal the invisibles enrich the mapping practices and expose the potential of a map as an operational and creative instrument.

1. CONTEMPORARY DRIVES

Advances in technology and the use of digital design tools also support the conceptualization of the map as a creative instrument, which embraces and exposes the invisibles in mapping practices. The radical shifts in communication and mapping techniques, as well as increased capabilities of gathering, storing and processing information enabled to acquire, interpret and use complex data. Altering the conventional mapping practices, this contemporary approach of working with big and complex data engages with what is 'unknown', 'invisible' or 'discreet'. This shift necessitates the acknowledgement of alternative ways of collecting, processing and conveying information as well as its visualization.

Computers and their variances are embedded the in all aspects of our lives in the recent years as a consequence of the miniaturization of the computer hardware, maximization of computational and storing capabilities of computers, expansion of network capacities, as well as the development of communication manners. Urban environments are occupied with data collectors, processors and archives, where huge amount of data is made accessible and visible to the society and the designers. Immersed with these abilities, the contemporary city gains the ability of storing and sharing its data through various layers. Massive amount of data is stored, processed and conveyed continuously since the cities are generating new and fresh data in an increasing speed and variety. The complex and big data accessed and processed by the advanced use of technology should be mapped to reveal the multidimensional view of the cities, either visible or invisible.

However, reconceptualization of mapping can be defined both as a revised practice, which is diversified with huge amount of data entry, and also can be considered as an instrument for dealing with the massive data exceeding the limits of human cognition and perception. This paper specifically focuses on the practices where mapping is used as a way of visualizing and understanding data. Through questioning how the data-driven mapping

practices of the recent years changed our definition, understanding and visualization of the city, it is aimed to discuss whether or how they differ from the conventional mapping practices. Considering the conventional and contemporary mapping practices, it is possible to assert that all mapping practices are defined though a process of gathering and interpreting objective or subjective data. However, the contemporary practices that are dependent more on the digital tools and computational capabilities of humans and devices can be asserted to provide deeper insights to the city and the actors involved in it.

The amount of available and operational data defines a dramatic shift in how humans understand, define and visualize the cities. However, changes defined through the use of data are not only in city scale and has affected all sections of the life, as data has become the 'de facto standard through which the world is ordered and understood' (Boyd and Crawford, 2012). The current tendency of understanding the world (cities, science, business etc.) and human through the data -mainly through the big and incomprehensible amount of data- necessitates the extension of humans perceptive and cognitive capabilities, which results in significant changes in the society. Although the increasing tendency for rendering the world through numbers is an ever-present debate (Scott, 1998), the scale of current data sets defines a radical change in the society and hence should be handled with a different mind set. Witnessing the difficulties of dealing with the complex and big data necessitates the adoption of a new mind set and instrumental approach, since the conventional approaches will not be effective in dealing with the multidimensionality of the large data sets.

With a specific emphasis on the city mapping practices, it can be stated that gathering, processing and visualizing the multidimensional and huge amount of data gathered and processed with the contemporary tools and models enables to focus on which was not visible in the conventional maps. During the recent years, it is aimed to work with the *unacknowledged* features of the city and introduce them as another layer of the multidimensional maps defined through the use of technological advances (Amoroso, 2015). However, such an approach to expose the city with its *visible* and *invisible* features necessitates an alternative mapping technique. Since these maps are not expected to only document the existing but also bring the invisible information to the forefront and make it visible, they should be open to unpredicted readings and interpretations (Amoroso, 2015). Hence, they should be structured different than the static and flat conventional maps and should be flexible enough to gather new data, host its interaction with other data sets and sustain its visualization.

Making use of technological advances and new modes of visualization, alternative readings can be provided through the integration of large sets of data, which in turn can also be embraced to understand these data sets. Therefore, attaining the flexibility of the map gains importance, when the continuous input from the city and its actors are considered. Since the data provided by and within the city is continuously changing and this change can be recognized, gathered, recorded by the technological habitat of the city, the mapping is also altered continuously and is never finalized. The maps defined through the computational tools and processes can represent the ever-changing relations and ever-expanding data, and can be used to map the visible and invisible data of the contemporary city.

2. AN ALTERNATIVE MAPPING_Naked City

The search for mapping the invisible features of the city or studying with unsteady and ever changing data is not specific to the contemporary approaches of the digital world. Rather, there have been various attempts of mapping the invisible, unstable, subjective and ever changing information. These maps were also questioning the available techniques of mapping and were proposing ways of widening the visual perspective to be able to visualize and manage information. A specific example of this search, which is also consider by many references as a critical shift in the history of mapping, is the concept of psycho-geographic mapping studied by Guy Debord.

Guy Debord was a key figure of Situationist International, which was an interdisciplinary organization active in Europe in the mid-20th century attempting to return the map to everyday life and to the unexplored, repressed topographies of the city (Corner, 2011). Debord defined psychogeography as: "the study of the specific effects of the geographical environment…on the emotions and behavior of individuals" (Debord, 2008) and made a series of studies on the Paris map, which were not mere representations of the cityscape. Rather, Debord's studies were reflecting the subjective inputs such as perceptions and desires of the human. *The Naked City* map was produced in 1957 by Debord through taking nineteen sections from the original map of Paris, which were reassembled in a subjective manner considering the experience and the desires of the human. Defining this work as a construct that creates a synthesis between the existing conditions and the human experience, Debord also added red arrows to the map (printed in black ink), which illustrate the "spontaneous turns of direction" between the fragments (McDonough, 1994). The fragments and the turns are all defined according to the personal experience of Debord when he wandered along the streets and alleys of the city, defining his own path through turning here and there (McDonough, 1994). Therefore, the arrows together with the fragments- reflect the desires and experience of the human through the city. The produced map is an ephemeral, subjective and personalized one, where the invisible desires and experience of the human is brought forth and opened up new discussions on different aspects of the city ranging from politics to perception.

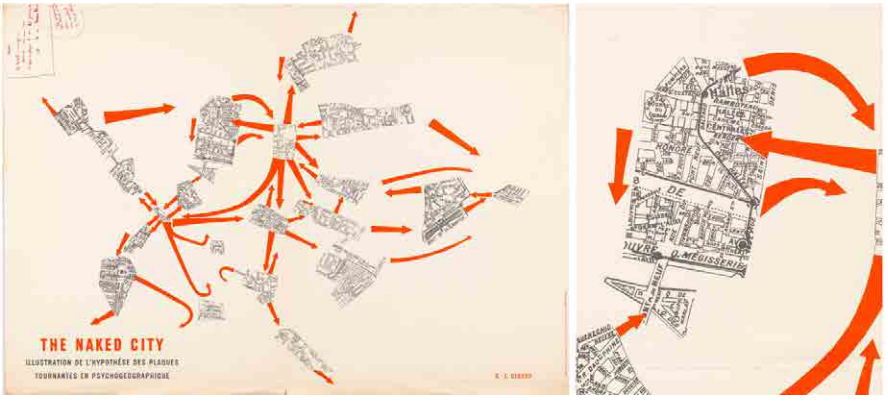


Figure 1. The Naked City map produced by Guy Debord. (1957)

3. DATASCAPES

Guy Debord's approach of considering the fluidity of the city and bringing forth its unknown features dependent on the personal and subjective inputs, initiated the studies that aim to define a deep awareness of the unquantifiable and immaterial qualities of the city. James Corner defines this approach as a creative one and outlines mapping as a process of a strategic and imaginative drawing-out of relational structures, rather than an indiscriminate listing and inventorying of conditions as in a tracing, table or chart (Corner, 2011).

Considering the complexity of the city and the relationship between the city, citizens and the society, the maps are expected to represent the dynamic relationships of the city. For that reason, they are structured to collect, interpret and represent the subjective inputs and experimental data through its multiple layers, besides the objectively constructed data through numeric and quantitative values. In this approach, maps are conceptualized as creative processes, which enable to collect, process and represent various types of data.

One significant development that initiated a radical shift in mapping processes and supported their definition as creative processes is the advances in technology and the use of digital design tools, which enabled to acquire, interpret and use complex data. Over the past few decades, maps have been re-conceptualized to support the creative processes through using the advantages provided with the digital media and computational abilities. Their further development can be asserted to initiate new techniques and definitions of mapping and widened the capabilities of the designer to investigate and interpret the urban data. Defining a shift in the conventional mapping practices, this contemporary approach of working with big and complex data engages with what is 'unknown', '**invisible**' or 'discreet'. These 'new' maps, which enable the representation of the invisibles of the city through the multilayered data, are considered as alternative approaches that re¬-vision and rethink the mapping and urbanism of the contemporary city (Amoroso, 2010).

This shift necessitates the acknowledgement of alternative ways of examining and conveying information as well as its visualization. 'Datascapes' are considered as multilayered and multidimensional representations of complex data, which not only represent the data visually or numerically, but also inherit the potential of influencing the mapping and design processes (Lootsma, 1999). Therefore, datascapes hold the potential to go beyond statistical descriptions and serve as creative grounds for designers. James Corner describes datascapes as representing "objectively" constituted data through numbers, quantities or facts in knowingly selective ways to construct or suggest new spatial formations (Corner, 1998). He differentiates datascapes from the quantitative maps and states that 'they are designed not only to reveal the spatial effects of various shaping (eg, regulatory, zoning, legal, economic, and logistical rules and conditions), but also to construct a particular eidetic argument" (Corner, 1999). Questioning the quantitative and creative potentials of mapping, the term eidetic is used by Corner to discuss the works that represent and mimic the reality and the ones triggering the creativity. He defines eidetic as referring "to a mental conception that may be picturable, but may be equally acoustic, tactile, cognitive, or intuitive" which is "unlike purely retinal impressions of pictures, eidetic images contain a broad range of ideas that lie at the core of processes of creativity" (Corner, 1998) Through point out the potential of eidetic conditions to engender, unfold and participate in emergent realities, Corner underlines their stimulating power for creativity.

Referring to WJ. T. Mitchell's comparison of a picture and an image, where the difference between a specific kind of visual

representation (the 'pictorial" image) and an image (verbal, acoustic, mental images) were discussed, Corner identifies the maps as images holding eidetic arguments (Corner, 1999). Through these arguments, the designer can both represent the reality and also reformulate given conditions, which may lead to new interpretations and innovative solutions (Corner, 1999). Since these eidetic arguments facilitate the subjective inputs introduced of the designer, they enable and welcome alternative reading and interpretations of the conditions. With this potential, they differ from the mere visual representations of quantitative maps and enable the *imaging* of data in instrumental ways (Corner, 1999).

Use of digital medium also affected its instrumental use and enabled multi-layered and continuous data input, which enable to render complex interrelations and interactions. They are not static representations confined with the two-dimensional representation medium, rather may be configured and represented in various forms. They can represent the ever-changing relations and ever-expanding data, which can be updated simultaneously and result in ephemeral maps of complex matters. They also hold the data in an interpretative manner, which stimulate the designer's creativity, enable they future readings and open up new grounds for explorations.

In the late 1990's, when the influences of the shifts defined through the use of digital medium and increased computational capabilities were asking for reassessment of the tools and approaches in use, Dutch architectural firm MVRDV questioned the conventional mapping processes and experimented on datascaping. Their approach to map the urban phenomena through datascaping was a provocative one, which extended the definition of mapping through the use of digital medium. In their publication Metacity/Datatown, MVRDV questioned the contemporary conditions of the city and the inadequateness of the ways used by designers to understand the data provided by the city that exceeds the perception and comprehension of the human. Considering a fictional and extreme scenario, where the current population of the Netherlands was multiplied to increase the data produced by the city, they studied data of the city and / city as data. Through using the qualitative

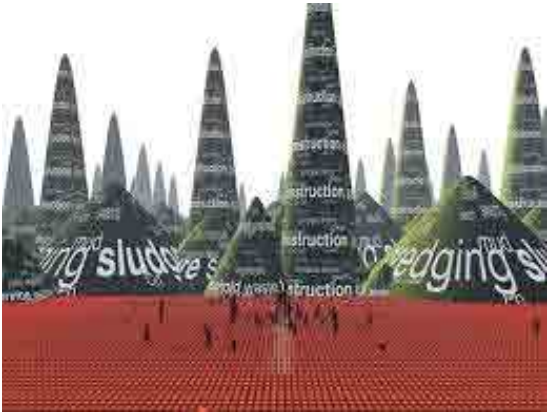


Figure 2 (left). One large red cube is created measuring over one and half kilometers on edge to represent a massive volume that would contain all the inhabitants of Datatown.
Figure 3 (right). Landscaped datascapes, created by waste emerge as hills and mountainous forms, which create a new landscape.

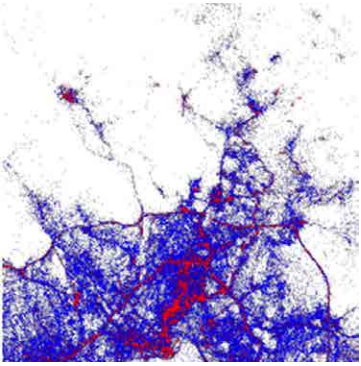
(visual approaches) to signify the quantitative (numerical data) data, MVRDV studied the scenario in two scales where Metacity relates to the whole world and Datatown relates to the Netherlands (Amoroso, 2010). The data gathered through the analysis of the spatial, social and economic consequences of the proposed population was studied both numerically and visually (Amoroso, 2010). Statistical analysis and use of numerical expressions were considered as essential tools to grasp the complexity of the data available, document and process it. However, the visual expression of these numeric values to attain a comprehensible form that abstracts the multiple layers of data in a powerful and yet informative way and also stimulates the creativity of the process. The visual images produced in Metacity/Datatown project can be considered as eidetic arguments, which initiate future scenarios of the city through imaging the statistical data in visual form. In this respect they are differentiated from the conventional maps, which picture the reality through representations.

Considering the uncanny relationship of the maps with real, where they are defined to be abstractions, that initiate new conditions and reading, datascapes provided by MVRDV can also be regarded as maps (Amoroso, 2010). Through considering the extreme scenarios producing complex and multidimensional data, these datascapes deal enable to translate the changing conditions and make future reflections on the urban situations. Processed digitally, these datascapes both reflect the reality and also define an uncanny relationship with the real, which liberates the designer to make predictions, speculations and new readings.

With the increased computational capacity of the twenty first century, map designers also integrated subjective and experience based data, which can be considered as a consequence of the conception of city as a multi-layered entity. Rooted from the experience based maps of Situationists, the contemporary maps have the potential of being datascapes representing not only the visibles and invisibles of the city as a physical object, but also consider it as a complex and emergent system generated through dynamic relations (Urry, 2005). In this system, the data of the human also gains importance, since they are one of the actors of these dynamic relations. These mapping practices ¬-that consider the experiences of the humans and consider the data provided by them within the multiple layers of the map- inherit the potential of providing new readings of the city. They enable to draw the invisibles of the city and explore its immaterial and embodied data.

One significant example of these experimental maps is produced by Eric Fischer, which visualizes the relationship between the social media posts and the location of the author. Introducing Geotagger's World Atlas project, Fischer aims to uncover how people interact with the cities and uses geo-tagged photographs of the cities or tweets in social media. Focusing on a specific period, Fischer attains a huge amount of data to be visualized, which provided the invisible interaction patterns and new data layers of the cityscapes.

Such practices enable to draw the invisibles of the city and explore its immaterial data, which focuses on the relationship between the individual and the city. These subjective mapping practices can also be considered as datascapes, since the datascape holds the flexibility of holding any kind of related with geography, sociology, economy, traffic or personal inputs. They highlight the subjective input from the human and investigate the relationship between the human and the space through analyzing the subjective aspects related with space (emotions, memories, personal experiences etc.) (Perkins, 2009). These practices benefit from the visual power of the mapping to abstract and comprehend the data, communicate with the designer/reader and to initiate new readings of the relations. The data provided



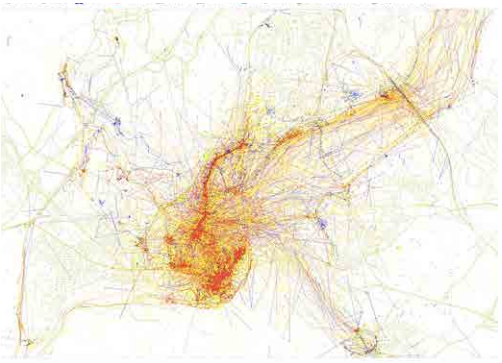


Figure 4 (left). The map visualizes the tweets of residents in İstanbul (identified with blue spots) and out-of-towners, namely the tourists (identified with red spots).
Figure 5 (right). The map visualizes the photographs shared by of residents in İstanbul (identified with blue spots) and out-of-towners, namely the tourists (identified with red spots), where yellow one might be either.

by the subjective definition may reveal the invisible relations, evoke unexpected readings and produce visual images triggering the creative processes of mapping. This aim of investigating the relationship between the human and the city, recalls the psychogeographic maps of Situationists, where it is possible to trace the similarities between these two approaches and define the datascapes including subjective data inputs as arrays of these psychogeographic maps.

With all types of data input the maps turns out to be multilayered and represent the collective invisibles of the society. Since the data becomes available and accessible with the advances in technology, its use in various phases of design and decision-making processes increase significantly. This change in the state of data enabled to map the geospatial data collected from the users, which diversifies the subjective inputs to the datascape and also shift the scale of the data set drastically. Compared to the psychogeographic maps of Situationists, where one or a limited number of subjective data were mapped, contemporaray studies hold the potential of gathering, analyzing and visualizing data provided from various subjects.

An up-to-date example of this approach is provided by Bits'n Bricks office where location mining and web scraping were used to gather data in urban scale for İstanbul. Collecting the publicly avaliable data retrieved from the urban sources they collected the data of the shared images by tourists (through their Flickr accounts) in İstanbul and tried to map the attraction points (Bits'n Bricks) They also provided an association between the routes provided by mobile map applications and the attraction point-instagram post maps (Figure 6). The produced maps read the geospatial data and provide insight on the visibles and invisibles of the city.

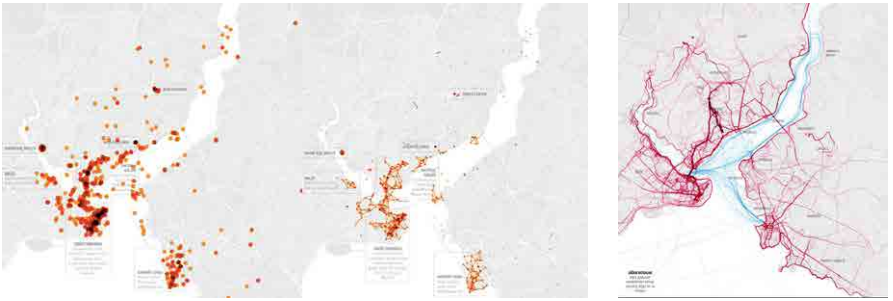


Figure 6. Mapping the attraction points for tourists in Istanbul, through processing the data provided by shared photographs.

CONCLUSION

Contemporary mapping practices that make use of the advances of the technology enable to gather, process, and visualize huge amount of data, where the ubiquitous data production feeds the dataset simultaneously and continuously. In line with the developments in the technology, changing lifestyles also motivates us to produce and share the data and hence become a part of the big data pool. Continuous update of the data sets to be considered in mapping also changes the validity of the mapping, since it evolves with the data input. Their short-term validity can be considered as an important shift, since the arguments and representations expire rapidly. These shifts in the definition and use of data necessitate the reconsideration of conventional mapping techniques to respond to these changes. Although alternative mapping techniques have been applied throughout the history, the experienced shifts request a different mindset and processes to be use in mapping practices.

In order to develop a new approach that may enable to understand how the city functions in line with its citizens, the conventional mapping practices should be updated to hold multiple layers of information; including the unexplored, speculative and subjective ones. These multi-layered studies necessitate going beyond being mere visual representations of the existing realities and trigger creative processes and initiate interpretations of the data sets. However, the gathered data from the collective and multiple sources are usually raw data, which has to be filtered, organized, categorized and read, which requires an interdisciplinary group of expertise. Therefore, mapping cannot be an individual practice but should be considered as a process guided by a group of experts.

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PAPER #5.02

INTEGRAL DESIGN FOR URBAN TRANSFORMATION TO A SMART CITY CORE

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ABSTRACT

Urban unities of sustainable development may act as transformers of knowledge and technological advancement achieving thus improved social, working and living conditions to their inhabitants. A representative case study of such development refers to the design proposals made in Spring Semester 2017, in the frame of the design studio with an emphasis on technology in the 6th semester of undergraduate studies in Architecture at the University of Cyprus. The design objectives referred to the regeneration of a unified core of Nicosia through the creation of flexible building units of industrial research and technological development, envisioned to act as urban transformers and interaction nodes with the local and global communities of labour, research and production. The presently existing decentralization of the city, as well as the diversity of social groups, lack of production, labour and green areas within the city core have so far led to unfavourable conditions with regard to a respective sustainable urban, architectural and social development of the old city centre. Nine design proposals presented in the current paper refer to timely variant activations of the city core bridge connections with the new city areas, aiming at the transformation of the city core into a smart urban area. The building units are expected to provide flexible and multi-use spaces, where different researchers may work at different time periods. Pedagogically, of equal high importance was the design requirement for the proposed buildings to comprise symbolically prototypes of technological development of respective activities and tectonic structures, while displaying the interrelated areas of function, construction and energy efficiency. The study further demonstrates that different activation scenarios of the buildings and the interactions with the city-core flows of activities are possible.

KEYWORDS

Urban regeneration; smart cities; urban and building transformability; architectural technology; integrated architectural design.

INTRODUCTION

Smart cities have become a landmark in urban planning. They are the result of knowledge-intensive and creative strategies aiming at enhancing the socio-economic, ecological, logistic and competitive urban performance. Smart cities are based on a promising mixture of human capital (e.g. skilled labour force), infrastructural capital (e.g. high-tech communication facilities), social capital (e.g. intense and open network linkages) and entrepreneurial capital (e.g. creative and risk-taking business activities).
Central paradigm of urban transformations to smart regions is the provision of innovation through networking. The key driving force of technological and economic progress essentially depends on cooperation and interaction between firms and different scientific and societal institutions. Such cooperation forms and the associated

personnel and information technological interaction are generally termed "network" (Sydow, 1992), primarily based on the concept of local or regional sustainable developments of so-called regional milieux (Läpple, 2001). The latter can be described as spatial production and actor systems characterised by collective learning processes. For urban development processes, milieux are primarily amplifiers of the city life and productivity. These can generate synergies and thus strengthen regional innovative resources (Läpple, 1994). In this frame, innovation processes are enhanced by local and global cooperation activities among individual research and development institutions and by the specific embedding of operations in the common urban context.

Research and development institutional knowledge-exchange links are important for increasing a city's knowledge economy (Acworth, 2008). In this framework, local proximity and geographic clusters have been important determinants in creating innovative cities, since knowledge and production are generated and realized more efficiently via local proximity and clustering (Audretsch and Feldman, 1996; Audretsch, 2002). These knowledge-production clusters (spaces) enhance the innovativeness of a region. Thus, such urban areas form local spatial foundations for knowledge and local production activities to flourish by bringing out the importance of knowledge- and skills-based activities, knowledge exchange, and spillovers in urban localities (Olcay and Bulu, 2016).

In parallel, the global economy has shifted from an industrial, goods-centered one to an innovation, service-centered one. This occurred gradually as innovative technologies, methods, and concepts evolved over time (Davenport et al., 2006). In today's innovation economy, new value is created through knowledge and intellectual capital and new entrepreneurships are the main drivers of wealth and economic growth, as opposed to the solely traditional physical assets and owners of the industrial economy. While rapid technological developments and increased globalization have forced the economic activity of traditional industries to move to low-cost countries, as Audretsch (2002) suggests, knowledge and innovation are less likely to be transferred across geographical spaces; on the contrary, they concentrate geographically, forming innovation districts and spaces, and eventually turn into innovative cities. Yigitcanlar et al. (2008a) call these urban innovation spaces "knowledge community precincts", mostly referring to place-centered knowledge and innovation clusters. These clusters comprise high-tech manufacturing of knowledge-intensive industrial and business sectors existing in a mix of urban life and culture within central urban locations (Yigitcanlar et al., 2008b). Along these lines, Kline and Rosenberg (1986) define the chain-linked model consisting of basic scientific research, product and process development, and commercialization as the three fundamental stages of the innovation process, where innovation can be initiated at any stage with inputs from internal stages and spillovers. The development of formal relations between research and development with urban unities results in mutual benefits.

In reflecting upon the approach of embedding research and development unities within an existing urban context, a representative case study refers to the design proposals made in Spring Semester 2017, in the frame of the design studio with an emphasis on technology in the 6th semester of undergraduate studies in Architecture at the University of Cyprus. The design objectives referred to the holistic regeneration of a unified core of Nicosia through the creation of flexible building units of industrial research and technological development, envisioned to act as urban transformers and interaction nodes with the local and global communities of labor, research and production. In the

following section, the city core of Nicosia will be briefly described. Subsequently, nine building proposals, a possible scenario of individual building units' activation and interaction with each other and the city core will be briefly presented.

1. NICOSIA CITY CORE

The walled city of Nicosia is an example of medieval town planning, and dates back to the Venetian period (1489-1571). During this time, of major concern was the entity of the urban form rather than the internal structure: the city's Renaissance walls with their 11 bastions and three gates were built to consolidate the town, which had revealed a dispersed character. In this frame, the city core has ten connection links to the new city. The walled city has an area of approximately 200 ha, and comprises the oldest part of the city, symbolizing the geographical and historical significance of Nicosia and Cyprus as a whole. The city core was declared a conservation area within the Nicosia Master Plan in 1989.

Today, Nicosia faces serious and complex problems that are largely caused by the existence of the dividing line, which has contributed to boosting development to the south and the region, and to the general downgrading of the walled city and the wider area of the city centre and the suburb areas along the dead zone. In these areas, there is a degradation of the quality of life and the urban environment, economic stagnation and population decrease. The initial concentration of services, commerce, administration and other core activities in the city centre encouraged the development of a radial road network that functionally results from the existence of a single employment center. Dispersal of employment opportunities and residential areas to wider areas followed in the last decades.

The design of building units of Industrial Research and Technological Development for the Nicosia Core in the Spring Semester 2016-17 aims at the holistic regeneration of a unified core of Nicosia. It is proposed that the

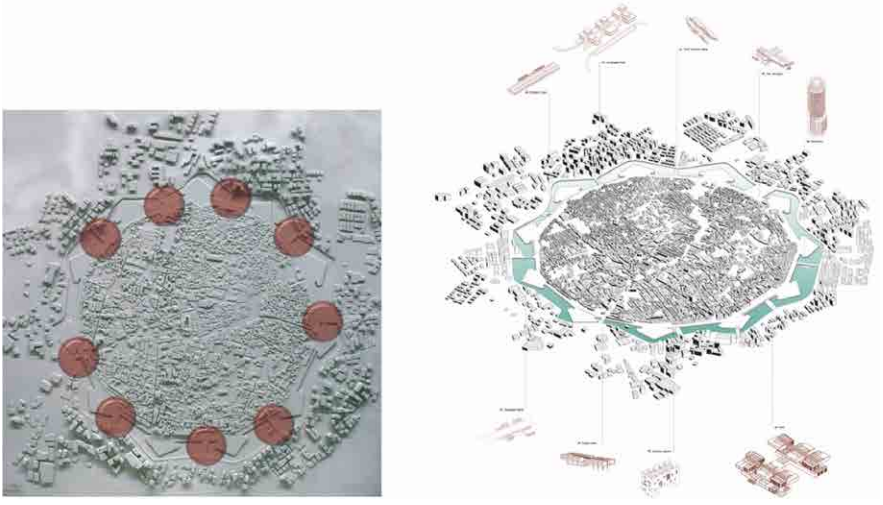

Figure 1. Nicosia city core with bridge connections to new city and corresponding building units

city core transforms into a smart wider urban area with time variant activation of nine bridge connections with the new city of Nicosia through the addition of "temporary" in each case, building units of industrial research and technological development (Fig. 1). In principle, the buildings comprise nodal points of research and technological development in the wider area of south-east Mediterranean, whereas the core of the buildings supports the areas within the city core.

2. BUILDING UNITS

The buildings units' proposals have been developed on the basis of an integrated architectural design approach, i.e. the development of the respective areas of the building morphology, structure, construction and environmental/energy design (Phocas, 2017). In an initial stage the proposed urban space, the functional zones of each building and the structure have been investigated. With the development of a general morphology of individual elements or the entire building, the formulation of an abstract design concept and the coordination between construction, function and form have been pursued. The architectural design has been further developed according to the functional disposition, the structure and the building envelope. Subsequently, the energy efficiency of the building has been investigated. The final stage of development consists of the construction design of the proposed elements and systems in detail.

The building units have a total area of 2000 m² and they are expected to provide flexible and multi-use spaces, where different researchers may work at different time periods. In all cases, of equal high importance is the design requirement for the proposed buildings to comprise symbolically a prototype of technological development of contemporary structures, or and of their internal special functional character, at aesthetic and morphological level, and while displaying the interrelated areas of function, construction and energy efficiency.

The building unit at Archbishop Makarios B bridge is directly positioned on the moat level of the city walls connecting the old with the new city. It consists of a tall skeleton structure acting as an outrigger system, with the prefabricated units of private and public usages plugged into (Fig. 2). A central atrium hosts vertically the exhibition of the building,

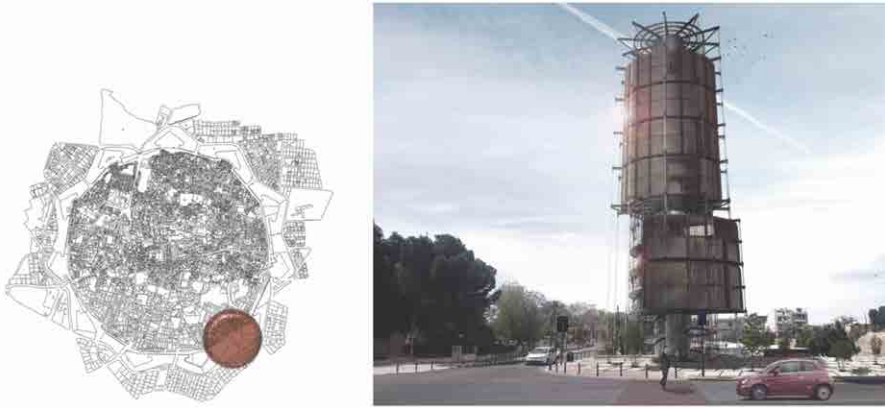

Figure 2. Building unit at Archbishop Makarios B

and all functional levels are accessed on the periphery of this open space through a ramp. Thus, the building develops vertically at the specific site.The building complex shown in Fig. 3 is positioned on both sides of the Dorou Loizou bridge. The building sections are interconnected at the moat level of the city walls underneath, through public spaces. At the street level, the building offers on both sides a window of related exhibits. On the level above, private and semi-public research spaces are accommodated. The building complex forms a gate for the main commercial circulation vain to the old city core.

The building at Solomou square extends from the moat level of the city walls over the level of the square in six floors (Fig. 4). The semi- and public areas of the center are distributed over the height, whereas the private areas are only visible by the public. The structural disposition enables openings at the floor levels, so that the functions are interrelated throughout the building. The circulation is achieved through a ramp on the periphery. A glass envelope with integrated adjustable sun-protection elements enlightens the appearance of the building. hus, the building acts like a showcase of its contents and activities in attracting the public flows within from the main bus stations at the site.

Figure 3. Building unit at Dorou Loizou

Figure 4. Building unit at Solomou Square

The building at the Pafos Gate consists of two main sections that are connected through a corridor over the street leading to the old city (Fig. 5). The north section hosts the entrance of the complex and a glassed exhibition space. The first floor hosts the private and semi-public research spaces accessible by the visitors. The façade panel openings adjust to the functional requirements of the corresponding spaces.

The building units at Sarayonu are positioned at the moat level of the city walls (Fig. 6). The main building section is situated below the street level, and extends on one side of the moat. Deployable units adjust through their size, structure and envelope elements to the functional disposition of the program. In this case the building primarily conveys open and closed spaces within the landscape at the moat level..

Figure 5. Building unit at Pafos Gate

Figure 6. Building unit at Sarayonu

The building unit at Kerynia Gate bridges two opposite sides of the city walls with the connecting street to the old city extending underneath (Fig. 7). The public functions are distributed within a main glazed open space. The private spaces are contained in prefabricated lightweight units plugged into the main structure on the back longitudinal side facing the new city. The building acts as a gate to the old city exhibiting the public activities within the old city area.

The building unit at Saracoglu Myd develops along the main connecting street to the old city (Fig. 8). A unified space is placed below the street, containing public spaces. The private spaces are placed on the upper levels of the complex. Three cores with vertical circulation elements connect the cantilever functional units above the street level. The latter consists of truss tubes connected to the cores. The building complex is primarily envisioned to activate the urban area at the moat level of the old city.

Figure 7. Building unit at Kerynia Gate

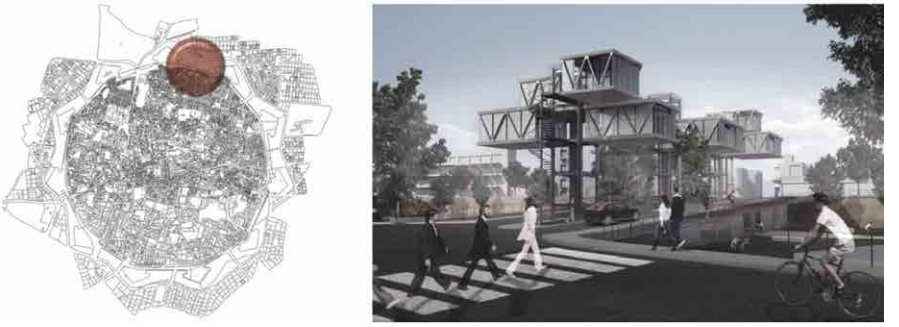

Figure 8. Building unit at Saracoglu Myd

The building unit at Sehit Huseyin Ruso is positioned on the street connecting both city sides, and it transforms the area to a pedestrian zone (Fig. 9). The building is developed in two autonomous sections interconnected at the street level. Each section consists of a mega truss tube, hosting two main functional levels. The public functions are mainly concentrated at the ground level, while the private ones, at the levels above. Thus, the building acts as a passageway at the site.

The building core unit at King George B is grounded at the moat level of the city walls on one side of the connecting street, and it extends over three levels. The building core hosts the exhibition of the center and the vertical circulation elements. The semi-public areas are hosted in prefabricated units positioned at street level and above, and the private research areas, within the main cantilever above the street. The building bridges the street, whereas a steel staircase connects the main cantilever with the park underneath. The building disposes a gate to the old city core (Fig. 10).

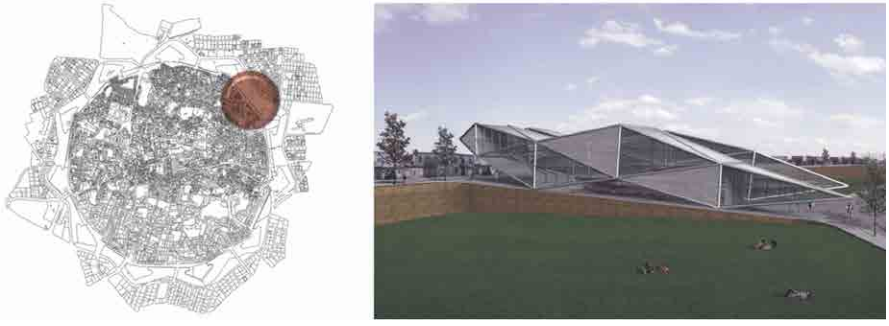

Figure 9. Building unit at Sehit Huseyin Ruso

Figure 10. Building unit at King George B

2.1. Urban activation scenarios

The development of the building units has been based on modularity, light-weight and mass-fabrication to -customization of the components. The buildings' articulation derives from the context of the site and favors a high degree of flexibility of the units' composition. At the same time, the proposals support sharing and networking of functions among different building units within the city grid and by extension, with local urban areas. Different urban activation scenarios may emerge according to the building units realized at different bridge connections to the old city. A case example is shown in Fig. 11, whereas four buildings are activated at a specific time, comprising further a corresponding urban network of research and development within the Nicosia city core. Based on such urban activation scenarios, the old city life and productivity are enhanced. In parallel respective circulation paths, labour, open space and green areas of the city are developed. Further related developments within the old city core are expected to arise due to further urban activations through different buildings' realization and interaction.

CONCLUSION

The current paper has presented design proposals of flexible building units of industrial research and technological development for the city core of Nicosia. In view of the current situation of the city centre, primarily characterized by a degradation of the quality of life and the urban environment, economic stagnation and population decrease, the units are envisioned to act as urban transformers and interaction nodes with the local and global communities of labour, research and production. At the building level, aspects of modularity, light-weight and mass-customization favor the achievement of flexibility for an effective time-dependent interaction of the units at a global and local level, especially within the specific urban context. The architecture developed, provides a particular vision of the future of the area while relying on contemporary technology, and supports flexibility, transformability and adaptability in macro and micro-scale. By extension, embedding research and development institutions within the walled city of Nicosia may further enhance its regeneration and sustainable development. Further investigations of the proposals refer to the socio-economic impact of mixed usages introduction at the urban scale and the application of technology for the achievement of a sustainable regeneration of the old city core.

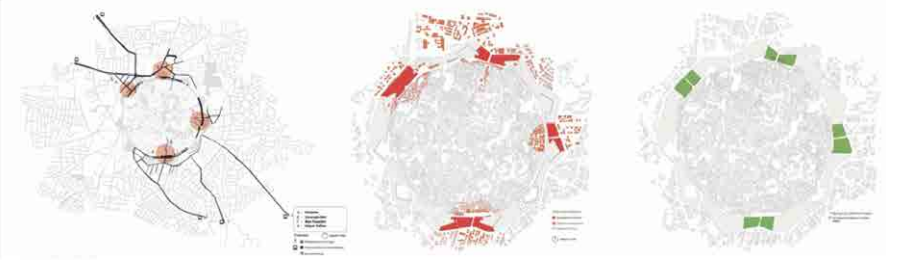

Figure 11. Urban activation scenario through operation of four building units (Dorou Loizou, Sarayonu, Saracoglu Myd, King George B): Main urban circulation axes, usages and connection areas along the city walls moat

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PAPER #5.03

ARCHITECTURAL ROBOTS: RETHINKING THE MACHINE FOR LIVING IN

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ABSTRACT

As the appearance of robots become more prominent in the built environment, architects face the challenge of exploring design opportunities for their integration. While such a synthesis involves an interest in technological systems and kinetics, it also importantly involves alternative ways of occupying space. This paper outlines the role architectural robotics play in the advancement of the human condition by proposing novel ways of living with and within the machine. Through a critical review of architecture's relationship to the machine paired with the outline of an experimental pedagogy, the intent is to uncover ways for equipping a future generation of architects, not only capable of realizing environments embedded with feedback and dynamism, but also adept in envisioning the design of a better world.

KEYWORDS

Robots; humanism; pedagogy; occupation; feedback.

INTRODUCTION

Like the language of machines that inspired Le Corbusier a century ago, advances in artificial intelligence and robotics have raised questions regarding how these technologies change the way we both design and inhabit space. Thus, contemporary architects are inevitably faced with the challenge of rethinking the creative and technological limits of the discipline. Greg Lynn stresses the need for such developments, when he writes:

> Rather than merely outfitting buildings with technology [and...] rather than implanting empty boxes with artificial intelligence or retrofitting our cities for driverless vehicles, architects should [...] integrate large scale robotics into buildings and urbanism at the very inception of their creative and critical processes [...] to realize not just dynamism and interactivity, but envision new kinds of spaces and structures with a technological integrity that challenges the static status quo. (Lynn 2016, 16).

From this provocation a set of key questions arise asking, how might we, as architects, become active participants in exploring ways robotic technologies are integrated into the built environment and what are the spatial implications and architectural ideas that might emerge from their integration?

The architectural robot legacy, in both its historical and contemporary context, provides a framework for the pedagogical experiment, outlined in this paper, entitled, the *Robot Project*. Taking heed to Beatriz Colomnia's call for radical pedagogies, which "shake foundations, disturbing assumptions rather than reinforcing and disseminating them," (2012) the *Robot Project* seeks to address transformations brought on by new technologies and an information culture. The project recognizes that emerging fields today are exploring the use computers and automation of robots in the home (domotics), in cities (urbotics), and on land (orbotics) (Somalvico 31). While Bill Gates forecasts "a robot in every home" (Somalvico 31), the former dean of architecture at MIT, William Mitchell, envisions homes not as "machines for living" but "as robots for living in" (Kapadia

2010, 48-53). It asks, will a future generation of practicing architects be prepared to address these emerging disciplinary concerns? Similarly to Walter Gropius's description of industrialization as a "'purifying agency' liberating architecture from outmoded technological as well as aesthetic values" (Picon 2014, 58-59) during modernism, the *Robot Project* recognizes that technological innovation can likewise be a driver for epistemological changes, which forces designers to think differently.

1. THE ARCHITECTURAL ROBOT LEGACY

1.1. A Machine for Living in

Importantly, the *Robot Project* is grounded in a much larger historical and contemporary context as defined through the longstanding relationship between architecture and the machine. In Le Corbusier's *Towards a New Architecture,* he envisioned a new world derived from industrialization and his infamous quote, "a house is a machine for living in" first appears. Corbusier situates the quote in the context of the airplane imploring that engineers define the problem of "wishing to fly like a bird" and in response "invent a flying machine" (1986, 113). He then questions how might we, as architects, define and solve the problem of the house. Despite the abundant reference to the machine, its application in modernism focused primarily on style rather than interest in the machine as an instrument. However, 1960's architectural discourse focused on the integration of the machine as way to explore how it might influence both the conceptualization and inhabitation of space from domestic to urban scale.

Post war thinkers like Reyner Banham called for "a restored interest in technology in terms of instrumentality" (Perry 2012, 74). For instance, in Banham's "Anatomy of Dwelling" in collaboration with François Dallegret, he exposes the relationship between technology and domestic life by pointing out that the house is so full of mechanical and electrical services that the instrumentation alone could provide shelter. These drawings acted as a provocation to architects to take a serious approach to technology. Banham also presented these ideas at the 1966 International Dialogue of Experimental Architecture (IDEA). *The Radical Pedagogy* archive describes Banham's talk stating:

> He concluded by asking whether the architect of the future would still find him or herself involved in the "enclosure business" or would instead have turned towards environmental conditioning systems of the type being developed for the space program, from life support suits, to telecommunications helmets and food "shots." (Buckley).

Banham's statement assumed that existing trends in technology would grow and urged architects to look at technological advancements as a precursor for working through the potential impacts on the discipline (Perry 2012, 74). Such early ideas of technological extrapolation focused on adaptable architecture and transformation of space as seen in the designs from many of those 1966 IDEA attendees such as Cedric Price, Archigram, and Yona Friedman. These key players conducted technological experiments that pushed boundaries in architecture and drove resultant ideas regarding ways of living.

Of course, the most notable project for the concept of a reconfiguring building embedded with responsivity was the Fun Palace (1959-1961) proposed by Cedric Price in collaboration with Joan Littlewood, John Frazer, and cyberneticist, Gordon Pask. The Fun Palace proposed a flexible and transformable building able to accommodate a variety of occupation possibilities. The building system included a user interface for reconfiguration along with the ability to autonomously suggest new spatial configurations whenever it would "get bored" with common arrangements. Price believed

providing spatial flexibility was the best way to consider a building's users and he argued that new technology "should both serve the public and further human freedom" (*Ways of Being Political* 2013).

1.2. Architectural Robots a Humanist Project

While the robot legacy in architecture reveals a trend, which exists primarily under a humanist agenda, by striving to explore alternative ways of occupying space in order to enhance the relationship between people and their environments. The exploration of technologically optimistic design practices suggest the line between social activism and a technological agenda is not so distinct. For instance, Buckminster Fuller, saw technology as "a means to redesign society" (Picon 2014, 56). His designs for the Dymaxion house and car "were not only […] meant to revolutionize the building industry, transportation and everyday life; they were also intended to pave the way for a radically different future in which men would roam free on the surface of the globe, live everywhere and fully take advantage of their intellectual capacities" (Picon 2014, 56). In the Potteries Thinkbelt project, Cedric price also appropriated mobility as a means to distribute knowledge. He proposed to occupy a railway system in order to transport and disperse knowledge with the cars behaving as mobile teaching units in addition to "inflatable lecture theaters, foldout desks, and information carrels" in order to provide a means of distributing, sharing, and cultivating knowledge outside of the static campus model (*Changing of the Avant-Garde* 2002).

Urban narratives for softer architecture of the 1960's suggested a liberation from the status quo through flexibility and choice as a means to facilitate density and the expansion of the city. Yona Friedman explored human centered design problems in his project Ville Spatiale, providing an urban infrastructure that supported flexible rearrangement, as a way of having occupants give meaning to their environment through the freedom of individual choice. While Friedman's proposal involved complexity of motion through reconfiguration, the project's focus was to promote the discussion of urban growth by providing the "fundamental right to self-expression of individuals" (*Ville Spatiale*).

Archigram's work provides multiple examples of the integration of various scale robots through the lens of fiction as a way to promote discussion that could lead to change especially different from the ever growing means of suburban life. For instance, their prototype for a house of the future in their exhibition titled, *Living 1990*, included a room with two robots to accommodate moveable services and change various states of walls, ceilings, floors, and furniture. Looking at an urban scale, Archigram's proposal for Walking City envisioned an intelligent infrastructure intended to freely roam the world making decisions about where to move based on resources and production capabilities. Such robotic interventions of the 60's from Friedman to Archigram suggest the capacity for resilient response to natural disaster and also promote an agenda for open boarders in which cities effectively relocate in support of vitality and equal access to resources for all of humanity. In response to skepticism about Archigram's ideas and their relationship to the "human factor," Hans Hollein describes both the social and political agenda behind the work when he writes, "Their ideas are always for people, for a better life for people" (Cook 1999, 6). As Hollein points out in Archigram's work, the architectural robot in its legacy interrogates both practice and culture by exploring novel ways of living with technology and each other.

While Archigram used fiction as a means to deflect questions of actualization, other key players like Nicholas Negroponte founder of the Architecture Machine Group (which later became the MIT Media Lab) sought to realize context responsive buildings.

Negroponte describes the group's vision of "a man-made environment that responds to and is 'meaningful' for him or her" (1975, ii), suggesting responsivity could provide additional significance to the built world. He also describes the goal of "humanism through intelligent machines" (1970, 7) and the desire to "conjure a world where buildings are […] animate, thinking, and emotive beings, which actively house and protect us physically as well as psychologically" (Beaumont 2015). Negroponte's experiments sought not only to promote alliances between architecture and computation, but also strove to find ways to advance the human condition by promoting a symbiosis between man, machine, and the built world.

1.3. The Speed of Society

In contemporary research and design practices, architects have been looking for ways to deal with dynamics and spatial reconfiguration. In projects such as, OMA's Maison Bordeaux in France (1998), Greg Lynn's RV Prototype House designed for the Bienniale Interieur (2012), Axel Kilian's Flexing Room exhibited at the Seoul Biennale of Architecture and Urbanism (2017), and the Hyberbody Group at the Delft University of Technology's projects Musclebody and Muscle Towers (2006), there is a commonality of exploring ways to reconfigure space based on the user needs and/or interaction. In fact, Michael Fox, author of Interactive Architecture, coined the term "robotecture", which explores "human and environmental interaction and behaviors, embedded computational infrastructures, kinetic and mechanical systems and physical control mechanisms" (2009).
Elizabeth Diller, in an interview about the use of moving parts in their practice, explains, "It's not the movement that is important. It's the speed of its responsiveness to the needs of the artist" (Davidson 2016, 59). In this statement she explains the necessity of the artist to not limit ideas or the actualization of ideas. Such freedom within architecture provides a means for the discipline to evolve to the growing needs of occupants within a digital age. In an interview with Sidewalk Lab regarding the development of the Shed along the High Line in New York, Diller describes that society is moving so quickly and it is essential that the architect's work try to respond to the shifting needs of society and the need to create an architecture which is both supple and distinct (Jaffe 2019).

2. ARCHITECTURAL ROBOT PEDAGOGY

2.1. Epistemological Change

Within the context of the historical and contemporary practices involving architectural robots comes a need for a complementary idea about robot pedagogies. Beatriz Colomnia urges for experimental pedagogies in architectural education when writes, "As schools appear to increasingly favor professionalization, they seem to drown in self-imposed bureaucratic oversight, suffocating any possibility for the emergence of experimental practices and failures" (Colomnia 2012). By looking back to the educational experiments of the 60's and 70's, she reminds us of the epistemological changes resulting from pedagogical practices that support a willingness to walk into the unknown. This kind of epistemological change, which forces designers to challenge, question, and rethink, is most important consequence of the subsequently outlined *Robot Project*, at least for now.

2.1. Methodology

Instead of amplifying anxieties about conditions of alienation produced by advanced technologies and machines, the *Robot Project* draws on the history of humanistic concerns seen in the architectural robot legacy and looks for ways that living with and within

the machine permits discovery of newfound intimacies between ourselves, each other, and the world around us. The *Robot Project* was part of a course, of approximately seventy architecture students, that aims to rethink current pedagogies for computational design. It imagines a space of learning that integrates craft and speculation, criticality and creativity, and innovation and social consciousness through production of architectural robots.

Drawing on the definition of a robot, which involves complexity of motion and programmability, paired with the essential qualities of architecture (i.e., space, occupation, light, experience, etc) the project asks students to combine these two characteristics in order to both design and build a working prototype of an architectural robot. Due to the scale and nature of the class (i.e., large scale and conducted outside of the studio setting), the project encouraged self-guided intellectual play through prototyping and workshops in physical computing. For instance, the first workshop was a two hour long design charrette in which the students, working in groups of two, were given a small DC motor and wired battery pack and told to make an object that propels itself forward with materials that are found, recycled, reappropriated, etc. Additional workshops topics included introduction to programming, the basics of physical computing, actuators, sensing, and mechanisms. The project methodology focused on hands on making and prototyping in parallel with modeling in order to see problems related to geometry, materiality, and fabrication. The students also explored historical and contemporary examples of architectural robots to help inform and promote discussion around their own creative narratives.

One of the resulting designs revisited Archigram's Walking City project through the lens of Theo Jasen's Strandbeast using a linkage configuration to both support and accentuate the performative nature of their robot's walking motion (Figure 1). Other student groups envisioned designs for the autonomous cars which separately housed a movie theater, gym, and library in order to provide programmatic amenities during the commute (Figure 2 and 3). Another group sought to explore the use of real time news data to filter out key terms related to gun

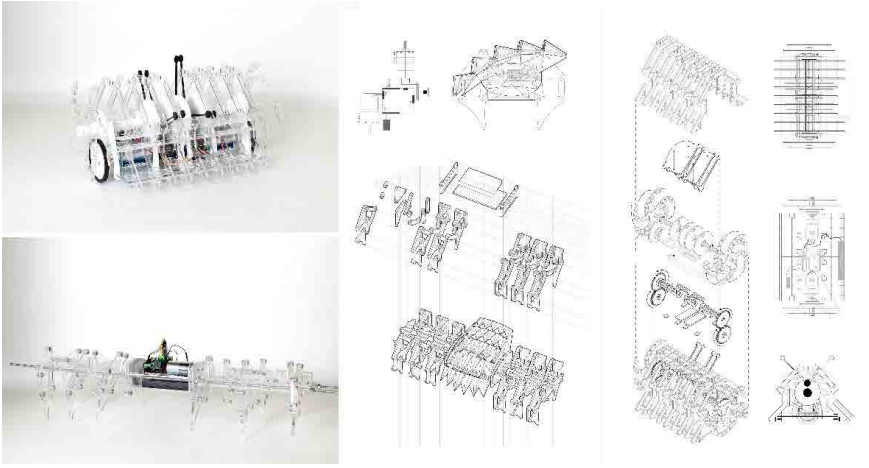

Figure 1. Image of revisited Archigram's Walking City robot through the lens of Theo Jasen's Strandbeast. Source: (Rachel Dickey 2019)

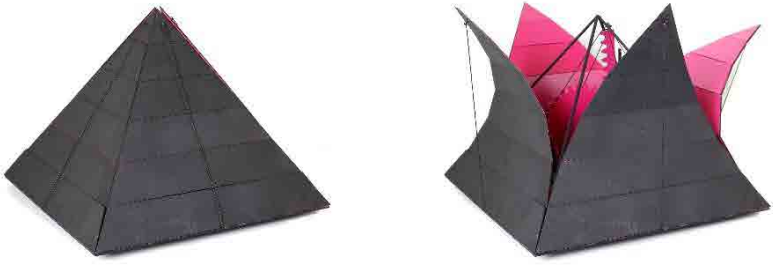

Figure 2. Public library and that roams the city providing access to wifi and distributing knowledge. Source: (Rachel 2019)

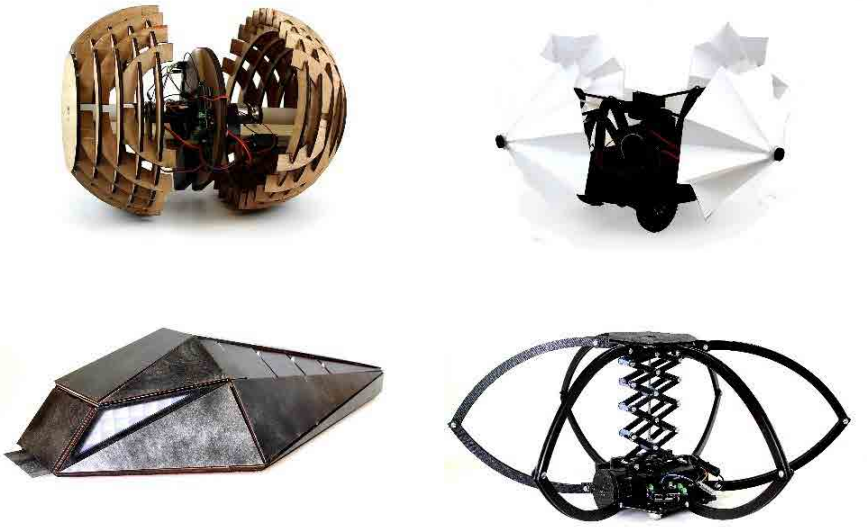

Figure 3. Top left: Autonomous car with 3D cinema display. Top Right: Robot uses real-time news data as input and expands and contracts based on the occurrence of key words related to gun violence. Bottom Left: Robot that reflects signals and remains unseen to other technologies. Bottom right: Expansion robot that temporarily protrudes outward and claims public space for events. Source: (Rachel Dickey 2019)

violence such that their robot would change shape in order visualize conflict in public space and provide a place where conflict is exposed, debated, and transformed (Figure 3). Inspired by Bauhaus pedagogies which included event, performance, and cultural play space, and in lieu of traditional formal design review, the students organized a concluding event and performance of their thirty-nine uniquely designed, fabricated, and programmed robots that strut their computational prowess while walking, rolling, even dancing down a fifty foot long catwalk in their final exam time debut. Driven by Bluetooth technology, and designed and actualized through physical computing and digital fabrication, these robots dared to excite and challenge ideas about the contemporary discourse and discipline of architecture. Evolving from the inherent interest in objects that move, the event also acted as a way to invoke curiosity about the work from faculty and students alike.

Rethinking the culture of design, making, and presentation, the students organized the arrangement of the runway space, designated a DJ to play each robot's theme music during their runway walk, and nominated a series of commentators to actively describe each robot during the runway debut. Some of the descriptions, prepared by each group, read like a detailed high fashion garment summary, while others read like a World Wrestling Federation commencing narrative. Both the project and related event draw a finer line between rigor and play. Similar to the motivations of the Bauhaus, as described by teacher, Johannes Itten when he writes, "Play becomes celebration; celebration becomes work; work becomes play" (Loewenberg 2012, 22). Like Itten's desciption the *Robot Project* and corresponding event try to encourage a design culture of fostering both critical thinking and creativity and provide a play space for responding to a world embedded with technology.

2.2. Takeaways

While a primary objective for the *Robot Project* was to introduce students to computational thinking and adaptive architecture, other architectural problems arose during the project. Students had to consider how to integrate mechanical systems by including their micro-controller, network of motors, gears, power supply, etc. Many for the first time, were exposed to working with integrated systems and specifications in order to understand the basic information related to their actuators, such as ratings, voltages, torque, etc. Additionally the students directly engaged in fabrication problems through both physical and digital prototyping, in which they had to consider material tolerances and material properties such as bending radi, elasticity, and even the coefficient of friction in order to get enough resistance for movement. Thus, the project constraints stemmed from the design problem of making an operational robot relative to their larger narratives regarding transformation of space.

Figure 4. Image of runway event. Omitted for blind peer review since it has recognizable traits of the institution. (Author 2019)

As growing emphasis on information and integrated technologies in the built environment place a new set of requirements on architects, the students were also provided with the opportunity to explore alternatives to previously determined conditions and embrace both quantitative and qualitative characteristics of dynamic systems. The explicit goals for the project seek to explore the boundary between robotics and architecture and promote creativity at their intersection by encouraging novelty with intention. It also strives to introduce students to critical ways of thinking about technological integration in architecture. While the project operated under these objectives, the course also took on a

transformation from its traditional pedagogy which shifted focus from the application of computation in design for the generation of new formal languages to the appropriation of computation as a means for thinking about integrating feedback in architecture.

The difference in shifting focus on computation as formal language to a means of understanding feedback relates to what Theo Spuyroploous, calls "the shift in preoccupation from building as object to building as system" (2011, 425). Early digital architects found interest in this notion of feedback not only related to production of design, but also integrated into the performance of architecture. For instance, Kas Oosterhuis explored shape changing structures using real time content to accommodate changing use over time in the Trans-Ports Multimodal Pavilion (2000). The nodes of the pavilion would change position to allow the overall surface to shift in form. Oosterhuis describes early revelations regarding an adaptable and shifting architecture when they were fabricating the Waterpavilion (1997) with NOX:

> We realized that CNC production machines do not read drawings but process data instead. So we decided to produce data which were directly used by the algorithms running the machines. It was the birth of deep parametric design to production. [….] This triggered me to think of architecture as a dynamic system, not only in the design phase where everything is still moldable, but also in its behavior as a built structure. (Oosterhuis 2017)

Through the lens of the parametric model, Oosterhuis suggested a mindset in which parametric animation does not stop, instead architecture itself could be set of parameters in motion guided by feedback. In other words there was an interest in not limiting architecture to "a static representation of a dynamic process" (Perry 2012, 73), but instead allowing the process to inform a flexible architecture. Thus early digital architects caught up in formal possibilities, like the modernist interest in the machine relative to stylistic concerns, lost sight of its origins, which Oosterhuis explains showed interest in the integration of contingency in architecture.

Another important lesson from the class was the consideration of time and speed relative to the built environment. Most students chose to think of architectural robots purely as a means for producing dynamic buildings and spaces and few considered how their robots situated in space change human behavior and activate space differently which is also inherently architectural. Overall the course placed emphasis on design ideas actualized through prototyping rather than efficiency or optimization. Future development of the project and course could include interdisciplinary collaboration between engineers and architects in order to advance kinematic components, while also exploring ways to enhance, define, and accommodate spatial needs. The hope of the *Robot Project* is to generate a new generation of architects that are able to realize architecture as a system, but also equipped in conceiving of novel spaces, environments, and experiences.

CONCLUSION

> Skeptics may well wonder: Why complicate our buildings with robotics? We'd be the first to agree, for example, that buildings should employ windows, not air conditioning and artificial lighting, to make the most of daylight and natural heating and cooling. Still, who would deny that electric lighting and central heating extend the usability of our buildings? We see architectural robotics the same way, as potentially extending and enhancing the use and usability of our built environments. (Gross 2012, 32)

The rapid changes brought on by an information based society and the complexity that exists within negotiating systems

and forms relative to varying needs of the occupant have generated a desire for dynamism and indeterminacy which greatly contrasts with the traditional architectural ideals of determinacy and permanency (Bhatia 2012, 216). The architectural robot legacy and project outlined looks outside the "static status quo" and instead envisions the integration of computation in design as a means for examining feedback directly related to human factors, which could evolve to include flexibility of use and unique forms of experience.

While automation of robots in the built environment is already being discussed by engineers and specialist in human computer interaction, current trends sum up an automated architecture to no more than a "disembodied voice" with voice control systems or "a world of scaffolds and screens" (Kilian 2018, 233; Young 2016, 130). Conversely if we revisit Corbusier's expression and really explore what is might be like to live with or within the machine, opportunities arise for novel spaces and structures that address human needs and ways living, perhaps even needs we never even knew we had or ways of living we have yet to explore. If we, as architects want to be leaders in the discourse and practice of determining the advancement of the built world, then we must carefully reconsider the machine for living and imagine a new set of possibilities for exploring the integration of feedback and responsivity into the built world.

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PAPER #5.04

THE CUTTING (ROUNDED) EDGE OF 3D-PRINTED ARCHITECTURE

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ABSTRACT

Digitally controlled machines and rapid solidification mixtures are allowing to execute buildings through 3D-printed construction with a reduction of resources, waste, time and manpower. Moreover, this technology provides a direct flow from design to execution. However, the general characteristics of buildings made with this technology have not been confirmed yet. This work aims to identify features of architectural design with 3D-printed construction through material tests, study of cases and digital models, with the purpose of guiding the building development. Printing proofs show the execution of elements with rough textures, rounded corners and limited ranges. The cases analyzed demonstrate the emergence of a variety of buildings executed with different equipment which share some construction conditions. Digital modeling of 3D-printed buildings offers opportunities of analysis and optimization, especially regarding curved walls, as well as the integration of fabrication design and control. The sinuosity of printed walls becomes a preview of the innovative spatial features that this technology is able to provide. This review reveals novel operational and perceptual conditions of 3D-printed architecture that indicate possible evolution in the roles of design and buildings in the city.

KEYWORDS

3D-printed construction; curved walls; additive manufacturing; architectural design; parametric programming.

INTRODUCTION

Digital control of machines and the fast hardening capacity of certain materials has promoted the emergence of new 3D-printing technologies. These technologies have allowed executing individual constructive elements or entire buildings (Labonnote et al. 2016; Delgado Camacho et al. 2018) that can reduce consumption of resources, waste, time and manpower in the construction industry, while providing higher accuracy and digital integration between design and execution. This leads to examine what would be the appropriate characteristics of buildings made with this technology. Therefore, this work aims to identify specific features of 3D-printed architectural design through the study of material tests, cases executed and digital models in order to boost the development and experimentation with this new technology.

3D-printed construction is an additive manufacturing (AM) process based on the deposition of a fast-solidifying fluid material that allows executing human-scaled elements (Craveiro et al. 2019). This deposition consists in the extrusion of a mixture pumped to reach a nozzle that is vertically attached whether to a 3 DoF gantry system or to a 6 DoF robotic arm. In some

Figure 1. Printed construction experiments with a Kuka120 R2500 robot. Source (Authors 2020).

occasions, there is an additional control, feed or pushing device in the final section of this system. The material pumping must synchronize with the movement speed of the nozzle, which is controlled by the gantry system or the robotic arm through digital programming of the deposition trajectory. This trajectory is determined from a geometrical model and usually divided in horizontal paths that define successive layers of material extrusion.

At the Universidad del Bío-Bío (Concepción, Chile) initial printing proofs were first performed with a small experimental gantry system (1 x 0.6 x 1.2 m) and a mobile deposit of 9 liters. Nowadays, more advanced experiments are being carried out using a Kuka120 R2500 robot with an action radio of 2.5 m, along with a concrete pump of 120 liters to build wall sections, columns and free-form pieces (Fig. 1). These proofs have made it possible to test cementitious mixture, to define procedure for printing proofs, and to identify construction features that have been found to be coherent with other experiences worldwide (Bos et al. 2016; Ghaffar, Corker, and Fan 2018; Ma, Wang, and Ju 2018).

1. THE CORNER ISSUE AND OTHER PECULIARITIES OF 3D-PRINTED CONSTRUCTION

When using 3D printers with fused deposition modeling (FDM), extrusion feed rates are proportional to the lengths of linear segments usually employed. However, in Computational Numeric Control (CNC) machines velocities does not remain constant during the path defined. At the beginning of each segment, the devices must accelerate until a constant speed is reached, and then must decelerate when approaching a change of direction. As a result, an excess of material is deposited in those zones where the trajectory's geometry abruptly changes (Ertay, Yuen, and Altintas 2018). This issue is also known as 'overshot corners'. Through a correct calibration of the speed, acceleration and over-acceleration (jerk) parameters of each axis, the flow rate or extrusion multiplier, and other parameters that can be configured through software, clean edges can be achieved, but there are also machine vibration.

In 3D-printed construction, the Contour Crafting (CC) method incorporates 4 DoF (TX, TY, TZ and RZ), where controlling the rotation of the nozzle during the printing process, to keep a tangential direction. However, in certain moments, the nozzle must stop or slow down the extrusion while

rotates and pushes the material from the opposite edge and this technique tends to create bulges around the corners. Therefore, the nozzle must reduce the flow rate when approaching a corner, and that reduction depends on the corner's angle (Khoshnevis et al. 2006). In rectangular extrusion nozzles another known effect is the torsion of mortar cords in corners. To avoid this torsion, the nozzle's direction must remain tangent to the deposition trajectory in synchrony with the tangential speed and the material pumping pressure. These parameters are directly related to the viscosity of the cementitious mixture (Bos et al. 2016).

Other effects are attributable to the electromechanical configuration of 3D printers or 4 DoF machines. Acceleration and deceleration ramps are necessary to break the inertia of the motors that are part of the pumping and/or extrusion devices. These configurations do not allow printing right angles because of the deceleration of the printer before reaching the corner. This results in an enlargement of material in the outer part of the arc (gap) and an over-accumulation in the inner arc of the corner (Fig. 2). Therefore, it becomes necessary to use a curvature radio in the edges to achieve an homogenous deposition of material (Borg Costanzi et al. 2018). Similar than fillet procedure in digital drawing of corners to execute regular trajectories.

Another printing issue is the cumulative angular error in corners of CC systems with 4 DoF. The nozzle must reach the required rotation in the last segment of a line when it passes through a corner. When the nozzle's rotation speed is too low to finish the rotation within that segment, an angular error arises that the system tries to correct in the next corner. These errors accumulate layer after layer, especially in short segments with great curvature radios (Xu et al. 2019). More effects, such as the lack of material at the beginning of a deposition trajectory occur because of the delay between the start of material pumping, the material's inertia in the interior of the hose, and the deposition movement. The effect of this discoordination increases in trajectories starting and ending in an orthogonal vertex, where they produce whether an excess or a lack of material (i.e. bulge or gap).

A different approach to this 'corner issue' in 3D-printed construction is presented in the CONPrint3D® (Krause et al. 2018; Mechtcherine et al. 2019), which consists in the use of a nozzle especially designed to end straight trajectories with no direction changes, combined with the overlap of cords with a rectangular section. This approach implies a discrete cut (true-false) of the monolithic cords in an alternate way avoiding continuous control of the extrusion flow rate. When approaching a corner, the pumping is abruptly stopped, then the rotation and new

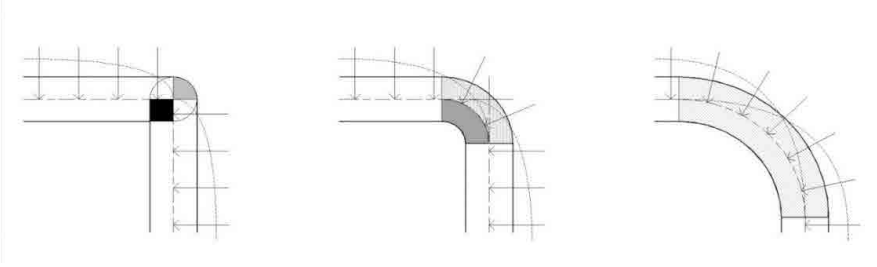


Figure 2. Material deposition in corners with different curvature radios. Source (Authors 2020).

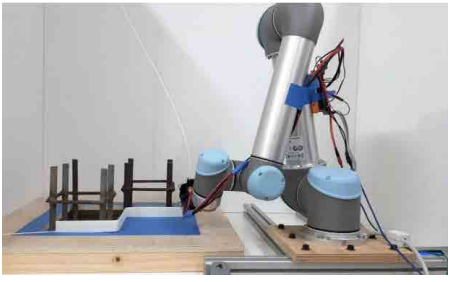
positioning is performed, and the pumping is started again to continue with the next straight segment. Thus, the overlap and gap effects in corners that arise from continuous rotation (RZ) in conventional CC systems with 4 DoF are avoided.

The use of robots with 6 DoF in 3D-printed construction can avoid the continuous flow rate and material pressure control in pumping equipment. The robot-based continuous welding technologies used in automotive industry allow the robot's end-effector to describe trajectories with continuous speed. This process only requires coordinating the start and stop via programming code. The use of conventional slicing programs for FDM that are usually applied in 3D-printed construction experiments to generate straight segments in G-code can be replaced with parametric control tools such asHAL or KUKA|prc , which already integrate continuous trajectories, lines, continuous arcs and splines.

Aside from the 'corner issue' here described, there are several phenomena that occur during the printing process. Since the printing material is deposited as a horizontal cord through the nozzle (which is usually circular), both a transversal expansion and a vertical reduction are produced because of the setting process and its own cumulative weight of material. As a consequence, an adjustment between the design dimensions, nozzle measurements and magnitudes of the deposited cord must be made, as well as a reduction in the horizontal joints between cords is produced making a rough texture in the elements' faces. The cord's dimensions depend on the nozzle's size, mixture density, air humidity, flow rate, print speed, opening time, and initial setting time. These dimensions must be supervised in the execution to estimate the modifications in the design to be printed and the trajectory that allow adapting to these phenomena.

When the printing path completes each lap, it is necessary to change the position of the nozzle in height, and this 'jump' produces a bulge similar to that of the aforementioned 'corner issue'. Thus, it becomes advisable to generate printing paths that follow a spiral form to avoid bulging when completing each lap. These spirals must grow the height of one cord in each lap minus the height adjustments due to the setting and cumulative weight effects. The early setting time of the mixture must be regulated to resist the weight of the subsequent layers without major dimensional alterations. The spiral trajectory, equipment range and material feeding establish maximum magnitudes for the printed elements to keep that slope progression. Therefore, sections and sequences of execution must be established according to the machines position and material load capacity.

The vertical sequence of cords is prone to overturn, especially in straight sections of



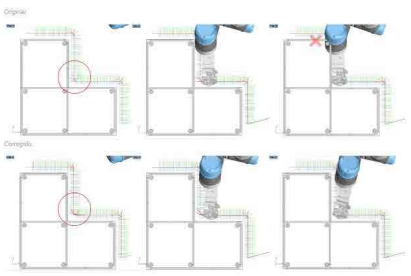


Figure 3. Perimeter printing proofs of a reinforced structural element. Source (Authors 2020).

the element, thereby making it advisable to use ample curves or transversal sections in the design. Interior reticulates also collaborate in supporting the element once executed and act as partial fillings. Additional proofs have been performed with an UR5 robot to print constructive elements with inner reinforcing steel bars (Fig. 3) aiming to determine strategies to move the robotic arm along the perimeter without interfering with them. However, this requires to apply the extruded mixture with an angle of the nozzle that allows avoiding clashes between the tool and the printed element, which can be predicted in the path programming using HAL, KUKA|prc or similar software. Also, this inclination of the nozzle generates greater accelerations both in concave and convex corners. These difficulties make also is preferable to design elements with rounded or curved edges.

2. ARCHITECTURAL EXAMPLES OF 3D-PRINTED CONSTRUCTION

The aforementioned preference of curved shapes has been also present in several examples of 3D-printed buildings worldwide (Perkins and Skitmore 2015; Hager, Golonka, and Putanowicz 2016; Tay et al. 2017). By September 2019, the authors identified 68 experiences in different countries, through a review of websites and scientific papers. These experiences were made by enterprises, universities and/or national programs, and mostly destined to experiment with this new technology and to present examples of what it has to offer. From a small refuge in Milano in 2010, a hotel in Philippines and an office in Dubai in 2016, a house in Russia in 2017, an emergency dwelling in Texas, an energy efficient house in Nantes and another one in Valencia in 2018, 3D-printed construction is spreading at a fast pace. In Latin America seven initiatives have been registered: a dwellings prefabrication company and three universities in Chile, and diverse enterprises in Colombia, Brazil and Argentina.

Most of these initiatives have appeared in the last four years, combining printed elements with other conventional components. 66% of them were executed with gantry systems and 18% with robots, and the vast majority with cementitious mixtures. The WinSun company in China exposed up this date fifteen buildings made with 3D-printed construction, some of them with several storeys, dwelling groups, or urban furniture, but without details on the components and processes used. Cybe (Netherlands), ApisCor (Russia), Printhuset (Denmark), and the Engineering Corps of the US Army presented printed buildings, and even designs, equipment and mixtures to sale. Besides, several institutions have participated in NASA competitions focused on extra-terrestrial construction.

The buildings presented are generally little houses or pavilions around 50 m2, with one floor and some common characteristics such as use of 3d-printed construction mostly in walls with rounded corners and ample curves. These designs use whether filled single-cord or hollow envelope with parallel cords. The visible texture is covered in some cases, and complemented with decorative vegetation, doors, windows and installations. Windows and doors are usually scarce and narrow, and roofs use a different constructive system, whether in wood, metal or concrete slabs. Speed and low cost are frequently highlighted as the main advantages, as well as waste reduction, higher safety and design versatility.

In the latest months, a big building printed in Dubai by ApisCor has been presented, using straight and circular walls. Also, the NASA contest for extra-terrestrial construction showed proposals based on vertical shapes with conical roofs and scarce openings (Fig. 4). Besides, a sinuous design for a dwelling has been executed in Morocco by the Spanish company BeMore3D in the Solar Decathlon Africa contest, as well as a second pavilion

Figure 4. Examples of 3D-printed construction; office building in Dubai (left); constructions in NASA contest (right). Sources: (https://www.apis-cor.com/, https://spectrum.ieee.org/tech-talk/aerospace/space-flight/3d-printers-could-build-future-homes-on-mars, photographer Tracy Staedter)

by the US Army. The companies COBOD and Cybe are executing buildings in different cities of Europe and Asia, and developing equipment and commercial organizations. In their constructions, modular walls with inner reinforcements and services have been observed.

3. BIM MODELING OF 3D-PRINTED ARCHITECTURE

The control of 3D-printed construction requires digital modeling, then some studies have devoted on testing BIM for design and planning printed buildings (Lim et al. 2016; Davtalab, Kazemian, and Khoshnevis 2018). The digital management allows also to analysis constructive conditions like shape optimization. For example, curved partitions provides greater stability against lateral forces than straight (Kounadis and Papadopoulos 2016; Lagomarsino 2015; Liu et al. 2018). Like 3D-printed construction can execute any shape, and in particular curved envelopes, this attribute can reduce material consumption, as well as to decrease environmental impact, manpower needs, waste and transport.

A geometrical analysis was developed by the authors through parametric programming in BIM for the configuration of a 40x20m rectangular enclosure by generating 1,600 randomized alternative solutions of straight and curved walls (Martinez-Rocamora et al, 2020). Considering similar overturning limit force for a straight wall 30cm-thick, and different curved walls with the same projected length but lower thickness depending on the curvature angle. However, it is worth noticing that using curved walls modifies the built-up surface of the enclosure, reducing it with an inner arc and increasing with an outer arc, besides increasing the effective length. In contrast, highly reduced thicknesses are not buildable and do not provide the required noise and thermal insulation. Thus, several factors must be compensated by combining several wall types in a same enclosure or building. Based on the estimation of volume, time and cost as resources for the execution of each solution, it was possible to evaluate their cost-efficiency. The programming allows identifying the most efficient designs to reduce the options that the architect should evaluate from an aesthetic viewpoint according to the spatial and formal expressiveness (Fig. 5). In the shown example, the design with the lowest time of construction presents more pronounced curvatures, while the solution with lowest consumption of material shows soft curves in all its sides. The combined analysis throws a solution with strong curvatures in the extreme sides and soft curves in its long sides. Thus, the architectural solution can

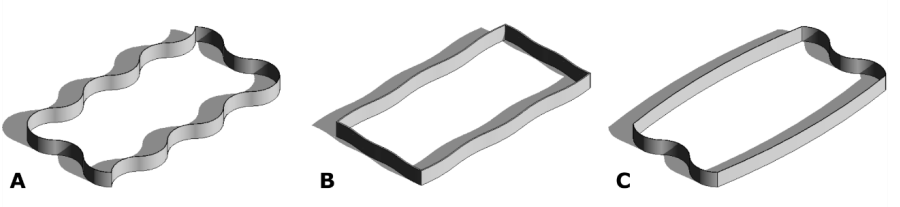


Figure 5. Renders of the best solutions in BIM analysis of envelope with 3D-printed walls in terms of material consumption (A), execution time (B), and economic cost (C). Source (Authors 2020).

consider whether an operational efficiency or economic reduction, with a more functional or expressive design, according to the activity or the building location.

Another initiative derived from the study of 3d-printed curved walls was a practical exercise in BIM with architecture, civil engineering and building engineering students. It was an intensive and collaborative work of integrated design where the students develop a project for an automotive exhibition hall in a site next to a main road with 3d-printed curved walls (Fig. 6, left). This work included building design, budget and energy consumption estimations, as well as architectural visualization, structural and construction details (García-Alvarado et al, 2020). The project was developed during two meetings and four collaborative work sessions of three hours each. Despite some differences among the participants occurred during collective work, it was possible to complete the design with the proper documentation and relevant architectural proposal consistent with 3D printing of curved walls.

In addition, experimentation with definition of 3D printing elements like families in BIM has been carried out. These elements were parameterized according to the analysis conditions, and exporting code for 3D printing through KUKA|prc in Dynamo (Fig.

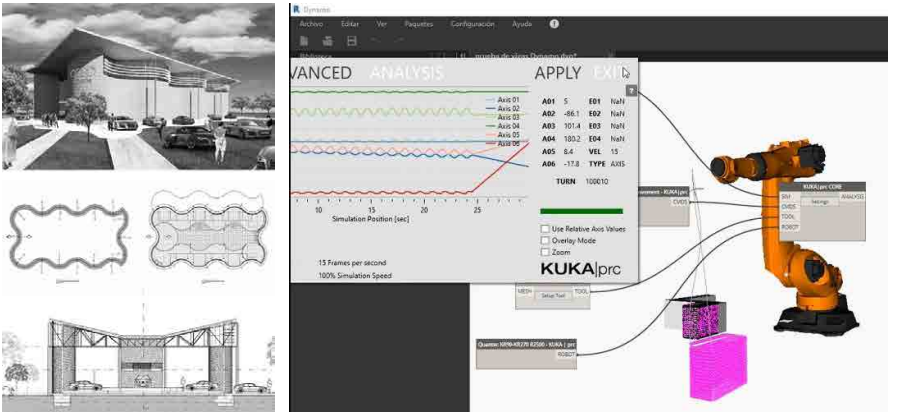


Figure 6. Excerpts of Design Exercise (left), 3D-printing programming in BIM (right). Source (Authors 2020).

6, right). In this case, families were defined for the repertoire of curved walls with angle and thickness variations, as well as material consumption. Also execution toolpaths were defined according to the equipment and concrete pump ranges, thus allowing to program printing trajectories for 80x40x20cm elements. These trajectories follow a helical tour adapted to the estimated dimensions for the printing cord, its vertical setting, and lateral displacement. The programming is usually generated from the volume section of the element by controlling the parameters of the trajectory according to the total length, corners' radio and the available volume of material, and subsequently the G-code for the robot is exported by KUKA|prc. With the robotic arm's control panel, the position of the element, direction of the trajectory, height adjustments and stops of the printing process are calibrated.

These experiences demonstrate the potential that BIM modeling offers for managing an architectural project based on 3D-printed construction, regarding the study and development of technological features with greater effectiveness. It also shows the singular expressiveness of 3D-printed architecture through the use of sinuous forms to accommodate interior spaces and innovative exterior appearance.

4. DISCUSSION

Printing constructive elements requires planning and executing a trajectory of deposition considering the machine capacity, range and constraints in corners. This technique produces rounded edges and textured surfaces. Besides, the building procedure promote curved walls, which can be optimized, integrated and controlled through digital modeling and fabrication. Thus, the design of 3D-printed buildings requires establishing sizes of rooms according to the central measurements of the spaces (see Fig. 7, left) and subsequently determine detailed tool-paths for walls and corners, which must be preferably rounded. Therefore, architectural work must establish the occupation and magnitude of spaces within an integrated analysis and management of construction process, apart from to establish the envelope according the equipment available and deposition strategy, with convex edges that could difficult the fitting of furniture but promote the interiority of activities and a fluid perception of surfaces.

The horizontal and sinuous configuration of 3D-printed buildings also provides a combined appearance of technological innovation and ancestral stability (Fig. 7, right), with curve walls and rounded corners that dilute the visual awareness of edges,

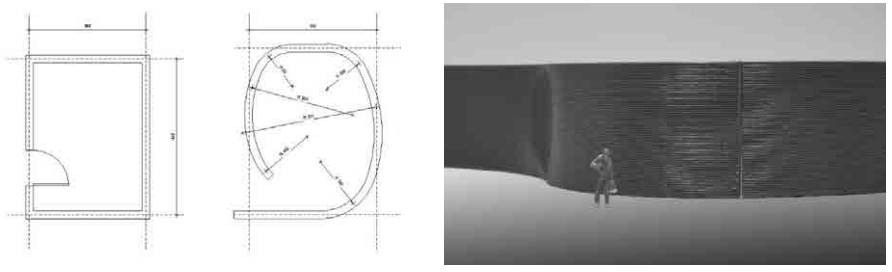


Figure 7. Drawing of conventional and 3D-printed buildings (left) and 3d-printed models (right). Source (Authors 2020).

thus privileging the expression of settled and continuous volumes. The perceptual extension of the faces prolongs the contours and dissolves limits, linking adjacent spaces and activities. Combined with technological and cultural meanings, architecture associated to 3D-printed construction promotes new social relationships, and the design are pushed to functional organization that must articulate technical procedures and expressive capacities of buildings and their urban possibilities.

CONCLUSION

The various proofs, designs and examples built with 3d-printed construction to date present novel architectural features. Material deposition produces rough textures in the building elements, with rounded corners and limited sections. Digital modeling allows integrating and optimizing construction, especially with varied and curved shapes. Buildings executed mostly have 3d-printed long and winding walls combined with conventional roofing elements, windows, installations and coverings. These conditions express an incipient architectural development oriented to an integrated management of design and execution focused on operational control and functional organization. But also, sinuous forms in buildings allow dedicating inner spaces to diverse activities and new expressions. Hence, this work provides a novel and initial review of architectural design with 3d-printed construction that suggests an emerging landscape of the architectural work and the cities' built tissue.

ACKNOWLEDGEMENTS

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PAPER #5.05

THE CITY AFTER THE CATASTROPHE. DILIGENT STRUCTURES

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ABSTRACT

In the last twenty years, society has witnessed complex humanitarian emergencies caused by radical atmospheric phenomena or sudden political changes with warlike consequences that have produced exceptional movements and resettlement of affected citizens. These emerging circumstances have hit especially hard the most disadvantaged sectors of the population. Needs for land preparation and fast small and large scale housing construction have emerged in order to accommodate those affected in the short or medium term.
In adverse environments, these needs require the generation of diligent architectural structures. In order to fulfill their objectives, these agile and versatile skeletons must be executed at local level, involving the citizenry and using as much autochtonous materials as posible. Capacities ans skills of the locals must be focused on four fundamental concepts: self-construction, portability, sustainability and reuse.
This study traces an introduction to the state of play regarding these diligent architectural studies. It exposes the problem of creating a model which responds by means of folding structures or dismountable ones, to the needs of each emergeny situation. Qualities such as versatility, adaptability to the problem, basic functionalities and conditioning factors are analyzed.

KEYWORDS

Deployable structures; removable structures; sustainability; self-construction; reuse.

INTRODUCTION

Since the 1990s there has been a growing interest not only in providing rapid accommodation for people who lose or have to leave their homes for a variety of reasons. But there is also an interest in making these habitats as safe, useful, flexible, reusable and sustainable as possible. Each location and each town has a certain and very specific idiosyncrasy which makes it unique. The shelter models implemented must be capable of responding to these needs with structural systems that are flexible enough to be able to adapt to different lifestyles, multiple locations and climatic conditions, with the use of sustainable and reusable materials. The present study aims to establish an approach to the needs that each emergency situation requires, the most appropriate type of accommodation in each case and which models of structure can offer a better response, without forgetting the needs of the individual and the sustainability of the system, i.e. its life cycle.

1. SUSTAINABILITY OF COLOR

After the Second World War, due to advances in technology, improved infrastructure and new communication systems at a global level, a movement of aid and collaboration among countries in case of humanitarian disasters and war began to be generated. After the Rwandan genocide in 1994, one of the largest population migrations of that decade took place and ths Sphere Project emerged. During that conflict, significant coordination failures among the different humanitarian

organizations that went to the area to help were observed and the success of those missions was meaningfully reduced. The aforementioned project was launched in 1997 with the aim of improving coordination among humanitarian organizations and of establishing common operating protocols for them all. The goal of the Sphere Project is to establish common principles and minimum quality standards in the event of having to act in any type of humanitarian emergency. These minimum standards are reflected in its "Humanitarian Charter and Minimum Standards in Humanitarian Response", which is regularly updated and revised. As the fundamental philosophy of the project, we can read in its Humanitarian Charter "[...] the right to live with dignity: the right to receive humanitarian aid and the right to protection and security." These rights are complemented by minimum standards covering the needs for: water, sanitation and hygiene promotion; food security and nutrition; shelter, settlements and non-food items; and health services. The present work will focus on this need for shelter and settlement. Two of the main causes behind the need of generating new housing are natural disasters and warlike conflicts, and both cases have different origins and needs that condition the type of response. Aspects such as the volume of population to be rehoused, the urgency with which the accommodation is needed, the assembly times, the duration of the stay, the model of population to be housed (family or individual nuclei), the lifestyle in the area (more or less rural), the climatic conditions of the area and the natural resources of the area determine the shelter model. Broadly speaking, we can establish two strategies that will condition the model of refuge to be implemented as a response to this need for new accommodation. The first one would consist of trying to maintain and respect the existing housing model by readapting it, reconstructing it and improving it and the second one would consist of standardized models or exported from other areas (Davis, 1978). Another important aspect to take into account when considering an efficient shelter design is the time factor. Up to 6 months we talk about emergency aid or what we could call immediate survival; after that time we find ourselves with humanitarian aid or post-disaster rehabilitation; and if the situation lasts for years we are facing a humanitarian action that would imply the reconstruction of the area (Ros García 2015). Any analysis of these issues shows that immediate relief, rehabilitation and reconstruction, although they are distinct phases, constantly interfere with each other, and immediate decisions taken a few days after the disaster usually influence long-term events (Davis, 1978).

2. METHODOLOGY

The bibliographical references shown in part 6 have been used for the drafting of this article, as well as consultations on specialized websites and search engines. Internet searches have been used mainly to extend and update the information on those interesting projects described in the books and whose description was too short, but interesting to extend in order to be able to go deeper into the subject.

3. DISCUSSION

In order to draw conclusions about the best shelters for each context, it is necessary to know which emergency accommodation solutions can be considered. The goal of the current work is, firstly, to analyse as many different models as possible from different points of view, namely: type of assembly, compactness of the system, reuse possibilities and structural system; and, secondly, to establish a classification of the different models employed in order to analyuse pros and cons, establishing then the suitability of each system

in each situation. For this reason, models implemented since the 1970s to the present have been studied, both used in the field and in the prototype phase or still under study. After the analysis a classification according to the constructive and structural features of the shelter models studied will be established.

3.1. Compact units

Compact units are already manufactured products, completely autonomous which do need no or very little assembly. They do not respond to any specific structural system. These models of refuge usually respond to rigid configurations that clash with the forms of traditional architecture of the place and use materials not always available in the area. Hence, it is a kind of model that has some acceptance as immediate accommodation but little success as a habitat in the medium or long term.

Dymaxion deployment unit

The Dymaxion Deployment Unit (DDU), or Dymaxion House, was created by Buckminster Fuller in 1940 to house American soldiers deployed around the world during World War II. It is a circular structure of about 6 m in diameter made of corrugated steel that resembles a silo. The dome shaped roof has perforations acting as windows and an upper ventilation hole. The interior is insulated and finished with wooden panels (fig. 1). This structural model was the germ of the "modern igloos", minimal constructions intended for housing and, later, of the geodesic dome (1948). The "modern igloos" were domes with an octagonal structural matrix that provided stability to the whole using a minimum amount of material. However, they were barely accepted as a shelter due to the rigidity of their shape.

Figure 1. Dymaxion deployment unit. Library of Congress: U.S. Farm Security Administration (Daderot 2011)

Western Germany Red Cross polyurethane igloo

Polyurethane igloos were used by the Western Germany Red Cross in 1972 as shelters after the Masaya earthquake in Nicaragua. It could be assembled in two hours, but it took more than 148 hours to occupy the first one as the right location could not be found. Of the 500 units assembled, only 30% were finally occupied because the model did not meet the living needs of the population.

CMAX System

The CMAX System is a prototype designed by Nicolás García Mayor in 2001 (fig. 2) which, according to the official website, consists of a housing module with a rigid central structure, built in polypropylene, aluminium and polyester fabric; and two wings made with a flexible material that, when unfolded, quadruple their size. This kind of shelter can

Figure 2. Cmax System housing shelter (García Mayor 2013)

withstand strong winds, is waterproof and easy to transport, as it is light and foldable and can be raised above the ground on a set of legs. It can host up to ten peoplele. With the adequate tools it can be assembled and secured in about eleven minutes.

3.2. Deployable structures

Deployable structures usually involve some mechanization and the use of their own materials. These structures are quick to assemble since joints are scare because the whole model is frequently solvid with membranes, curved sheets, domes or vaults. Models based on deployable structures display many possibilities for configuring the space beneath and around them. They are easy to be transported because of their reduced weight. They can be expanded or contracted because of their geometric, material and mechanical properties, turning them into meaningfully changeable elements with the possibility of constantly evolving and adapting to the architecture of the area where they are implemented (Rivas, 2015).

UNHCR Lightweight emergency tent

Tents are the most widely used system when it comes to generating new emergency accommodation. That fact responds to their economy, speed of assembly and versatility. On the contrary, these models do not always respond correctly to the climatic conditions of the area and have a very limited durability without the possibility of reuse after their lifespan. The most basic model consists of a double-flight tent with a central support and side braces that provide rigidity to the canvas. There are multiple variations and extensions of this model which even considers a model resolved with a dome. As a remarkable example, the UNHCR model was initially used in 2002 and is still in service.

Concrete Canvas Shelter

Commonly known with their acronym CCS, Concrete Canvas Shelters are constructed with CC13 concrete canvas, bonded to the outer surface of a plastic interior. The first step of the building process consists of inflating it. Once it has reached its final size and shape, it is hydrated with water and after twenty-four hours, it becomes a rigid structure ready for use. This typology generates curved structures of thin concrete wals which are both robust and lightweight. Concrete canvas shelter units can be coupled and arranged in series to generate sets of structures. The first prototype was developed in 2003 and is currently a registered system.

Weaving home

This prototype designed in 2013 by the architect Abeer Seikaly, re-examines the traditional architectural concept of field shelters by creating a technical, structural fabric which expands to protect but also contracts for later mobility while providing the comforts of contemporary living such as heat, running water, electricity, storage and many other.

3.3. Detachable structures

Detachable structures encompass all those structures which must be mounted entirely on site and require a much longer and demanding process to be finally assembled. In turn, this system has greater versatility making possible the use of local materials. Detachable structures display a much larger variety of structural models which range from framed systems with gabled or curved roofs to systems based on vaults or domes. The main purpose of a detachable structure is to be able to achieve more and better results with the smallest amount of resources as possible. This cathegory also aims to adapt the system proposed to provide answers to the specific needs of the area to be

intervened considering local resources and means. Therefore, detachable structures will be built with the minimum amount of what is available at a certain moments and by means of self-constructing, generating a universal system which allows new constructions to be adapted to the traditional models of existing housing (Ban, 2011).

Paper-Log-House

This currently used model was designed by Shigeru Ban in 1995. It is a temporary shelter made of cardboard tubes waterproofed by means of transparent polyurethane and filled with newspaper sheets. The plywood floor is supported by sand-loaded beer crates, while walls and roof posts are formed by the aforementioned assembled tubes, thus securing the canvas roof (fig. 3). The constructions is quickly recyclable, easy to transport and store, and quick and easy to assemble by the future occupants. Actually a unit can be built within ten hours, being fully reusable after its lifespan. It is a system which has been widely accepted and used in various emergencies, adapting it to the specific climate and materials of each area (fig. 4).

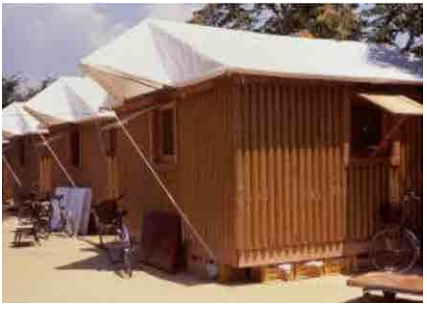

Figure 3. Paper-Log-House in Kobe

Figure 4. Paper-Log-House in Cebu

House elemental tecnopanel

This prototype designed by Chilean architect Alejandro Arevena in 2010 consists of a modular, mountable housing unit designed to meet housing needs during the floods which in that period affected his country. Its most remarkable characteristic is that, once assembled by three people in just one day, it can be both used as a permanent housing or as a temporary dwelling and then reused. It is based on an elemental prefabricated kit mostly based on structural insulated panels, SIP, which are self-supporting and made with a high-density polystyrene rigid foam core. More information on this system can be found in its official website: www.elementalchile.cl.

Superadobe sandbag shelters

Sandbag shelters are dome and vault shaped constructions which combine traditional architecture with new materials. Designed by Nader Khalili in 1995 they are still in use. Sacks filled with soil are compressed with a hand rammer and distributed following a circular pattern. A barbed wire is placed in the joints to prevent sandbags from moving and to provide stiffness to earthquakes (fig. 5). The system is completed with cement, lime or asht to add even more stability (Rivas 2015). This system was used for the fist time as a shelter in 1995 at the Baninajar Camp in Khuzestan, Iran. It was one of the results of applied research at the California Institute for Architecture and Earth Art, also know as the Cal-Earth Institute, founded by Nader Khalili in 1991.

Project VEM

This prototype was produced in 2017 by the Rebirth Inhabit Research Group of the CEU San Pablo University in Madrid, Spain. Architectural models builf after the VEM prototype can be completely dismantled. They are formed by a tubular structure in metallic allow, a light panelling on its horizontal base and a reinforced double layer textile envelope. It presents important architectural advantages when comparent to other current types of emergency housing, such as assembly easiness since it can be assembled by just two people in two hours, airborne, greater adaptability of seating and an extendable capacity system. VEM prototype versatility makes possible to adapt each unit to new locations and materials.

Figure 5. Figure 5: Superadobe sandbag shelters in Djibouti in 2012

CONCLUSION

When we are faced with a natural disaster, we are dealing with a population that is deeply rooted in the area and reluctant to leave their home no matter how destroyed it is, who prefer emergency accommodation in locations close to where they live rather than in remote camps, as all their possessions are there. In these cases, where what is lost is the home they live in, they look for a temporary shelter that can provide and allow for the lifestyle they are used to, a refuge that, if necessary, can end up becoming their permanent home. On the other hand, when we are facing migration due to war, the needs are different. People leave their homes and there is no feeling of attachment to the area. The new accommodation is seen as something temporary. The main purpose will be to return to the original home or find a new one. In these cases there is more freedom to establish the location of the shelters, it is possible to make a better forecast of the volume of people to be housed and the system does not need to be based so much on local models and allows the use of materials from the area. From this we conclude that any study on the provision of housing, shelter or new habitat should start with an analysis of what is needed in that particular community, to make housing that has a relationship to local cultural patterns and not consider it as a minor issue (Davis, 1978). Therefore, in many cases the success of the model to be used depends, not so much on the goodness of the model itself, but on an adequate tuning between the model and the concrete use it is intended for. Thus, we see that forms of housing or shelters that completely ignore the cultural customs of the occupants can become a failure. And the same goes for universal solutions if they are not used in the right context. On the other hand, providing a shelter while recognizing cultural issues and trying to use appropriate

and safe construction techniques has been more widely accepted (Davis, 1978). Analyzing different systems used as emergency accommodation in recent years we can establish a classification of them from a constructive and structural point of view and assess in which situations each model has been more appropriate. We find compact units, completely autonomous and ready to start working immediately as they do not require assembly; but with little capacity for modification and adaptation to different locations. So a priori it is a model suitable for short stays, emergency aid, and in temporary locations with no intention of becoming permanent. Secondly, we have the models of deployable structures, quick to assemble and with a greater flexibility, which allow the intervention of the users as regards their final shape and the use of materials to adapt it to their needs. Finally, we have the case of dismountable structures which need a longer execution time as they have to be assembled entirely on site, which in turn gives the system greater versatility, allowing the use of materials from the area and facilitating self-construction and reuse of the system. Deployable structures and dismountable or detachable structures, due to their versatility, are more suitable solutions for location in areas where there is a strong tradition and which are considered as long term stays, humanitarian aid or post- disaster, and which can end up becoming definitive as they are adaptable, reusable and self- constructed.

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PAPER #5.06

CONSTRUCTABILITY CRITERION FOR STRUCTURAL OPTIMIZATION IN BIM AND HYBRID DIGITAL TWINS

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ABSTRACT

The introduction of Lean Construction standards into the AEC Industry has changed the way that the professional approach the different problems. BIM and Hybrid Digital Twins are new high demanded technologies that improve the efficiency of the industry's procedures as they allow new and faster methodologies. Optimization algorithms are often used in combination with these techniques to improve the result at several points of the design phase, including the structural project. The optimization can be done using different criteria, like the economy, sustainability, energy consumption or constructability or a combination among them. While there exist exact formulas to quantify some of these criteria there is not a universal one to quantify the constructability. In this article, we establish the key points to create a constructability criterion for each structural project and explore its efficiency. The way to quantify the constructability depends on the structural design and element to be optimized and as there is not an exact formula to quantify the different factors that influence it have been defined and their combinations explored for a certain structural problem: optimization of a concrete beam. With this, we are able to quantify the easiness to build a certain structural project and reduce the building time and crew cost and create a way to improve the structural design. This exposed method can then be expanded to different structural elements.

KEYWORDS

BIM; digital twins; constructability; optimization algorithms.

INTRODUCTION

The Architecture, Engineering and Construction Industry (AEC Industry) has been one of the most static industries in the world and has been reluctant to changes, in the last years this tendency is starting to change. The introduction of powerful informatic tools creates a new environment where automatized tools can be developed for several tasks (Eastman et al. 2011). These tools allow the professionals to improve their productivity and quality of the project and at the same time have more control over it and are based upon management improvements. Some of the management improvements to the industry are led by the increase in the usage of Building Information Modelling (BIM) Environments (Volk, Stengel, y Schultmann 2014) and Digital Twins (Chinesta et al. 2019). Both provide great advantages for the professionals as they are able to handle a lot of parameters and work with them simultaneously. Allowing the AEC Industry to introduce the different Lean Construction (LC) precepts effectively and improve the sustainability of the project. The adoption of the two different environments is an evolution to traditional methodologies and by using them the professionals are able to reduce the risk of errors during the project, achieve

better accuracy through the design phase or their management capabilities. There is also utility when working in cloud-based servers (Jiao et al. 2013) with several people operating at the same time in the same model with coordinated modifications and improvements which are natural in both of them. There are a lot of differences among both of the previously stated environments. On one side, BIM is hard to define term as it includes three concepts: a product, the digital file where the model of the project is stored, the specific type of software and the methodology used to create the model (Eastman et al. 2011) («Frequently Asked Questions About the National BIM Standard-United States™ | National BIM Standard - United States» 2016). BIM, in reality, is a mix between the three concepts is an n-dimensional matrix of the project's data where the user can define and relate new dimensions and variables between them, this set of dimensions is the digital model of the project that is developed on a BIM software and to properly use it the methodology has to be used. On the other side, Digital Twins are one step ahead of the BIM environments in terms of project management. They do not only work during the design phase but also during the life cycle of the building. A Digital Twin is a virtual model for a certain procedure, product or service which is continuously being updated with new input from the real object on the world. For the AEC Industry, it consists of a digital model of the building itself which is being updated through sensors from the building. This model can be used to visualize, analyze, simulate and plan everything on the building (Chinesta et al. 2019). As seen each one of them has its advantages and its uses. BIM works better in the design and construction phase allowing the professionals to optimize results and procedures and Digital Twins are better managing variations and modifications through the life cycle of the building. The environments by themselves are only a framework to control the project and visualize its different aspects simultaneously. They are a completely new methodology that is starting to change the way that the AEC is working. But by themselves, they are only able to control, show and manage parameters. To fully take advantage of the environments these parameters have to be analyzed in conjunction with each other. For this purpose, the Building Performance Tools (BPS Tools) are used, as they are able to take the parameters stored in the digital environments and use them for several tasks. A lot of BPS Tools have been developed through the last ten years to improve sustainability (Chong, Lee, y Wang 2017) (Lu et al. 2017), reduce CO_2 emissions (Chen y Luo 2014), waste reduction (Akinade et al. 2015), optimize structural design (Fernández-Mora y Yepes 2017), among other purposes. A large group pf BPS Tools are focused on the design aspect of the project, helping the professionals to make decisions or even designing some elements by themselves, like structural elements. These design tools are based upon design restrictions (structural analysis and requirements) and design criteria like economy, sustainability, energy consumption or others. These design restrictions or directives can also be introduced into an optimization algorithm that is able to find an optimal design for the problem. In (Diao, Kato, y Hiyama 2011) we can find an example that uses a BPS Tool to optimize the CO_2 emissions for structural design. One of these criteria that can influence the design of a structural element and improve it is the constructability. The constructability or buildability of a certain structural element measures its aptitude to be built. So, it is a measure of the easiness to build a certain element. Lower constructability

measurements allow easier structures to be built and easier structures are more economical. It also reduces the number of mistakes occurring during the execution, because error appearance is directly related to the complexity of the element (Shrivastava, Chaurasia, y Saxena 2017). The term constructability is usually referred to several aspects at the same time. First, the extent to which the design parameters facilitate the construction of the element while achieving the building requirements. Second, the effective and time integration of construction knowledge into the conceptual planning and field operations. Third, to balance the different environmental constraints, project goals and building performance. It is not an universally measurable criteria as different factor interact in a different way for each case. In this paper, we aim to define a way to measure the constructability of an element and be able to compare it among other similar ones. This mathematical model to measure the constructability can then be used in a multicriteria optimization algorithm complementing other criteria and help the professionals to achieve an overall better design.

1. METHODOLOGY

1.1. Case Study

Per the definition above, the constructability is a criterion that has to be defined for each specific problem. So, in this problem, we will not find a universal definition to measure it, but a methodology to define it for every structural case, which will need further study. In this paper, the case study is a concrete beam with rebars on both faces and transversal reinforcement. We use a fixed span of five meters and loads according to residential use, without any particularity that may alter the design there are constraints for both, bending and movements at each ending. We assume that when measuring the constructability the design has been already validated and it is enough to resist the efforts on the beam. The constructability criteria will

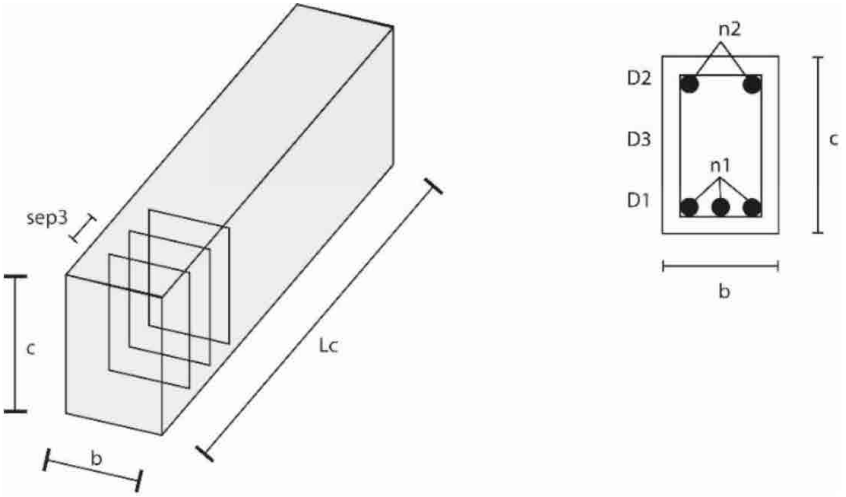

Figure 1. Geometrical parameters of a concrete beam

not check any design restriction, including those regarding the buildability itself as rebar disposition, assuming that they are sufficient for their structural requirements.

1.2. Parameter Definition

Fig. 1 contains the geometrical parameters of the beam. Its dimension is defined by two parameters, width (w) and height (h), in combination with the fixed span they define the external dimensions of the element. The distance between the face of the element and the rebar is defined by the cover (c) parameter. To define the rebar a total of six parameters have been used, three for the diameter of the different rebars: one for the diameter of the rebar in the bottom side of the beam (D1), a second for the diameter of the rebar in the top side (D2) and a third one (D3) for the transversal rebar. And three more to determine the number for each of the reinforcements: bottom rebar (n1), top rebar (n2) and the distance between the transversal rebars (sep3). Constructability is not only related to the geometrical definition of the beam, but there are also other factors that can affect it. The weight of the different materials has to be taken into account through its density with two more parameters also the relationship with the other elements in

Table of parameters	
Parameter	Measurement
Geometrical parameters	
Width (w)	Centimeters
Height (h)	Centimeters
Cover (c)	Centimeters
Bottom-side diameter (D1)	Millimeters
Top-side diameter (D2)	Milimeters
Transversal diameter (D3)	Millimeters
Number of bars in the bottom (n1)	Direct amount
Number of bars in the top (n2)	Direct amount
Spacing between transversal bars (sep3)	Centimeters

Non-geometrical parameters	
Concrete density	Kilonewton per cubic meter
Steel density	Kilonewton per cubic meter
Concrete consistency	Slump test
Rebar homogeneity	Mean value of the rebar diameter
Type of beam	h equal/greater than span thickness
Formwork	Square meters
Type of construction	On-site/Precast

Table 1. Parameters defining the case study

contact and if it is needed the formwork and its size. The consistency of the concrete is another factor directly related. On-site or precast construction can also be a key factor because the parameters interact differently between them. Or the homogeneity of the rebar reinforcement understood as the use of rebars of similar sizes. There are also factors external to the element itself such as the experience of the working crew, time of the day or weather that can affect the constructability of the element. In this paper, this is not taken into account, as our goal is to create a mathematical model able to handle the criteria for further use in the design stage. These parameters can't be known prior to the execution and are independent of design changes and they can introduce noise in the model that will not improve it as they are nor design dependants. A total of 16 parameters have been used to define the constructability of a beam. Table 1 summarizes the different parameters and the units utilized to measure them. Some parameters are not measurable and describe certain characteristics of the element. To be able to compare and combine the factors into one criterion it is necessary to unify and categorize them. For this, a survey has been conducted among several AEC professionals, including architects, engineers and constructors asking for a hierarchy among the parameters.

2. RESULTS

2.1. Parameter Definition

The survey asked different professionals to sort the parameters in order of relevance for the constructability of a beam. With this approach, we can create a hierarchy for the parameters and determine their importance. The results of the survey are shown in Figures 1 and 2. The first one shows box-plots of the results showing the dispersion in the importance of the parameter for the different professionals tend to prioritize different variables when designing the structural elements, this dispersion has to be taken into account to weigh the importance of each parameter. From Figure 2 we can gather the parameters into three different main groups regarding the importance. These clusters have been shown in the figure with the colored lines. The first group consists of two parameters, height and type of construction, both of them are related to the relationship of the beam with their environment, their mean values oscillate between one and four. The second group contains all the parameters regarding both rebars and type of beam. The third and last group covers the rest of the parameters, these group also has the biggest deviations in the box-plot diagram, so different professionals give different attention to them. During the survey, the professionals were also asked about other parameters that were not taken into account in the research. Some of the professionals suggested the size of the arid as a parameter to be added. After further study, this has been discarded, as its effects are taken into account considering the number of rebars and the consistency of the concrete. There is also the fact that in some areas the size of the arid is determined by the availability and not chosen by the professional, so it can be considered an external factor instead of a parameter. From this survey, we can extract a hierarchy based upon the experience of the professionals and how they evaluate the constructability in a concrete beam and then establish a way to measure it. Figure 3 shows the correspondence between the mean value and the standard deviation for each parameter. A parameter with lower mean has been given more importance by the respondents and a lower standard deviation implies more agreement among the professionals in the importance of a certain parameter.

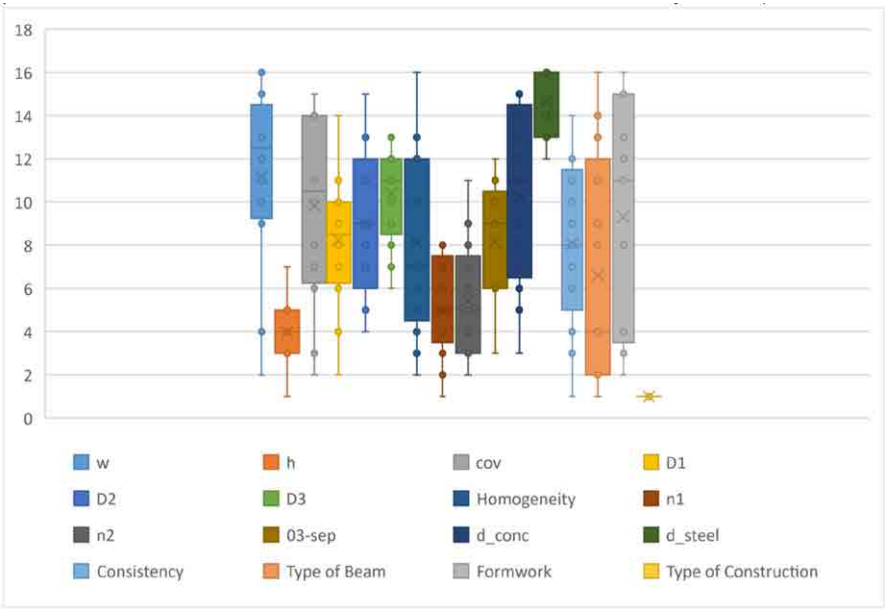

Figure 2. Box-plot diagram with the results of the survey

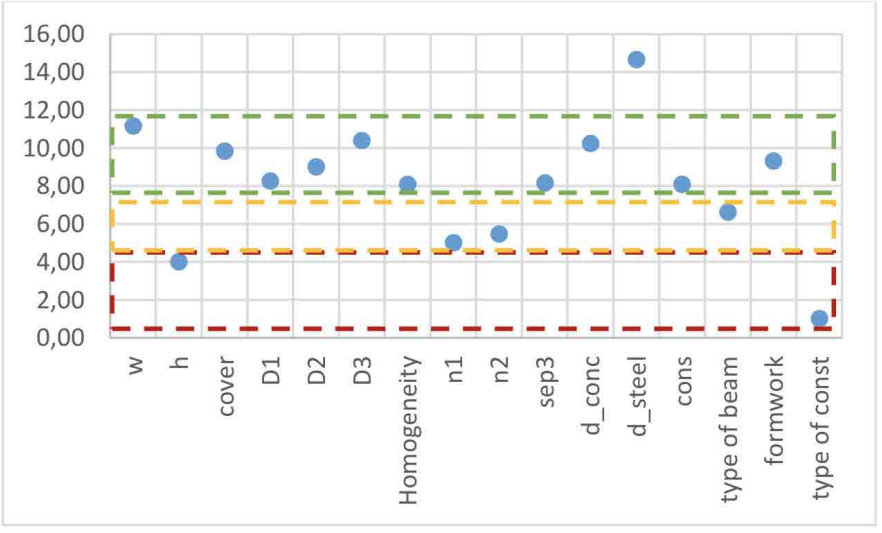

Figure 3. Mean value for each parameter

3.2. Hierarchy for constructability

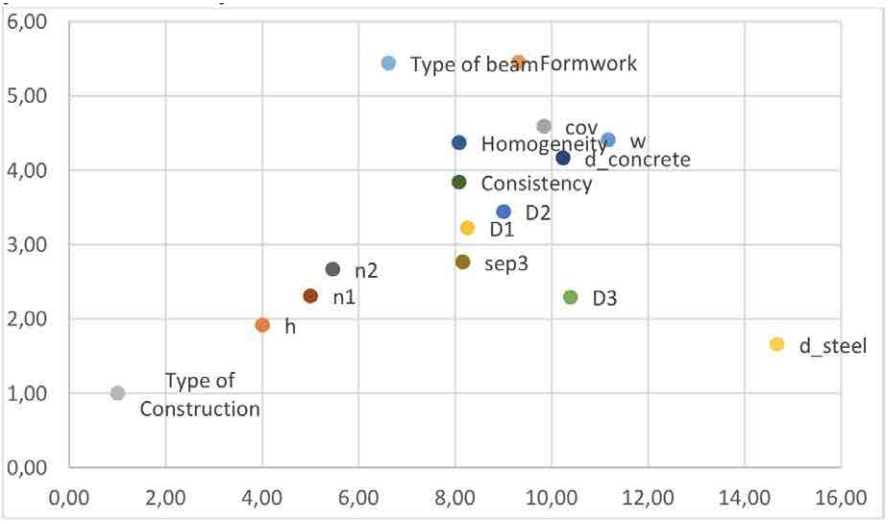

Figure 4. Cluster analysis of the mean and standard deviation for each parameter

From the figure, we can see a tendency between the mean and the deviation, parameters with more importance are also important for most of the interviewees in almost a linear regression. This phenomenon is more accused in the first group of parameters and defines two sets of clusters encircled in the figure, there is a parameter outside of this phenomenon "steel density" which has been considered by most of professionals as the least valuable one. The parameter which has been given more importance is the "type of construction". The first cluster is the one with higher importance and it will be considered in that way when considering the constructability analysis, either way, the second cluster is also relevant and influential even if it has less impact on the criterion. The "steel density" parameter has been unfavored by most of the professionals given its position, for this reason, we are going to discard it as its influence can be explained through other parameters that have a bigger impact on the whole environment. The "type of construction" parameter has been proved to have a lot of influence on the constructability and after analyzing the data its two values cannot be compared between them, so it is going to be considered as an external factor to achieve a more accurate result.

3. DISCUSSION

3.1. Units of measurement

After sorting the parameters and weighing them we are in need to establish a measurement system. Typically, an optimization criterion can be quantified using a certain unit, like currency when

studying the economic aspect, the mass of carbon dioxide emitted during production or watts consumed among others for sustainability, but this cannot be done with the constructability as different units are taken into account. When assessing the constructability every parameter has its own unit and some of them are discrete variables dependent on the amount of something, like rebars placed. These quantifications cannot be mixed in a direct way as it will create inconsistency in the measurement. There are two possibilities to unify the parameters in an indirect way: currency value and working time, both related to the efficiency of the working crew. Both of them can assess constructability in an indirect way. The economic value is usually also taken into account when using a multicriteria optimization algorithm, but it is hard to completely take into account the prize for the working crew exactly as can overload the computer with data or create inaccuracies due to too many factors taken into account. Other possibilities based on discrete quantitative indirect approaches can be used to evaluate the constructability as working crew time but it is hard to define.

3.2. Quantifying the constructability

From the survey results and the cluster analysis, we can confirm that there are factors which influence more than others The hierarchy shows which of them need more weight than the rest, we can also estimate that the first cluster is roughly twice as important as the second, because their total mean values differ in that proportion. Optimization algorithms tend to overload the computer creating a huge population that must be handled and analyzed at the same time. Computational time is a determining factor in them and adjusting the methodology to evaluate the criteria is crucial. Depending on the research it is possible that it is beneficial to reduce the accuracy to favor the computational time. Through this paper, we have seen that constructability is not universal, either by the perception of the professionals or the units that can be measured. We are going to define several methods to quantify the constructability in a concrete beam, allowing us to adjust the computational cost to the necessities. The different proposed methods are sorted from lower to higher computational cost and data needed to perform the analysis.

- Number of rebar reinforcements: The most influential parameters in the constructability are the rebars. The raw number of them is directly related to its constructability. An element with more rebars will need a bigger resource investment to be built as it gains complexity. So, the element with fewer rebars has more constructability than the rest. This criterion can be exposed by the following formula:

$$C_1 = n1 + n2 + \frac{sep3}{l}$$

-Number of rebar reinforcements modified: Considering not only the rebar number but the difference in diameter among them creating and adding the height of the element into the criteria a more accurate scale can be obtained. This takes into account all the parameters existent in the first cluster and weighs them based upon its importance. The formula is the following:

$$C_2 = h \cdot (n1 \cdot D1 + n2 \cdot D2 + \frac{sep3}{l} \cdot D3)$$

This formula does not have any direct physical meaning but weighs the criteria following the intended parameters. Larger values for the parameters reduce the constructability of the element. Each rebar is weighed by its diameter, as thicker rebars are harder to be placed, in the same way, the height increases

the constructability as it lowers showing the negative effect of it. It is also low in computational cost and considers the most influential parameters.

-Working time invested

As previously discussed, one of the most accurate values for the constructability is the time spent by the working crew to build the element. This criterion quantifies the number of hours needed to accomplish it and takes into account the different considered factors and interactions between the defined parameters. The standard amount of time for each of the considered operations differs from country to country, but there are databases where an accurate estimation can be obtained. This criterion is split into different sections.

$$C_{3a} = [(h \cdot w + cov)] \cdot t_{3a}$$

The first section takes into account the time spent in shaping the element or how its external shape and contour factors affects the time spent. The parameter t3a measures the time spent to position the element in the building measures in m^2/h.

$$C_{3b} = [\sigma_{hom} \cdot \left(n1 \cdot D1 + n2 \cdot D2 + \frac{sep3}{l} \cdot D3\right) \cdot (con.)] \cdot t_{3b}$$

$$Homogeneity\ (\sigma_{hom}) = \sqrt{\frac{1}{n-1}\sum_{i=1}^{n}(D_i - \bar{D})^2}$$

$$Values\ for\ consistency\ (con):\ (based\ on\ the\ slump\ test\ results) \begin{cases} (0-2)cm. \rightarrow 1.1 \\ (3-5)cm. \rightarrow 1.05 \\ (6-9)cm. \rightarrow 1.00 \\ (10-15)cm. \rightarrow 0.95 \\ (16-20)cm. \rightarrow 0.90 \end{cases}$$

The second section quantifies the amount of time spent to put the rebars into the right place and distribute them consistently. It takes into account the loss of time due to using different rebar sizes and its difficulty in a placement through the homogeneity of them and also the amount of time spent when dumping the concrete in the cast and its interaction with the rebars. The parameter t3b considers the time spent to develop all these tasks.

$$if\ h = slab\ height$$
$$C_{3c} = (l \cdot w) \cdot t_{3c}$$

$$if\ h > slab\ height$$
$$C_{3c} = [(l \cdot w) + 2 \cdot (l \cdot (h - slab\ height))] \cdot t_{3c}$$

The third and last section takes into account the time spent in the construction of the formwork and it varies depending on if the element has a higher height than the one in the slab that it is in. The parameter t_{3c} measures the hours spent to build the formwork expressed in m^2/h. With these three sections we can define the constructability criterion like the following:

$$C_3 = C_{3a} + C_{3b} + C_{3c}$$

-Working time simplified

A simplified version to quantify the working crew time can be done assuming a relationship between the steel weight in the section of the element. The parameter t4 measures the mean value to build a certain section based on this assumption and is obtained through databases and increased gradually as the amount of steel increases. With this simplification, we can quantify the constructability with the following formula.

$$C_4 = \left[(\left(\sum_{i=1}^{n} n_n \cdot [\left(\frac{D_n}{2}\right)^2 \cdot \pi]\right) \cdot \gamma_{steel})/(h \cdot w)\right] \cdot t_4$$

CONCLUSIONSThe AEC Industry has a tendency to automation and improving the procedures by using digital tools such as BIM environments and Digital Twins. For this several BPS Tools are in development to analyze the building requirements and improve, and optimization algorithms are being used in connection with them to help the professionals to achieve better designs.

In this paper, we have explored the parameters necessary to define a new criterion, the constructability for a specific structural problem, a concrete beam. By using a survey a hierarchy among the different parameters has been created and discovered two sets of parameters This methodology can be used to define the same criterion for a different structural element. Using this previous survey, four distinct ways to measure the constructability have been defined and their strong and weak points explored to adjust the accuracy of the criterion to the optimization purpose where it is going to be used.

Future Research

The model presented in this paper is not a fully developed model, as we have assumed some simplifications. The different mathematical models for the constructability that have been proposed can be refined taking into account more parameters and will achieve a more accurate result, probably at the cost of more computation time. Further research is required to create a mathematical model able to handle a discrete approach for the rebar disposition, including the analysis of each diameter and position individually. A comparison among the results obtained with the four definitions for constructability in this paper can be done and tested with real results to properly adjust the mathematical models. This comparison of results will show the ideal cases of optimization for each of the four models. Also, the movement of the crew along the whole building site and the position of the element itself can be taken into account, to assist the constructability for the complete structure and not to each of the elements or the reduction of trims in the rebars to optimize not only the working time but also to reduce the waste. Further study is required to be able to mix both types of construction, usually, precast elements tend to have better constructability because the process has a higher level of automation, but this is not always true for simpler elements and the different interaction between the parameters has to be taken into account.

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PAPER #5.07

THE SUSTAINABLE WHITE CITY

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ABSTRACT

The history of architecture and urban planning tells of white cities, whose chromatic characteristic derives from the use of local resources (stone, lime) and which unconsciously responded to principles of environmental sustainability. During the first half of the twentieth century, some European countries undertook economic and social policies aimed at the agricultural development of the territories and a consequent repopulation of the countryside. Especially in the south of Spain, numerous white-colored cities were founded.
Global warming issues call into question the current organization of the city, which must renew itself and create comfortable and compatible living conditions with long-term development. Today the importance of color is reaffirmed in the possibility of re-establishing the contemporary city according to principles of environmental and economic sustainability. In the field of architectural design, one of the central aspects to consider is the amount of energy that buildings need to cool down, and the amount of heat they emit into the atmosphere. Especially in areas with warm climates, the energy consumption of a building is determined by its thermal insulation properties, which mainly depend on the material and color of the external surfaces. The use of white color allows to reduce the heat absorbed by buildings, with lower energy consumption and emissions; furthermore, the amount of heat re-emitted in the atmosphere is reduced, with the possibility of decrease the urban heat island effect.
This simple chromatic principle of architecture can be extended to the urban scale thanks to a wide range of products and technologies, so that some cities have already undertaken a chromatic conversion.
The contribution tells the idea of a sustainable white city and, starting from examples of built architecture, it defines the possible principles, materials, techniques and technologies available for the design of architecture and the contemporary city.

KEYWORDS

Architecture; design; tradition; innovation; color.

1. TRADITION AND CONTINUITY OF THE WHITE COLOR

The origins of the use of white in architecture and the arts are distant and difficult to trace, related to primordial values and ancient ideals such as the sacred and purity, which give this particular color an almost universal meaning (Zammerini 2014). The history of architecture and urban planning tells of ancient white cities, whose chromatic characteristic derives from the use of local resources (stone, lime), a traditional practice that has above all hygienic reasons but which, almost unconsciously, responds to principles of environmental sustainability. In fact, in the thinking of vernacular architects, the holistic conception of the project is completely synergistic with the methods and materials available. The practice of whitewashing the walls of buildings spread throughout the Mediterranean area mainly during the eighteenth century, thanks to the hygienic properties of lime; at the same time, the white coating protects the masonry, decreases

solar radiation and improves the thermal conditions of the buildings. For these reasons, for centuries white color can be considered one of the characteristics of Mediterranean architecture and cities, which also corresponds to a spatial principle based on the construction of elementary and compact volumes - another principle of economy that also has the effect of reducing the exposed surfaces - the adoption of shaded patios and courtyards, and the creation of a few and measured openings, which allow lighting without heating. But the color white is also strongly linked to classical culture: for many centuries (and until the early 19th) the idea that Greek sculpture and architecture were white, idealized in the monochrome of Parian marble, resisted. In the eighteenth century, the tales of the *Grand Tours* and the passion for antiquities emphasize a mythical ideal of Greek art that Johann Joachim Winckelmann encoded in "noble simplicity and quiet grandeur" in which white enhances the beauty and perfection of forms (Winckelmann 1994, 117). Despite Winckelmann's historical reconstructions then turn out to be erroneous, these aesthetic theories are followed by most of the neoclassicals, influencing the plastic arts and architecture for a long time up to the present day (Collins 1970, 111-116). In the revolution wrought by the Modern Movement, white is the background of a page on which to write a new story: it expresses the cleanliness of the surfaces (to which the absence of ornament and the need for hygiene refer), the purity of forms and principles, the concepts of abstraction and denaturalization of volumes and materials[1]. Subsequently, the events of white in some cases are directly linked to the nationalist ideals of the ideologically similar governments of Italy, Spain and Portugal, where a new trend arises that leads to the study and recovery of popular building traditions, to the interest in spontaneous and anonymous architecture. This trend will have its peak, at the height of its diffusion, in the famous Bernard Rudofsky's *Architecture Without Architects* exhibition at the MoMA in New York and in the homonymous book published in 1964. In Spain, during the first half of the twentieth century, as part of a program for the repopulation of rural areas (initiative common to many nations), the color white asserted itself as a particular character in the architecture of newly founded cities. In this context, white experiences a great diffusion as a common feature of the various colonizations, predominant in these neo-popular architectures, which certainly refer to the elements of traditional architecture of southern Spain, but which starting from these introduce interesting linguistic innovations, so much so that it can be considered a pioneering experience on the theme of the rural house and on urban planning (Centellas Soler 2009). Among the many works of interest, those by José Luis Fernández del Amo and Alejandro De la Sota stand out. The projects of the *pueblos* extend the chromatic principle of white to the entire new settlement and, thanks to the sensitivity of their designers, they become bearers of the architectural concerns of the time, certainly extendable to the rest of European culture but, by their nature, referable to the specificity of contexts. This architecture built with reduced economic resources, with essential and humble tools (both design and technical-construction), rediscovers the true *spirit of necessity* that guides the *highest* forms of the art of building. A pioneering and experimental experience, capable of influencing the development of architectural and urban research from the twentieth century up to contemporaneity. So, the history of the white color in architecture is clearly linked to the history of construction materials, techniques and technologies that, as they evolve, contribute to the creation of forms, styles, movements and trends. The events of white architecture - and not only of it - cannot

[1] On the issues of color in modern architecture, a relevant contribution is that of Cramer Ned, "It was never white, anyway", in Architecture n. 88, 88-91. On the same theme, an analysis of the context of modernity is provided by Juan Serra Lluch, "Il mito del colore bianco nel Movimento Moderno", in Disegnare: Idee Immagini n. 41, 66-77.

be separated from the cultural evolution in the succession of the epochs, from the specificity of the places, from the psychological meaning, as they cannot be understood without considering the technological progress of the architecture. Today, new materials and innovative techniques allow to think about further applications of the color white in architecture - combining spatial research and sustainable thinking - potentially extendable, thanks to a wide variety of solutions, to the entire city.

2. SUSTAINABILITY OF COLOR

2.1. Physical factors

Global warming issues call into question the current organization of the city, which must renew itself and create comfortable and compatible living conditions with long-term development. Today the importance of color is reaffirmed in the possibility of re-establishing the contemporary city according to principles of environmental and economic sustainability (De Marco, Margagliotta 2018). In the field of architectural design, one of the central aspects to consider is the amount of energy that buildings need to cool down, and the amount of heat they emit into the atmosphere. Especially in areas with warm climates, the energy consumption of a building is determined by its thermal insulation properties, which also depend on the material and color of the external surfaces. The use of white color allows to reduce the heat absorbed by buildings, with lower energy consumption and emissions; furthermore, the amount of heat re-emitted in the atmosphere is reduced, with the possibility of decrease the *urban heat island* effect. In fact, regardless of the material and construction technique chosen for each architecture, the use of white offers some advantages for the sustainability of buildings. It can be said, in fact, that white is the greenest color in architecture, both for the exterior and the interior of the building (Lechner 2015, 120).

The physical properties of the color white make it particularly efficient from an energy point of view and therefore sustainable. If we are to consider temperatures, the most sensitive surfaces to the absorption of sunlight are the ceilings. The greater reflection of light rays causes, for example, that white ceilings heat half of black ones. This characteristic is quantifiable through solar reflection, also known as albedo, that is, a parameter that measures the capacity of a surface to reflect solar radiation. An albedo equal to 0 (zero) indicates a surface that does not reflect sunlight and, therefore, absorbs it in its entirety, with a consequent increase in temperature; conversely, an albedo value of 1 (one) indicates that sunlight is fully reflected. Table 1 indicates the albedo values for some surfaces commonly used in construction, of which it is observed that the white color has an albedo that varies from 0.5 to 0.9 (50% - 90% solar reflection), depending on the roughness surface and cleanliness. The so-called cool roofs are precisely the roofs that remain cool, or rather less warm, than traditional roofs. Especially in hot climates, paying attention to these aspects of construction can significantly reduce building overheating, resulting in lower costs to cool it down. At the same time, the widespread use of cool roofs can affect the urban scale for the reduction of the already mentioned *heat island* effect. Even on vertical surfaces, the white color reduces heat, two-thirds less compared to a black wall. If applied in buildings arranged in narrow streets, the white color increases the diffusion of natural light on the lower floors. In general, opaque white surfaces can be considered more sustainable than glazed ones, even if they are protected with sunscreens or shading elements. These briefly enumerated principles could be applied to the project of architectures more suitable to the climate and, ultimately, more sustainable; In any case, to more accurately quantify the reduction in temperatures, it is necessary to evaluate not only the color of the material, but also its thermal transmittance properties.

Building surface	% Albedo
White paint	50-90
Highly reflective roof	60-70
Colored paint	10-40
Brick and stone	10-40
Concrete	10-40
Red/brown tile roof	10-40
Grass	20-30
Trees	10-20
Corrugated roof	10-20
Tar and gravel roof	5-20
Asphalt paving	5-20

Table 1. Albedo of typical building surfaces (Lechner 2015)

2.2. Space and perception

According to some studies on human response to the color of its environment, white should not be chosen as the color of a space where people stay for a long time, such as offices or classrooms (Birren 1978; Mahnke 1996). This observation is not based on aesthetic but ergonomic reasons: the use of white - which has the highest light reflection factor of all other colors - associated with high levels of illumination (natural or artificial) and glossy and reflective finishes, it can produce glare and, consequently, a decrease in environmental comfort, causing visual, mental and emotional fatigue. In fact, to adapt to very bright environments, the eye muscles continuously act to reduce the opening of the pupil, with the consequent rapid tiredness. If the chromatic component confers a particular dimension in the architecture, this is even more true if the color is white (Cage 1993). In fact, white has the ability to minimize solar radiation (with the clear advantages previously described), improve the perception of shapes, expand spaces, enhance the play of light and shadow; in contemporary architecture, the use of white can refer to ideologies and specific spatial and linguistic investigations. According to design choices, today more than ever materials are projects in themselves (Deplazes 2013); in addition to building the architecture, the material qualify the space with its perceptual qualities (opacity-transparency, smoothness-porosity, temperature), so that even color must be considered an architectural material. The higher performance demands in contemporary buildings determine a constant drive to implement product quality and improve traditional techniques. These requests also lead to the adoption of materials that have been tested in other scientific fields and then, in some cases, conduce to the definition of exclusive materials for a special work, which can then be extended for a wider production. But the sustainability of architecture does not only concern the energy performance of a building or a set of these. A profoundly sustainable thought must also consider the influence of the project on the landscape (urban and otherwise), its correspondence to the cultural context and the relationship with the construction and living traditions. White architecture, in this sense, refers to universal values capable of adapting to the different conditions of the places.

3. APPLICATIONS FOR ARCHITECTURE AND THE CITY

This simple chromatic principle very present in the architecture of individual buildings may be extended to the urban scale thanks to a wide range of products and technologies, so much so that some cities have already undertaken a chromatic reconversion, intervening on the space and on the existing buildings, as a first step towards a profound change in the paradigms of building and urban design. Below some realizations are analyzed, chosen to represent the principles of white in architecture and which, thanks

to the qualities they emanate, allow the specification of the range of products available for the sustainability of white, by relating their uses and the possibilities they offer to the different design purposes of architectures. It is then made up of a catalog of solutions, materials, techniques and technologies available for the architectural project and the contemporary city.

3.1. Conversion of existing places

For the intervention on existing buildings (especially for refurbishment and renovation of buildings with shape constraints) an important contribution to the use of white in architecture comes from water-repellent and self-cleaning paints, which can also have insulating properties. A particular case is that of the liquid ceramic insulation that Elisa Valero Ramos has used for the construction of her own studio on a small plot in the center of Granada (Fig. 1). The availability of only 3.60 meters of depth, has led to reduce the thickness of the wall towards the street through the use of this special insulation, put into work as a simple painting. Composed of spherical microgranules of special ceramic, the liquid insulation uniformly covers any surface, forming a continuous, flexible and crack-free layer, which in a thickness of less than 1 mm provides insulation equivalent to 10 centimeters of polystyrene. From the point of view of the project, the use of white inserts the building into the chromatic and material continuity of its surroundings and, in other respects, adequately insulates it. As for the sustainable conversion of horizontal surfaces, flat or sloping roofs, the aforementioned cool roof technology includes a wide range of high solar reflectance paints that can reduce the surface temperature up to 30 °C. With regard to circulation spaces, however, the market offers a range of high-performance water-based sealants, directly applicable to existing surfaces (including asphalt) as a normal waterproofing product. The white color and the high reflectivity - although they reduce their effectiveness if not cleaned - allow to significantly reduce the surface temperature and consequently that of the environment, also increasing the night visibility of the streets without producing glare[2].

Figure 1. Elisa Valero Ramos studio in Calle Belén, Granada.

[2] In 2019, the city of Los Angeles began testing this particular technology on 15 stretches of road.

3.2. Design of new spaces

For the external horizontal surfaces (car parks, secondary roads, paths and pedestrian areas or green ways), there are interesting applications of white draining concrete, as in the case of Italcementi i.lab center in Bergamo, designed by Richard Meier (Fig. 2). The building - also entirely white thanks to the use of a special photocatalytic concrete - is part of a large natural park, accessible by walkways, ramps and outdoor spaces made of white draining concrete. This technology, thanks to the special mix-design, allows to safeguard the aquifers and, thanks to a high albedo, reach significantly lower temperatures than asphaltic floors, with the possibility of reducing the heat island effect typical of metropolitan areas. Regarding the building envelope, plaster still represents the most widespread technique for white architecture, due to its low costs and ease of application, especially for small-scale interventions (Reichel, Hochberg, Köpke 2007). However, to achieve the performance required for current architecture, the plasters acquire increasingly high insulating and breathable properties, obtaining interesting characteristics of durability and sustainability. One of the most interesting technologies applied to renderings is photocatalytic, which today is also being used in other finishing materials for architecture (such as the previously mentioned white concrete). In fact, the photocatalytic plaster is particularly white and shiny due to the presence of titanium dioxide (TiO_2); This chemical compound makes the plaster active, decomposing the microorganisms present in the air: with a process similar to the chlorophyll photosynthesis, air and light oxidize polluting substances and fine particles, forming harmless residues. These compounds are washed away by the rain, thus obtaining anti-pollutant, antibacterial and self-cleaning properties. With a greater durability, the photocatalytic plaster also allows to prolong its chromatic characteristics and consequently the physical effectiveness of its whiteness. The use of ceramics in architecture dates back to an ancient tradition, particularly widespread in countries and cultures with Arab influence. In its contemporary use, the ceramic material is renewed, so that some elements - today available in large sizes and reduced thicknesses - can be designed according to specific needs. Some producers also manufacture ceramic pieces with photocatalytic characteristics (also in this case with the use of titanium dioxide) that endow the surfaces with antibacterial, anti-pollution, anti-odor and self-cleaning properties. Among the examples of contemporary applications, always in the context of white architecture, the rental housing building in Gójar designed by Elisa Valero stands out (Fig. 3), which on the exterior, both on the facades and on the roof, is clad with alveolar ceramic: stoneware pieces traversed inside by alveoli that improve insulation; Research for sustainability has also led to the use of an enamel that is characterized by its capacity to capture CO_2.

Figure 2. Italcementi i.lab in Begamo, by Richard Meier.

Figure 3. Housing building in Gójar, by Elisa Valero.

Figure 4. Balint house in Valencia, by Fran Silvestre.

Figure 5. EDP Headquarters in Lisbon, by Aires Mateus.

To remain in the context of Mediterranean architecture, the *Balint house* project by Fran Silvestre Arquitectos studio in Valencia is also interesting (Fig. 4). The white cladding of the unusual curvilinear geometry is made with *solid surface* - a technology widely used for the construction of countertops and sanitary accessories, due to its hygienic properties and the absence of joints. The elliptical and shiny house appears as a monolithic sculptural piece, endowed with a continuous ventilated façade, which also covers the curved roof in continuity. Among the contemporary applications of white concrete coatings, the technology of glass fiber reinforced panels (*Glassfiber Reinforced Concrete - GRC*) is widespread. Present in the architectural field for decades, recent research has improved the characteristics of GRC - greater mechanical resistance and extreme lightness - and has acquired the possibility of prefabricating elements with different shapes and sizes. These technical characteristics, together with the aesthetic qualities, have made GRC panels widely used in white architecture, especially in large-scale projects with complex geometry. The architects Aires Mateus Associados, who often render their small houses white, also used GRC technology in the project of the new headquarters of the electric company EDP in Lisbon, on the banks of the Tagus (Fig. 5): the large building consists of two tall glass blocks whose steel structure is clad with special GRC elements. Oriented to the southwest, these white ribbons run along the facades and cover the square between the blocks, setting the rhythm of the entire composition and solving, with a single expressive gesture, the entire project. The GRC elements act as sunscreens and protect spaces from excessive radiation, varying their size according to the internals, while the diagonal orientation generates a transparency effect that changes in relation to the position of the observer. White, often conceived as an opaque, full and static material, thanks to GRC panels, can express dynamic shapes and combine in an innovative way with transparency and light.

In the historical context of Berlin's Museum Island, David Chipperfield has recently completed a long series of interventions with the James Simon Galerie (Fig. 6). While exposed concrete is widely used in the interiors of the building, the exterior parts are characterized by architectural elements deduced by the neighboring constructions of Schinkel and Stüler, made of *Engineered stone*, a composite material made of stone fragments (in this case limestone and sandstone) joined by a resin. This technology - used above all for the construction of kitchen and bathroom countertops - makes it possible to use the residues from stone treatment and produce elements of large sizes and limited thickness. Finally, some less common materials in contemporary construction are mentioned, which are nevertheless the object of interesting research: fabrics, membranes and translucent polycarbonates, which come to architecture through technological transfer (as in the case of polytetrafluoroethylene, commercially known as *Teflon*) and they come to define new poetics that no longer root the building to the earth (and to history) but are projected towards new concepts of duration and dissolving forms. An example is the *experimental house* at Meme Meadows Center, built by Kengo Kuma, which uses a layer of transparent membranes to provide thermal insulation suitable for the harsh winters of northern Japan (Fig. 7). If the large sloping roof, as well as the larch wood structure, is derived from the traditional constructions of the region (the *chise*, home of the Ainu population), the construction is completed with the use of technologically advanced materials. The outer membrane is a polyester cloth painted with fluorocarbon (colorless substance with high hydrophobic properties), the inner thermal insulation is made of polyester fiber obtained from recycled polyethylene (PET) bottles, while the removable inner membrane is made of polyester cloth. fiberglass. Therefore, the use of transparent plastic materials defines a semi-opaque white volume, capable of being passed through by light.

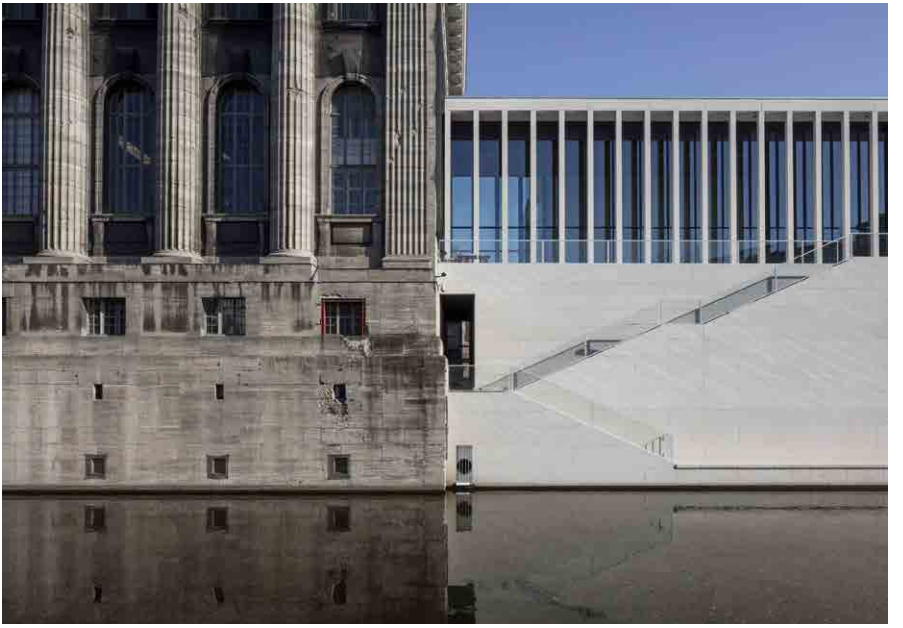

Figure 6. James Simon Galerie in Berlin, by David Chipperfield.

Figure 7. Meme Meadows experimental house, by Kengo Kuma.

CONCLUSION

Today, also due to the recent vicissitudes linked to the pandemic unfortunately still underway, culture, economy and society have returned to discuss the city, its population density, its morphological characteristics and the quality of life of its inhabitants: in other words, we have returned to talk about the sustainability of urban living. The proposal for the displacement of the population from the city for the rediscovery of life in the countryside, supported by some internationally renowned designers, nevertheless appears as an initiative which, if not controlled, could have disastrous effects on the territory. It is useful, however, to return to reflect on the city, first of all on how to intervene on the existing, to make it more responsive to the future vision of living; secondly, on the design of new buildings, public and private spaces. It is from this perspective that color can be rediscovered as an elementary principle of sustainability, as the constructive wisdom of traditional Mediterranean architecture reminds us. Nevertheless, the sustainability of white does not only concern the surface (or the *skin*) of the city, but implicitly includes principles of essentiality and economy for the living space which, consequently, influence people's lifestyles. The sustainable principle of white would thus represent an initiative of rapid feasibility and immediate results, albeit aware that probably, a sustainable model for the city of the future must address much more complex problems. Extending these principles to the urban scale, then, does not mean wrapping the metropolis with a veil of homogeneous, indifferent candor; on the contrary, as demonstrated by the different architectural solutions mentioned above, there are different ways in which white can be used, in the most suitable forms also in relation to particular contexts. From this point of view, white in architecture is not a simple color but instead represents a spatial principle, with technical and technological implications. "Sustainable design has also become a new marketing strategy both among designers and developers" - claims Juhani Pallasmaa (2010, 34) - describing the trend that favors the proliferation of projects that superficially tackle the issue of sustainability, for example, by adorning condominiums with vegetation but without actually intervening on the quality of the living space. A risk, that of *decorativism*, which in some cases also affects white architecture since, unfortunately, the current sustainability assessment system does not promote environmental policies and truly ecological thoughts. In any case, the search for sustainability must be approached from a holistic point of view, which cannot ignore formal qualities: "aesthetics is the mother of ethics", argues the poet and Nobel Joseph Brodsky, for which sustainability in architecture it will find, together with its own aesthetic, its ethical principles.

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PAPER #5.08

MACROCRITERIA FOR COMPILING DATA ON CO2 EMISSIONS IN BUILDING MATERIALS UNDER EPD, EN, ISO; CATALOG -IVE.

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ABSTRACT

The objective is to carry out a macro-classification and qualification criteria for the selection of useful data on CO2 emissions in building materials, to be compiled in material databases. It is determined that CO2 emission data are necessary in building technology when selecting a material in relation to environmental impact (Hypothesis 1), the classification of emission data is useful for retrofitting, designing or building systems, for example in facades (Hypothesis 2).
Methodology. The data on CO2 emissions were classified in a representative sample of 829 materials studied from the Catalogue of building solutions, from the Construction Database of the *Instituto Valenciano de Edificación*-IVE, Annex I: Thermal and acoustic insulation (2019), Valencia, Spain ; Analyzing the environmental statements of existing products (EPD) with data on the global warming potential GWP [kg CO2 eq], the information was qualified with 3 evaluation points: 1) use of UNE-EN 15804: 1.00 point, 2) use of EN ISO 14025: 1.00 point, 3) EPD and data on current dates: 1.00 point; being for the IVE catalogue: 0.00 to <2.00 (Not useful); > 3.00 (Useful). The results of the qualification and the obtaining of 3 points provided useful emissions data according to: a) GWP [kg CO2 eq], b) EPD, Standard and ISO, c) current public data.
Conclusions. From the sample of 829 materials in the IVE's catalogue database, about 214 EPD of materials were found in the market, with useful data of CO2 emissions according to European Union regulations; information to be compiled regarding the environmental impact of the material.

KEYWORDS

Emissions; materials; embedded; carbon; energy.

INTRODUCTION

The scope of this study is to identify the criteria for compiling data on CO2 emissions, to be considered within the information of the catalogue of constructive solutions *(Construction Database 2019)* developed by the Valencia Institute of Building-IVE and successive editions (2020), providing specific data, in the building materials applicable in facades, envelopes, thermal capacity and their impact at the time of selecting the material, in relation to nearly zero-energy buildings and knowledge of embodied carbon. The purpose is to establish criteria for the evaluation of GHG data in relation to building material databases.
The comparison and selection of the data is obtained from specific criteria of Environmental Product Declarations- EPD(s), according of the ISO regulations *(ISO, I. 14020 2000)*, the data of CO2 emissions, were identified according to the standard *(UNE-EN 15804 2012)* and *(EN ISO 14025 2010),* through which data were obtained, coming from processes of calculation of emissions, in which the organizations or product companies, indicate data of GHG, according to the global warming potential GWP [kg CO2

eq]. The data of CO2 emissions reported in the EPD(s), are varied, so the classification and qualification of the information was established, to determine its usefulness for the *(Construction Database 2019)* of the Valencia Institute of Building - IVE.
This study is based on a compilation of CO2 data developed in the Environmental Product Declarations; the EPD(s) are regulated from the International Organization for Standardization -ISO(s) (Murphy, Yates 2009), European Union standards and technical sheets; the research defined the hypothesis in the use of a macro-compilation criterion, to demonstrate the usefulness of the data based on the calculations of GHG emissions.

1. DESCRIPTION OF THE CASE STUDY IN CONTEXT

1.1. Embodied carbon and CO2 emissions (energy matrix, production of EPD(s))

The life cycle of materials, as well as embedded energy, identifies the relationship between the energy production matrix and the production process of a material, where the impact of the carbon emissions of a material is also related to the energy matrix on which its production system is based. In the case of countries where the energy matrix is based on fossil fuel sources, the result not only implies a building material based on fossil fuels, but also a production of this material with high CO2 emissions, also establishing an increase in the embodied energy. The energy matrix on which the industry depends on a building material and the use of materials, links it to low or high emissions, the data on energy consumption in the process of producing a material, are reflected in the cycle of the embedded energy and identified in the EPD(s) according to *(ISO, I. 14020 2000), (UNE-EN 15804 2012)* and *(EN ISO 14025 2010)*.

In the international sphere, countries such as Costa Rica *(ICE Group promotes national electromobility with the presentation of a new fleet, consulted on May 1, 2019, https:// presidencia.go.cr),* Iceland, Norway, Portugal, identify successful cases in which the energy matrix is reaching 99% or 100% of production based on renewable energy, it is an achievement of locally produced stationary energy where the objective of carbon neutrality is a success. Another similar case occurs with Uruguay and Lesotho, which also have around 100% of energy production based on renewable energies; according to (Clarke 2017), the case of Iceland is also identified, as an example for the industrialized countries of the planet, for producing clean energy, where stationary energy is 99% renewable energy.
The energy consumption for the elaboration of a building product evidenced in the EPD(s) *(ISO, I. 14020 2000),* is associated with the energy matrix on which its production depends, it implies emissions according to the energy used and the Life Cycle. Building materials have CO2 data, which in the case of Spain are in turn equivalent in emissions from energy use, such as Natural Gas, Diesel emissions, G. Generator, Diesel and Gasoline emissions, Fugitive and Process Emissions, Emissions from Electrical Energy, according to *(Greenhouse Gas Emissions Report 2016)*.
The knowledge of CO2 data is related to sustainable design, the lack of production of materials with emissions data generates a problem in contemporary design that aims to reduce the environmental impact of a construction.

1.2. Standard(s) and ISO(s), GHG emissions and criteria for the calculation of CO2 eq

The objective of a low-carbon global economy, seeks to establish criteria and methods for the analysis of the carbon footprint, which allows to establish common policies and regulations that are unified in a homogeneous way,

standards in the European Union establish unified criteria *(UNE-EN 15804 2012)*; in the case of Spain, some management policies were those of the Royal Decree 163/2014, of March 14, relating to the registration of the carbon footprint, compensation and absorption of carbon dioxide projects, published in the BOE on 29 March 2014 *(Royal Decree-Law 2014)*.

The calculation of the carbon footprint after the effect of greenhouse gases has involved both organizations and the building sector, in the case of the European Union, the standards *(UNE-EN ISO 14064-1 2012), (UNE-EN ISO 14064-2 2012), (UNE-EN ISO 14064-3 2012),* have evolved towards an improvement in the calculation of greenhouse gases. According to the standard *(UNE-EN ISO 14064-2 2012)* GHG are understood to be gaseous compounds in the atmosphere, both natural and anthropogenic, that retain and emit radiation at wavelengths, which occur in the spectrum of infrared radiation emitted by the planet's surface, clouds and atmospheric layer *(UNE-EN ISO 14064-2 2012)*.

According to the standard *(UNE-EN ISO 14064-2 2012)*, in point "5.8 Quantification of emissions reduction - increase in GHG absorption", the ton is used as a unit of measurement, converted into the amount of each type of GHG in tons of carbon equivalent -CO2e, using the global warming potentials (PCG). The global warming potentials of PCG greenhouse gases, for a 100 year projection, published by the Intergovernmental Panel on Climate Change *(IPCC guidelines for national greenhouse gas inventories: reporting instruction, 1997)*, are the basis for the current calculation of CO2 equivalent GHG emissions. The standards *(UNE-EN ISO 14064-1 2012), (UNE-EN ISO 14064-2 2012), (UNE-EN ISO 14064-3 2012),* have been part of a standardized evolution for the quantification of greenhouse gases and carbon footprint, during production processes or activities; as of 2019, these standards have been replaced by the standards *(UNE-EN ISO 14064-1 2019), (UNE-EN ISO 14064-2 2019), (UNE-EN ISO 14064-3 2019)*.

The calculation of GHGs is carried out in two stages *(UNE-ISO / TR 14069 2015);* the first stage consists of converting activity data into GHG emissions: GHG emissions or removals = activity data x emission or removal factor. The second stage considers the Global Warming Potential (GWP) of each GHG and allows calculating the conservation of GHG emissions or removals in the climate impact, identified in tons of CO2 equivalent (tCO2-e):

$$\text{GHG emissions} = \sum_{\text{gas}} \text{emissions} \times \text{PCG}_{\text{gas}}$$

Calculation of GHG emissions; Definition of the symbols: GHG, CO2 equivalent: Σ, sum of gas emissions; PCG, to the potential of global warming. *(UNE-ISO / TR 14069 2015).* Equation (1). Source: *(UNE-ISO / TR 14069 2015).*

The basis for calculating carbon emissions in a building material is defined from the sum of the GHGs provided by the chemical components that make up a material; within the EPD(s) and *(ISO, I. 14020 2000)*, in many cases the content of the sum of GHGs can be seen, data that as a whole will be understood as CO2 emissions and that are indicated according to the ISO *(EN ISO 14025 2010)* and the standard UNE-EN *(UNE-EN 15804 2012),* in which the current foundations are determined, both for the calculation of the life cycle inventory and for the life cycle impact evaluated of an EPD, being verified and validated in the European Unión.

A product is defined as a good or service, or a group of goods or services in relation to the life cycle of the product in which the environmental aspect implies activities, with environmental impact *(EN ISO 14025 2010)*. According to *(EN ISO 14025 2010)* an environmental declaration (type III) -EPD the production of a product implies the acquisition of the raw material, the Industrialization, the use, the end of the useful life (life cycle).

According to the standards *(UNE-EN 15804 2012), (UNE-EN 15804 2012+ A1 2014)*, the stages and modules included in the life cycle are: 6.2.2, A1-A3: Product stage, modules and information, 6.2.3, A4-A5: Stage in process, construction, modules and information, 6.2.4, B1-B5: Stage and use, information modules referring to the building structure, 6.2. 5, B6-B7: Stage of use, modules and information concerning the operation of the building, 6.2.6, C1-C4: End of life stage, information module, 6.2.7, D: Benefits and burdens occurring after the limits of the material's use (potential for reuse, recovery). These described stages are part of the content of an EPD *(ISO, I. 14020 2000)* and constitute the data of embodied carbon in the materials.

The Building Services Research and Information Association- BRISA, indicates that in order to calculate the embodied carbon in the building, it is necessary to: a- Identify the type of material to be used in a project or design, b- establish the amount of materials to be used , c- make use of the Carbon and Energy Inventory, developed by the University of Bath, UK, d- Multiply each weight of each material by the CO2 emission factor, obtaining the CO2 emissions of each material that has been used in the building, e- finally add up all the CO2 emissions obtained from each material used to see the total impact of the embodied carbon. *(BRSRIA Measuring embedded carbon - the next indicator of sustainability, consulted on August 10, 2020, https://www.bsria.com/)*.

In the research presented in this article, an evolution in the procedure for calculating embodied carbon is demonstrated, as more accurate CO2 data is used in this case: a-Identify the data of the declared functional unit of the material according to the EPD based on the European Union standards *(UNE-EN 15804 2012), (EN ISO 14025 2010),* b-Identify the area in m2 of the surface to be intervened with the material(s) to be used, c-Multiply the data provided by the GWP in the EPD, of the CO2 emissions declared in each material by the surface in m2 to intervene, d- Add up the emissions obtained by each material to be used to define the total carbon embodied in the proposed building or design.

A1-A2 kg CO2 equiv/UF x A.m2 = kg CO2 equiv/UF

Calculation of Embodied Carbon (materials for architectural design); Definition of the symbols: A1-A2: modules (data in EPD), Finished product stage. A.m2: Surface of the facade; Ratio of m2 of the material to be used in the renovation and the weight of CO2 emissions. Equation (2). Source: César Arguedas

2. METHODOLOGY (DESCRIPTION)

2.1. Criteria for compiling CO2 emission data according to DAP(s), UNE, ISO standards

According to the Catalogue of building solutions *(Construction Database 2019)*, of the Catalogue of constructive retrofitting solutions of the Valencia Institute of Building and the classification of products and materials, depending on the properties of thermal insulators for energy retrofitting IVE- Generalitat Valenciana *(P1 Products and Materials: Properties of thermal insulators for energy retrofitting 2014)*, (Serrano, García, Ortega 2011), the following materials have been classified: Mineral wool (MW) - rock wool (SW) of mineral origin, Mineral wool (MW) - glass wool (GW) of mineral origin, Expanded polystyrene (EPS) of synthetic origin, Extruded polystyrene (XPS) of synthetic origin, Polyurethane or Polyisocyanurat or (PUR) of synthetic origin, Expanded Perlite (EPB) of mineral origin, Cellular glass (CG) of mineral origin, Sheep wool (SHW) of animal origin, Cotton (CO) of plant origin, Hemp (HM) of plant origin, Cellulose (CL) of plant origin, Cork (ICB) of plant origin, Coconut fiber (CF) of plant origin, Flax (FLX) of plant origin, Wood fibers (WF) of plant origin.

From the Catalogue of building solutions *(Construction Database 2019)*, the equivalent materials in the construction market were studied, in relation to building products or materials with environmental declarations of EPD product(s), environmental self-declarations, material data sheets according to the producing company; also analyzed data from the Eduardo Torroja Institute of Construction Sciences (IETCC), *(Opendap 2013)*, all according to the standards *(EN ISO 14025 2010), (UNE-EN 15804 2012), (UNE-EN 15804 2012+ A1 2014)*.

The analysis of the data was based on the content of the Environmental Product Declarations -EPD(s), taking into account the data of the global warming potential GWP [kg CO2 eq], and the calculations of the greenhouse gas emissions -GHG, related to the definition of CO2 according to the time horizon of 100 years by the IPCC, Table. A.1 *(IPCC guidelines for national greenhouse gas inventories: reporting instructions 1997)*, and the updated data in the ISO 14067 *(UNE-CEN ISO / TS 14067 2015)* replaced in 2019 *(UNE-EN ISO 14067 2019)*.

The process and criteria of the study are described in Table 1; the objective of the analysis of the EPD information was to establish a macro-criteria of information selection to compile the GWP emission data [kg CO2 eq], in the materials indicated in the construction database *(Construction Database 2019)*. The content to be evaluated and compiled after the classification of the data was: Product stage: A1-A3, Construction process: A4, A5, Use stage: B1-B7, End of life stage: C1-C4, and reuse: D, indicated in the information, of the EPD according to the standards *(ISO, I. 14020 2000), (UNE-EN 15804 2012+ A1 2014)*.

Table 2 shows two cases of materials with information on CO2 emissions, according to the parameters of the stages (A1-A5, B1- B7, C1- C4, D); the data were compiled after being classified and evaluated. Case 1: mineral wool (MW); case 2: glass wool (GW).

Table 2 shows two cases of materials: Mineral wool (MW) - rock wool (SW) of ROCKWOOL *(Thermal Insulation of Rock Wool for Buildings 2015)* and Mineral wool (MW) - glass wool (GW), from Isover saint gobain *(ECOVENT 35 2017)*; the EPD information of each material - product, in this case of thermal insulators, identifies the CO2 emission values to be compiled in the Construction Database *(Construction Database 2019)* of the Catalogue of constructive retrofitting solutions of the Valencia Institute of Building.

Graph 1 identifies the analysis performed in the Catalogue of building solutions of the Construction Database of the Valencia Institute of Building-IVE *(Construction Database 2019)*, after entering the data of the compilation according to the EPD(s) of the products. From a total of 829 materials, the data of GHG emissions (kg CO2 eq) were introduced, in 214 materials that complied with EPD(s) and the standards *(EN ISO 14025 2010), (UNE-EN 15804 2012+ A1 2014)*; of the total of 829 materials studied, no specific emission data was found in some 615, due to Lambda (Λ λ) and the specificity of the material, it was not always possible to find data to compile the information to the catalogue, although this does not rule out the relationship of emissions, with the denominations or origins of some others materials.

Design of the study						
Stage 1: data study	Stage 2: qualification of data	Evaluation	Stage 3: analysis of data	Total of materials analyzed (stage: A1-A3, B1-B7, C1-C4, D)	Stage 4 compilation of data	Total of materials compiled
Data	Points	Total score: 5 point	GWP emissions	Materials (building, thermoacoustics)	opendap	128
EN ISO 14025	EPD(s), data: most up-to-	1	opendap	128	EPD	85
UNE-EN 15804	Assuming: EN ISO 14025	1	EPD(s)	85	no data	515
Data; current in EPD	Assuming: UNE-EN 15804	1	total data EBI	214	EN ISO 14025	214
LEED/BREEAM	Overall rating:	3	IVE	829	UNE-EN 15804	214

Table 1. Graphic representation of the research study design. Source: (own elaboration)

	PRODUCTS AND MATERIALS (thermal insulators for energy rehabilitation, based on data and information from the Valencian Institute of Building - IVE)																		
	Detailed value, depending on the Environmental product declaration-EPD, (Global warming potential) GWP [kg CO2 eq]																		
	Parameters	Product stage: A1-A3	Construction process: A4, A5		Use stage: B1-B7							End of life stage: C1-C4					Entity- Source of information, EPD.	Publication date	Expiration date
	ROCKWOOL rock wool thermal insulation (37 mm thickness; 30 kg / m3 density)	A1: Supply of raw materials, A2: Transportation to factory, A3: Manufacturing	A4: Transportation to work	A5: Installation / Construction	B1: Use	B2: Maintenance	B3: Repair	B4: Substitution	B5: Rehabilitation	B6: Use of energy in service	B7: Use of water in service	C1: Deconstruction / demolition	C2: Transportation	C3: Waste treatment	C4: Elimination	D: Reuse potential, recovery recycling	ROCKWOOL products	1/11/2015.	1/11/2020.
CASE 1	ISO 14025: 2010, EN 15804: 2012 + A1: 2013	A1- A3: 1.2E+00	1.5E-01	3.1E-02	0	MNA	MNA	MNA	MNA	MNA	MNA	MNA	2.1E-03	MNA	7.3E-03	-4.0E-02	https://static.rockwool.com/globalassets/rockwool-es/herramientas/certificados/daps/ROCKWOOL_DAP		
	Total Rating: 3																		
CASE 2	Factory facade air chamber (Glass Wool, 35mm) Isover- insulators	A1: Supply of raw materials, A2: Transportation to factory, A3: Manufacturing	A4: Transportation to work	A5: Installation / Construction	B1: Use	B2: Maintenance	B3: Repair	B4: Substitution	B5: Rehabilitation	B6: Use of energy in service	B7: Use of water in service	C1: Deconstruction / demolition	C2: Transportation	C3: Waste treatment	C4: Elimination	D: Reuse potential, recovery recycling	Isover saint gobain	1/8/2017	31/5/2020.
	EN 15804/ ISO 14025	A1/A2/A3: 2.1E+00	1.3E01	1.1E-01	0	0	0	0	0	0	0	0	7.2E-03	0	0	0	https://www.isover.es/productos/ecovent-035		
	Total Rating: 3																		

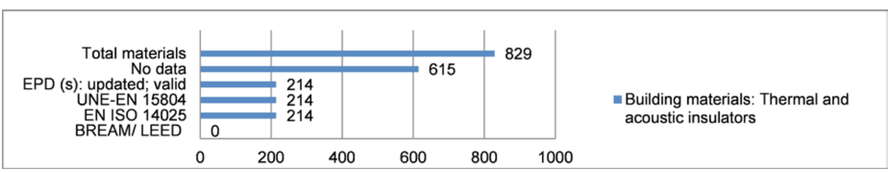
Table 2. Detailed value, according to the Environmental product declaration –EPD, and the Global warming potential -GWP [kg CO2 eq] - Products: ROCKWOOL, Isover, saint gobain. Source: (own elaboration)

Graph 1 shows that the information of the environmental statements of product(s) EPD, were decisive because they are data developed based on compliance with ISO(s) and standards *(EN ISO 14025 2010), (UNE -EN 15804 2012+ A1 2014)*, in this case the regulatory compliance of the European community in terms of environmental product declarations, was the determining aspect to find data to qualify and proceed to compile the information.

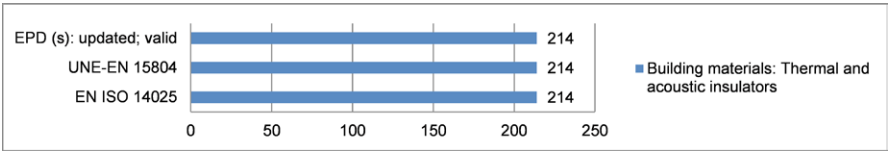
Graph 2 identifies that of the total data analyzed for 829 materials in the catalogue of the Construction Database, of the Valencia Institute of Building-IVE *(Construction Database 2019)*, about 214 comply with the standards *(EN ISO 14025 2010), (UNE-EN 15804 2012+ A1 2014)*. This information was evaluated with the aim of indexing the data to the database *(Construction Database 2019)*, following a criterion of qualification of the information according to the fulfillment of the 3 Points evaluated.

2.2. Qualification according to the macro-criteria for the compilation of CO2 emission data

Graph 3 identifies the 3 qualification criteria, which allowed establishing the classification of the data information in the macro compilation criterion applied to the rest of the 829 materials; the qualification was based on the data of the EPD(s) of the consulted materials, the material designation and the origin in relation to the materials in the catalogue *(Construction Database 2019)*. The macro criteria for the compilation of the emission data was: comply with 1- Environmental Product Declaration- EPD according to: Standard *(UNE-EN 15804 2012+ A1 2014)*, 2- Environmental Product Declaration - EPD according to: ISO *(EN ISO 14025 2010)*, 3- Environmental product declaration - EPD, according to: EPD (s) with the most up-to-date information.



Graph 1. Data to be compiled in the database (Construction database 2019), of the Valencia Institute of Building - IVE, according to the EPD(S), and the standards (EN ISO 14025 2010), (UNE-EN 15804 2012+ A1 2014). Source: (own elaboration)

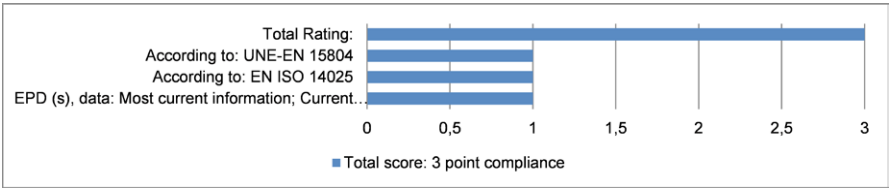


Graph 2. Useful CO2 emissions data for compilation in the database (Construction Database 2019), according to EPD(S). Source: (own elaboration)

By complying with a 3-point rating, the data to be compiled has provided information on the CO2 emissions according to: a-global warming potential (GWP) [kg CO2 eq], environmental impact *parameters (Summary for Policymakers and Technical Summary of Working Group I Report 1995)*, b- EPD according to standard(s), and ISO(s) according to standards *(AENOR, search for 2020 standards),* c-public data, for Spain with information according to standards *(UNE-EN 15804 2012+ A1 2014),* useful information from other data sources, e.g. Eduardo Torroja Institute of Construction Sciences-Spain *(Opendap 2013),* d- EPD from the public website - international information (other media), e - EPD(s) verified with current European Union standards *(AENOR, 2020 standards search),* f- EPD independent data from: BREEAM / LEED / VERDE, g- data supplemented with self-declarations of environmental products.

3. RESULTS

The 3 points obtained in 214 cases of compiled materials, implies that the information on the emissions of the materials comply with the regulations *(UNE-EN 15804 2012+ A1 2014), (EN ISO 14025 2010),* and valid information. In 15% there were two or more EPD(s) to compare from which emission data compiled only obtained the 3-points, for the other cases there was only one EPD source that in turn met the 3 points. In other cases the only information about the CO2 emission data of a material was based on the web data *(Opendap 2013)* according to the standards *(UNE-EN 15804 2012+ A1 2014), (EN ISO 14025 2010)*.
The evaluation of the 3 points qualified was of the following scale: 0.00 to <2.00 (Not useful); 3.00 (Useful), being the qualification (useful), the one of importance for the compilation. This procedure established the selection criteria for the data to be compiled in the database (Construction Database 2019), see the example in Table 3. From the sample of 15 cases of materials, taken based on the



Graph 3. Criteria for data qualification, for compilation to the database (Construction database 2019), (P1 Products and Materials: Properties of thermal insulators for energy rehabilitation 2014). Source: (own elaboration)

information of the EPD according to (ISO, I. 14020 2000) are useful for compiling 14 data from 15 samples, obtaining in these 14 samples the three points.

3.1. Tested hypotheses, criteria for data compilation

Table 3 shows the compilation criteria before including any type of emission data [kg CO2-eq.]. At this stage it was proposed to compare the qualifications obtained among 4 cases of the same type of Rock Wool material, according to the content of 4 EPD(s) case1: *(Acustilaine 70 2013),* case 2: *(Thermal Insulation of Rock Wool for Buildings 2015),* case 3 *(DP-3 Multipurpose Rock Mineral Wool insulation, Knauf Insulation, doo, Skofja Loka 2013)*, case 4 (Rock Mineral Wool Insulation 33 - 45 kg / cu.m 2016) all with market emission data; where the second case of rock wool (SW), went on to have a rating of 3 points, since it obtained the maximum value in each of the criteria evaluated, obtaining the values assigned on the use of *(UNE-EN 15804 2012+ A1 2014)*: 1.00 (point), *(EN ISO 14025 2010)*: 1.00 (point), and EPD, with data on current dates: 1.00 (point); 3 points.
The materials in which it is not possible to find a minimum of 4 EPD(s) to compare them, because they are materials with few data in the market and whose rating in one or two EPD is 3.00 (Useful), which is useful information for the catalog; all cases with ratings> 2.00 (> 3.00) are doubtful.

3.2. Tested hypotheses, classification, and qualification of data usefulness

Table 4 explains the data classification ratings: 0.00 to <2.00 points (Not useful); 3.00 points (Useful); where most of the samples based on EPD(s), obtained useful scores (3 points), i.e. CO2 emissions data are useful for the Database, from the Valencia Institute of Building-IVE *(Database of construction 2019)*. Of the 15 samples, only one case (without data) had a data rating: 0.00 to <2.00 (Not useful).
The demonstration of the usefulness of the qualified data of emissions, with 3 points obtained (compiled in the IVE catalog), applying Equation (2) (A1-A2 kg CO2 equiv/ UF x A.m2 = kg CO2 equiv/UF), in the case of 2 materials in an example of retrofitting of a façade of 83 m2, demonstrated the importance of using CO2 qualified data to calculate the embodied carbon of a building. Case of 2 materials compared: A- Expanded polystyrene (EPS) of synthetic origin: A1-A3: 9,76E+00kg *(GlobalEPD-RCP-007 2018),* (table 4). Apply the material in the retrofitting of the façade: build 83 m2 of facade surface to intervene. 9,76E+00kg x 83 m2= 810, 08 CO2 equiv/UF in façade. B-Mineral wool (MW): A1/ A2/A3: 2.1E+00 *(ECOVENT 35 2017)*, (table

	Qualification for compilation of emission data of [kg CO2-Eq.] (catalog of materials of the Valencian Institute of Building - IVE) according to the content of the "Environmental Product Declaration" -EPD							
	Material designation	Origin	Material Name in the market	EPD according to: EN ISO 14025 (European Union)	EPD according to: Standard, UNE-EN 15804 (European Union)	EPD, data: effective dates	Sum of qualification: utility of emission data, for compilation in catalog IVE: 0.00 to <2.00 (Not useful); > 3.00 (Useful)	Highest Rating: Index to the catalog of materials of the Valencian Institute of Building - IVE
Case 1	Mineral wool (MW) - rock wool (SW)	Mineral	Rigid rock wool panel ISOVER, non hydrophilic, uncoated (0.034 W / (m · K))	1,00	1,00	0,00	2,00	
Case 2	Mineral wool (MW) - rock wool (SW)	Mineral	ROCKWOOL rock wool thermal insulation (37 mm thickness; 30 kg / m3 density)	1,00	1,00	1,00	3,00	Useful ✓
Case 3	Mineral wool (MW) - rock wool (SW)	Mineral	Multipurpose rock mineral wool insulation (0.039 W / (mK))	1,00	1,00	0,00	2,00	
Case 4	Mineral wool (MW) - rock wool (SW)	Mineral	Insulation of mineral rock wool 33 - 45 kg / cu.m (0.035 - 0.037 W / mK)	1,00	1,00	0,00	2,00	
				EVALUATION CRITERIA	EVALUATION CRITERIA	EVALUATION CRITERIA		

Table 3. Comparison of ratings after evaluating the content of 4 EPD(s), case: Mineral wool (MW) - rock wool (SW), according to the grade obtained 3.00 points (Useful); based on the indexation of CO2 emissions data to the database (Construction database 2019) Valencia Institute of Building - IVE. Source: (own elaboration)

4). Apply the material in the retrofitting of the façade: build 83 m2 of facade surface to intervene. 2.1E+00 kg x 83 m2= 174, 3 CO2 equiv/UF.
A- Expanded polystyrene (EPS)= 810, 08 CO2 equiv/UF of Embodied Carbon in façade; B-Mineral wool (MW)= 174, 3 CO2 equiv/UF of Embodied Carbon in façade. In case of using both materials (EPS and MW) in the façade, the total of Embodied Carbon is: 984, 38 equiv/UF. It includes Stages A1-A3 of the EPD(s) including the transport. The calculations in the cases A and B show the importance of the qualified data.

CONCLUSION

The macro-criteria for the compilation of CO2 emissions data proposed in this research, for the database *(Construction Database 2019)*, are defined in the classification and qualification of the information of the EPD(s), the technical sheets, the investigations, according to the data of GHG emissions, based on the standards and ISO(s), *(EN ISO 14025 2010), (UNE-EN 15804 2012+ A1 2014)*. The current European Union regulations on GHG emissions include global warming potentials (GWP) as a function of CO2 over the 100-year, IPCC *(2006 IIPCC guidelines for national inventories of greenhouse gases, IIPCC 2006)*.
The contents that most contribute to a process of compiling emissions data of the global warming potential GWP [kg CO2 eq], are: Product stage: A1-A3 (including transport),

Qualification based in data of GHG emissions (15 cases of thermal materials)				
Bullet point list	**Material name**	**Material name in data source**	**STAGE A1- A3, GWP [kg CO2 eq]**	**Qualification**
1	**Mineral wool (MW)**	**rock wool (SW) of mineral origin, rock wool ROCKWOOL (37 mm; density of 130 kg / m3) *(Thermal Insulation of Rock Wool for Buildings 2015)***	A1-A3: 1,2E+00	**rating: 3 (Useful)**
2	Mineral wool (MW)	glass wool (GW) of mineral origin (Air chamber factory façade (Glass Wool, 35 mm) Iso ver- insulators) *(ECOVENT 35 2017)*	A1A2/A3: 2,1E+00	rating: 3 (Useful)
3	**Expanded polystyrene (EPS) of synthetic origin**	**Stabilized expanded polystyrene insulator (EPS) <0.065 W / m - K (Traditerm System)*(GlobalEPD-RCP-007 2018)***	**A1A3: 9,71E+00**	**rating: 3 (Useful)**
4	Extruded polystyrene (XPS) of synthetic origin	Extruded Polystyrene Foam (thickness 5 cm) *(Extruded Polystyrene Foam Thermal Insulation Sheet XPS -DANOPREN 2016)*	**3,98E+00**	rating: 3 (Useful)
5	**Polyurethane or Polyisocyanurat or (PUR) of synthetic origin**	**Thermal insulated projected polyurethane foam (projected polyisocyanurate) *(Thermal insulated projected polyurethane foam, closed cells, density 40 kg / m3 2016)***	**A1A3: 11,0**	**rating: 3 (Useful)**
6	Expanded Perlite (EPB) of mineral origin	Expanded Perlite *(" Databases: Building" , Opendap, accessed May 1 2019, https://www.opendap.es/)*	**A1A3: 0,11**	rating: 3 (Useful)
7	**Cellular glass (CG) of mineral origin)**	**Cellular glass *(FOAMGLAS® T4 +2016)***	**A1A3: 1,3E+0**	**rating: 3 (Useful)**
8	Sheep wool (SHW) of animal origin	Sheep wool *(" Databases: Building" , Opendap, accessed May 1 2019, https://www.opendap.es/)*	**A1A3: 5,53**	rating: 3 (Useful)
9	**Cotton (Insulating, not hydrophilic)**	**Cotton *(" Databases: Building" , Opendap, accessed May 1 2019, https://www.opendap.es/)***	**A1A3: 5,53**	**rating: 3 (Useful)**
10	Hemp (Aislatne, not hydrophilic)	Aislatne, not hydrophilic *(" Databases: Building" , Opendap, accessed May 1 2019, https://www.opendap.es/)*	**A1A3: 1,7**	rating: 3 (Useful)
11	**Cellulose (CL) of vegetable origin**	**Cellulose (CI) cellulose insulation - AislaNat (Loose fill cellulose insulation 2018)**	**A1: 7,11E-02 / A2: 2,10E-02 / A3: 0,49E-02**	**rating: 3 (Useful)**
12	Cork (Wood, compressed)	Wood, compressed *(" Databases: Building" , Opendap, accessed May 1 2019, https://www.opendap.es/)*	**A1A3: 1,1**	rating: 3 (Useful)
13	**Coconut Fiber**	**Coconut Fiber *(Carabaño, Bedoya, Ruiz 2011)***	**no data**	**rating: no data (Not useful)**
14	Linen (FLX) of plant origin	Flax fiber *(" Databases: Building" , Opendap, accessed May 1 2019, https://www.opendap.es/)*	**A1A3: 1,7**	rating: 3 (Useful)
15	**Wood chips (WF) of vegetable origin**	**Fiber: Wood, MDF Melamine *(Medium density fibreboard (MDF), both raw as well as melamine faced medium density fibreboards 2011)***	**A1-A3: 0,74**	**rating 3 (Useful)**

Table 4. Data-based qualification (EPD) of GHG emissions, in 15 cases of thermal materials. Source: (own elaboration)

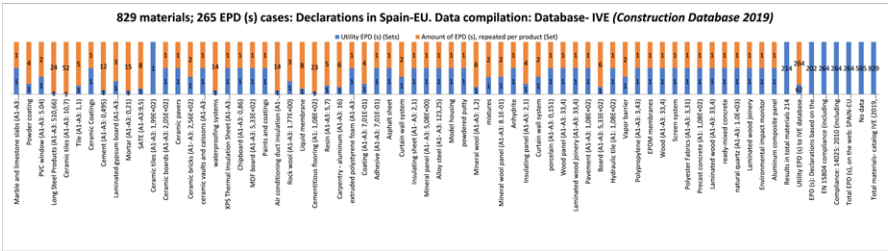


Table 5. Table with 214 materials that have reached 3 points; including data of equivalent CO2 emissions, according to qualified data of the EPD(s), according to the regulation. Source: (own elaboration)

Construction process: A4, A5, Use stage: B1-B7, End-of-life stage: C1-C4, D: reuse, according to the EPD(s), with stage A1-A3 being the one with the most information as it is mandatory.

The macro-criteria used in this research defines a logical procedure for the usefulness of the CO2 emissions data, when compiling the information for the Construction Database, of the Valencia Institute of Building-IVE *(Construction Database 2019)*. From the sample of 829 materials indicated in the catalogue database, about 214 materials whit EPD(s) have been found in the market, which mainly comply with the standards *(EN ISO 14025 2010), (UNE-EN 15804 2012+ A1 2014),* according to the calculation procedures of CO2 emissions established in the European Union standards.

Table 5 identifies a summary with 214 materials with useful data for the materials catalogue, including data on CO2 emissions, according to the EPD regulations. 264 materials include EPD data for repeated materials. Of the 829 materials in the catalogue *(Construction Database 2019)*, no emission data was found according to EM 565 regulations. The usefulness of GHG emissions data in the life cycle of 214 materials for compilation in the construction base *(Construction Database 2019)*, identifies the current status of materials in the building products industry in Spain and its relationship with technological innovation and environmental impact analysis, the choice of materials in the construction of sustainable designs in Spain and the European Union, can be justified in the comparison of CO2 emissions.

The usefulness of the data of the emissions in the EPD(s), is related to the total of the life cycle stages, calculating the emissions for each of the material stages (Product stage: A1-A3, Construction process: A4, A5, Use stage : B1-B7, End-of-life stage: C1-C4, D: reuse; this allows to identify the impact of the embodied carbon from the use of a material in a building, to the possibility of reusing the material; The calculation method for each stage can be carried out with equation (2), which allows to calculate the impact of the emissions even at the time of reuse of the material at the end of the life cycle.

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PAPER #5.09

MASS TIMBER CONSTRUCTION FOR MULTI-FAMILY URBAN HOUSING: CARBON12 AND THE CANYONS

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ABSTRACT

By the year 2050, an additional 2.5 billion people are expected to inhabit urban areas. In addition, cities across the globe face the challenge of aging housing stocks coupled with the necessity to decrease carbon emissions from building construction and use. Such challenges suggest that data-driven design solutions that prioritize fast and efficient construction with sustainably harvested, low-carbon materials such as cross-laminated timber (CLT), a mass timber product, may be best suited to address the housing needs engendered by the aforementioned macro factors. Considering that CLT construction is nascent in many regions of the world other than some timber-dominant countries in the European Union, this document explores how effective information exchange among project constituencies can help CLT-based mass timber projects overcome the unique barriers to construction that exist in regions without well-established mass timber industries, the United States being of particular focus. Two innovative case study projects, Carbon12 (2018) and The Canyons (2020), are unpacked by the authors in regard to both analog and digital information transfer. Both multi-family housing projects were designed and developed by Kaiser+Path in Portland, Oregon and are two of the first examples of high-rise, multi-family mass timber construction with CLT in the United States. The authors draw upon first-hand CLT design experience with one author being an architectural designer for Kaiser+Path's The Canyons. A primary conclusion of this case study document suggests that a close integration between project team members early in the design process is critical to successful project completion. The authors also highlight specific design-to-construction situations where more advanced digital workflows could be particularly beneficial. Based upon the authors' knowledge, this is the first peer-reviewed case study publication to document either building.

KEYWORDS

Low-carbon construction; multi-family housing; cross-laminated timber.

INTRODUCTION

Low-carbon construction technologies including cross-laminated timber (CLT), a mass timber product, have proven to lower carbon emissions from construction and lower construction costs while increasing construction speed and construction site safety in Europe and Australia where a majority of CLT-based buildings have been built (Mayo 2015). Underpinning each of the aforementioned CLT-related construction benefits are integrated workflows, or data flows, that allow project teams to collectively coordinate nearly every aspect of the design-to-construction process. Data-driven design solutions that prioritize fast and efficient construction with low-carbon materials like CLT may provide a solution for the architecture, engineering, and construction (AEC) industries over the coming decades

as they attempt to overcome the inverse, "wicked," challenge of significant urban growth and provision of housing on one hand, and the need to lower greenhouse gas emissions from construction on the other (Boyer Cook 2013). Despite the recognized benefits of mass timber construction in the AEC fields, only a few European countries have mass timber industries that are well-developed enough to facilitate fast, efficient construction of low-carbon multi-family urban housing on a large scale. For many other countries globally including the United States, the infancy of the mass timber industry - including the relatively slow adoption of building codes that permit high-rise mass timber buildings - hinders overall construction efficacy.

This case study research provides a roadmap for AEC professionals regarding two of the first large-scale, CLT, multi-family housing projects developed in the United States: Carbon12 and The Canyons. Carbon12 was completed in 2018, becoming the tallest CLT building in the United States, whereas The Canyons is scheduled to complete construction in Summer 2020. Located in Northeast Portland, Oregon, both projects were designed and developed by Kaiser+Path, a Portland-based company composed of Kaiser Development, Inc. and PATH Architecture, Inc. Similar to other CLT-based mass timber projects in the United States and in countries around the globe with nascent mass timber industries, the projects faced a number of unique process barriers due to the novelty of CLT use among project constituencies and the size of the projects for which the material system was employed. Such barriers challenged the Kaiser+Path project team, and despite the successful completion of Carbon12 and the expected successful completion of The Canyons, could, if improperly handled by a project team, lead to undesirable project results or cancelled projects.

Carbon12 and The Canyons are uniquely innovative in the context of American housing and employ construction methods not found in other buildings of similar type and scale. As such, this case study document provides novel intellectual content to the AEC industries as the projects have not been the subject of peer-reviewed documentation previously. This case study document of Carbon12 and The Canyons will begin with a background description of the global macro factors that have engendered the mass timber movement with CLT. The background description frames two primary challenges to the city of the future, the ability to provide enough equitable housing and the ability to provide that housing in a low-carbon manner. Using Carbon12 and The Canyons as examples for high-quality, innovative construction technologies/practices - quick to build with low-embodied carbon - the case study then focuses on the barriers to CLT construction in regions of the world like the United States with nascent mass timber construction industries. Barriers to successful project completion include the difficulty to accurately cost estimate a project under evolving financing conditions, the difficulty to achieve code compliance when local jurisdictions are unfamiliar with mass timber construction, and the difficulty to coordinate construction when few of the project constituencies have experience with mass timber products and the related logistical demands they entail.

Through a particular focus on the aforementioned project barriers, each of which relate to data management and interchange, the authors seek to provide a resource for related CLT-based projects in urban areas globally as a means to support the increased provision of mass timber housing and the successful completion of buildings with low embodied carbon. The innovative building technologies and practices explored in the following sections

are relevant due to their ability to enhance urban quality of life and urban social and environmental sustainability through high-quality, high-tech construction.

1. INTELLECTUAL CONTEXT

1.1. Case study background

According to research from the European Commission, the world's urban population is expected to nearly double by year 2050 from the 4.2 billion people in cities in 2018. "By 2100, some 85% of the population will live in cities, with urban population increasing from under 1 billion in 1950 to 9 billion by 2100" (European Commission, n.d.). To support urban population growth globally and the related provision of adequate housing in cities by 2025, construction spending alone is expected to cost $9-$11 trillion (Woetzel et al 2014). In the United States, "the baseline demand for new housing units between 2015 and 2025 will range from 16.0 to 18.2 million units" as a short-term forecast (McCue 2017). A vast majority of these homes are expected to be built in urbanized areas.

Inversely, the building sector must significantly reduce greenhouse gas emissions from building construction and operation to align with the climate goals set forth by a number of leading global organizations including the World Green Building Council and the United Nations. It is widely recognized in the architecture, engineering, and construction (AEC) industries that lowering the embodied carbon in building materials is one of the key avenues to achieve global climate goals. As embodied carbon in building materials accounts for 28% of total greenhouse emissions from construction globally, the utilization of low-carbon or carbon-negative building materials can be particularly significant for lowering total expenditure (Cramer 2020).

Wood is widely recognized for its carbon sequestration benefits and its potential to assist in the lowering of embodied carbon in construction. As such, global demand for wood products is expected to double in the next 15 years and global wood industries

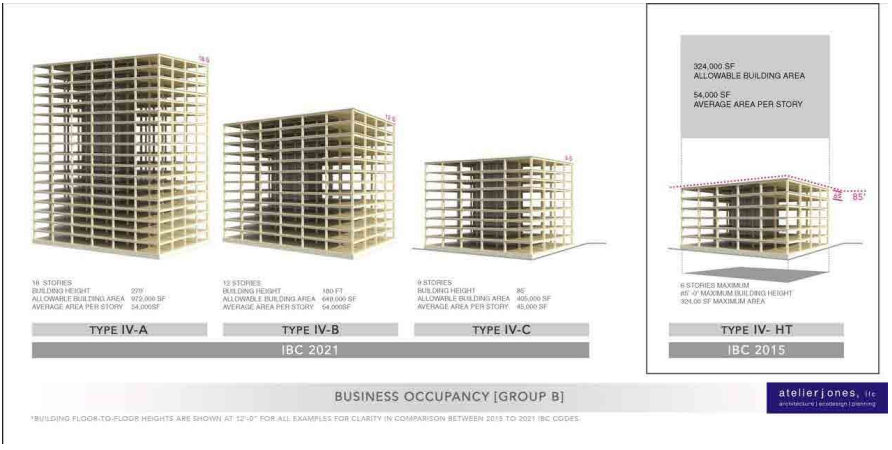

Figure 1. Mass Timber Code (IBC 2021). Source: (Atelier Jones, LLC n.d.). "CLT is a large-scale, prefabricated, solid engineered wood panel. Lightweight yet very strong, with superior acoustic, fire, seismic, and thermal performance, CLT is also fast and easy to install, generating almost no waste onsite. CLT offers design flexibility and low environmental impacts" (APA 2018).

are experiencing the highest growth since the 2008 economic crash (Laguarda-Mallo Espinoza 2018). In the United States, the increased demand is coupled with changing building codes, sustainable forest management policies, and the expanding demand for low-carbon construction solutions. The increased demand for wood is largely in opposition to concerns over global deforestation, only recently in decline due to emerging forest management practices such as FSC certification in the United States. Additionally, the International Building Code recently adopted new terminology and height protocols for heavy timber material use after an internal committee focused on tall wood buildings conducted over two years of extensive interdisciplinary debate, research, and testing including, but not limited to, structural studies and fire performance testing. Although the new Type IV codes (Fig. 1) have yet to be fully implemented within individual American states, such legislative adjustments present new opportunities for the utilization of technologically advanced wood products such as cross-laminated timber (CLT).

CLT in combination with other mass timber technologies has been heralded as the first new way to build skyscrapers and related multi-story construction in over 100 years. Despite the expanded use of cross-laminated timber (CLT) for structural applications, timber-dominant countries in the European Union are the only countries globally with matured mass timber markets/industries. For much of the rest of the world, CLT is a nascent technology. The infancy of mass timber markets/industries in many countries, including the United States, injects certain use barriers to mass timber construction that may limit the potential for such low-carbon construction solutions to be used on a large scale in response to housing needs for increasing urban populations. Thus, a key objective for AEC professionals with successful CLT-based design and construction experience should be to disseminate knowledge to lower such use barriers for future projects. The following two case study projects are a direct attempt to disseminate such knowledge as it pertains to the information exchange or "dataflows" found within the two projects' design-to-construction processes.

1.2. Novelty of case study buildings in non-European contexts

Carbon12 is the first - and tallest - CLT-based mass timber structure to be built in the United States. It is also the only high-rise residential building to be permitted and completed in the U.S. The Canyons is a furtherance of the mass timber construction ideas and processes developed for Carbon12. It is the first and only CLT project in the U.S. to use a hybrid, light timber frame and CLT structural construction system. Both projects provide novel information for the subject area of this study. Brock Commons is the only related non-European CLT-based high rise project globally. It was permitted and built in Canada with construction completing in 2017.

2. METHODOLOGY

As presented in the forthcoming sections, the extracted information from both case study projects is drawn from the authors' first-hand experiences with mass timber construction in both Europe and the United States, as well as relevant project references. One author of the paper was an Architectural Designer for Kaiser+Path who was intimately involved in the design development, permitting, and construction administration process for The Canyons. The author also has experienced-based knowledge of Carbon12 through the direct exchange of project insight from colleagues who designed Carbon12 – e.g., the project owner, architects, and builders who sought to facilitate a dissemination

of mass timber education as well as to further prepare the author for their design/construction role within The Canyons project. All case study information was acquired through first-hand experience with the project team and on the project site unless otherwise noted. This information was also corroborated with multiple project team members for the writing of this document. The authors' objective to provide uncompromised information directly from the source and the lack of available project-specific data elsewhere about The Canyons are both rationales for using the direct-knowledge, experienced-based approach for this document.

3. EXTRACTED INFORMATION FROM CASE STUDY PROJECTS

3.1. Carbon12

At the time of this writing, Carbon12 is the tallest mass timber building in the United States. The eight-story urban multi-family housing project was completed in 2018 in Portland, Oregon and was designed and built by Kaiser+Path: an integrated design, development, construction firm led by Owner and Principal Benjamin Kaiser (Fig. 2, 3). Carbon12 set multiple key benchmarks for high-rise, multi-family mass timber construction in the United States. As stated by Kaiser+Path, the firm "set a new standard for what's possible in sustainable development in the United States … [by working] with city and state officials to waive restrictive codes limiting the height of wood buildings, making Carbon12 and future tall wood buildings in the US possible" (Kaiser+Path, n.d.). The 95-foot tall, 38,000 square foot building features a German-developed, mechanized underground parking system, first floor commercial space, and 14 multi-family residential units above. Structurally, the project utilizes a hybrid system composed of steel buckling restrained brace (BRB) frames paired with glulam columns and beams. Carbon12 uses "Douglas fir lumber in its columns, beams and the bottom layer of the exposed CLT" (Kaiser+Path, n.d.). The interior of the CLT panel uses spruce-pine-fir (SPF). The wood is sourced from British Columbia and uses wood killed by the Mountain Pine Beetle. Exemplifying the multifaceted

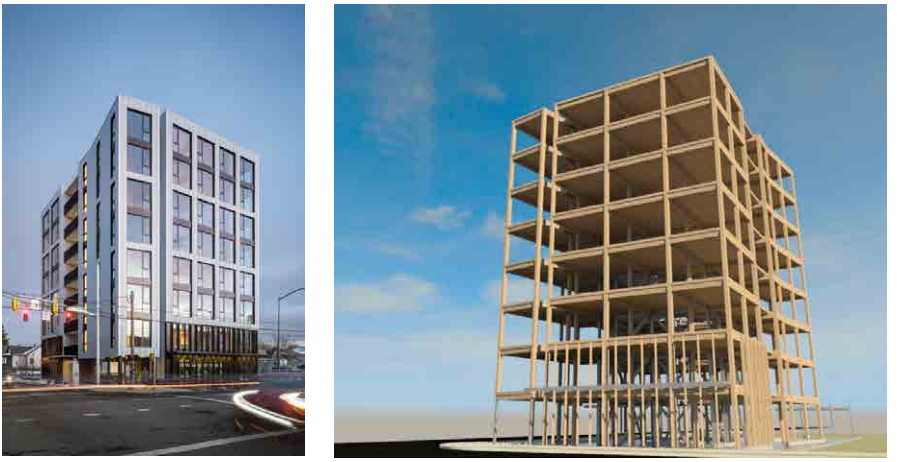

Figure 2. Carbon12 by Kaiser+Path. Source: (Kaiser+Path n.d.)

benefits of tall wood construction, the project overcame legal and logistical barriers to construction and provided new insight into the potential benefits of dataflow optimization to enhance future mass timber construction and project team coordination. The project also illustrates the importance CLT-related design teams should place on manufacturer engagement and coordination even within early design phases.

3.2. The Canyons

Following the successful completion of Carbon12, Kaiser+Path designed and developed The Canyons, a six-story, multi-family mixed-use project located directly adjacent to Carbon12 in Portland, Oregon (Fig. 3). The Canyons is a 65-foot tall, 110,000 square foot building that uniquely utilizes a combination structural system pairing lightframe timber bearing and shear walls with CLT floor panels. It has 70 market-rate residential units in the main building with a pedestrian alley, located on a North-South axis, that separates 11 micro-retail work-units from additional ground floor retail within the main building. Unlike Carbon12, Kaiser+Path collaborated with local builder R&H Construction as their general contractor while working directly with Catena Consulting Engineers to develop the structural strategy. Similar to Carbon12, Structurelam was the mass timber manufacturer/supplier and a critical project partner for both buildings. The Canyons is currently under construction with completion expected during Summer 2020. While the project is considered by Kaiser+Path to be a direct furtherance of Carbon12 regarding the pioneering of low-carbon construction techniques and methods in the United States, The Canyons' hybrid timber structural system, unique atrium design, and construction interfacing and logistic strategies are each unique to the project.

Figure 3. The Canyons by Kaiser+Path. Source: (Kaiser+Path n.d.)

Both projects contain valuable process-knowledge for the AEC industry globally, particularly in regions of the world with nascent mass timber industries. The projects are presented in a back-and-forth manner over the following paragraphs with case-study knowledge being disseminated through the following two sections: (1) project funding and code compliance; and (2) project construction. The authors focus on specific instances in the design-to-construction process for both projects that are intended to provide the best use-value information for AEC professionals to positively influence future, urban, multi-family construction with CLT.

3.3. Project funding

"As part of the Obama administration's commitment to mitigate climate change," the USDA launched the U.S. Tall Wood Building Prize Competition in 2014 (McKalip 2014). As engineering cost factors and code-related variances were deemed as key limitations to the expansion of tall wood construction in the US, the $2 million in USDA funds were targeted to specifically address both issues through the selection and subsequent financial support of winning projects. Having just independently developed, designed, and constructed a commercial mass timber

(glulam) project, Kaiser+Path shifted their focus and entered the competition with six weeks before the deadline. Due to their unique internal composition of "trained architects, contractors, and developers... [that also] already owned the proposed building site," they submitted a proposal for Carbon12 but were not ultimately selected (Kaiser+Path, n.d.)(Fig. 4). Despite the setback, the team decided to move forward with the design anyway. Kaiser+Path's office composition as owner/developer, architect, and general contractor will reappear throughout the case study as a key strategic advantage for successful project completion. In this case, the team was able to pivot financially and fund the project without USDA money, although there was a significantly smaller amount of US Forest Service Wood Innovation Grant money supporting engineering and permitting. The project's integrated, architect-as-developer funding model allowed greater flexibility with design and construction logistics than would otherwise be available if the project were reliant upon other funding means or an alternative team composition. This is one key reason the project was ultimately constructed successfully whereas other related projects by other offices were cancelled (Njus 2019). Throughout the project period, the team was able to adjust hard and soft project costs on-the-fly in coordination with the digital models and project affiliates. This was particularly important for a CLT-based project as the unique, hybrid structural system and novel wood use added additional complications to the standard methods of costing and construction. The ability to pivot design-wise to adapt to changing cost conditions and project constraints was time efficient in the small office where the owner/developer-architect-builder team consisted of approximately seven persons - depending upon the project stage - unlike related situations in larger, less-centralized companies. The project was planned as a condominium project with two ground floor commercial tenants and 14 potential residential owners. The high upfront project costs of using new CLT construction methods were able to be handled through the condo financing model. The premium price for high-end condo units in the up-and-coming Williams Avenue, Portland neighborhood was able to offset the uniquely high development costs for the project in terms of its special underground parking system and CLT expenses as compared to other non-CLT projects of a related size.

Figure 4. C12 Render 1, Tallwood Competition Proposal by Kaiser+Path. Source: (Kaiser+Path n.d.)

Kaiser+Path relied on the same architectural and general contracting Revit model for Carbon12 and separate Revit models for The Canyons. Structurelam, the mass timber supplier for both projects, produced a CLT package and project-specific glulam package that included handling and assembly notes, tolerance specifications, CLT panel data charts, and construction sheet sets in coordination with the general contractor. This information was not cohesively imbedded in a singular BIM model with linked data flows between project teams. As Carbon12 was the first project for which Kaiser+Path had utilized CLT at this scale of building, the project team held weekly meetings regularly to manage the complexity of design, construction, and CLT-specific material challenges. The project team was proactive and intentional in regard to predesign work

and coordination. For The Canyons, close coordination within the design development phase between architect, general contractor (GC), and mass timber supplier led to cost savings through the reduction of CLT panel thicknesses which then led to decreased concrete foundations.

3.4. Building code compliance

The challenge of building code compliance is one of the key factors that may impact design-to-cost decision making by CLT-related project teams. In world regions with less developed mass timber industries and relatedly less mass timber use, the work to overcome building code compliance challenges can cause significant financial problems due to project delays, unexpected fees, or further required research to gain approval by local governing bodies. The process for Carbon12 was no exception.

> Initially, the City of Portland required that Carbon12 go through an extensive third-party review process similar to a concrete building over 240 feet tall. The city had never reviewed a CLT project before, so it was clear that this route would take significant time and cost. However, at the state level, the Oregon Building Codes Division was launching a pilot program to establish a method for reviewing CLT buildings for local jurisdictions (Kaiser+Path, n.d.).

Ultimately, the city and state partnered on the review effort for Carbon12 after multiple city entities were consulted, and project data from Carbon12 was shared with the state to enhance its review process for future CLT buildings. The sharing of Carbon12's data with the state directly benefited The Canyons project by Kaiser+Path, which was designed a few years later, and it is likely to have lasting benefits for future CLT buildings even outside of Oregon's jurisdiction. This is not only due to the establishment of a baseline code review process for Oregon mass timber structures, but also due to the impact Carbon12 has had as a direct reference for the ICC Ad Hoc Committee on Tall Wood Buildings in their "review and approval of new building types to the 2021 International Building Code" (Kaiser+Path, n.d.).For both Carbon12 and The Canyons, challenges to overcome building code restrictions impacted the project timelines and had the potential to significantly disrupt cost estimates. The developer-architect-builder model at Kaiser+Path provided flexibility to overcome cost barriers and the small project team size helped to expedite project workflows. Each Kaiser+Path building also illustrates from a cost and code perspective how beneficial pilot-type buildings can be to pave the way for a further streamlining and optimization of related projects.

3.5. Project Construction

Above and beyond the required planning for a typical multi-family housing project, CLT-based mass timber projects require extensive pre-planning and project coordination. In regions of the world with nascent mass timber industries, the administrative hierarchy and coordination methods between the architect, general contractor (GC), and product manufacturers is particularly important to determine early in the process as working relationships and the division of labor may be different than in typical project delivery models. Additionally, the digital model, or building information model (BIM), may be developed and utilized differently than in standard - non-CLT - practice. For CLT-based projects, the tolerances between various building materials must be considered early in the design process and reflected in the method of BIM model development and utilization due to the high-level of mass timber precision from the factory, often 1/32 inch, as compared to steel and concrete which are considerably less precise.

The following paragraphs present specific aspects of the construction process for both Carbon12 and The Canyons. Through the following examples, tradeoffs are introduced between the utilization of integrated digital models for construction sequencing and coordination versus the less digitized methods of direct manufacturer interfacing and in-the-field construction workflow improvements. When novel material systems for construction such as CLT are adopted by the project team, key questions must be answered regarding the reliance on digital planning tools like BIM versus more traditional forms of project team communication, and at what point may more traditional methods of project team communication need to evolve into more advanced digitally-integrated workflows.

3.6. Carbon12: Material tolerance and coordination

If low-carbon construction using CLT-based mass timber elements is to provide a widespread, scalable solution for urban housing construction, the precision-based benefits of CLT's manufacturing process likely will need to be maximized, namely construction speed. As construction speed increases, project costs are lowered. Carbon12 was faced with a dual challenge, the need for construction speed to lower project costs on one hand and the inability to use CLT for the building's elevator cores on the other - a result of local seismic code limitations. As concrete construction for the building's structural core would have been schedule inhibiting due to time-intensive formwork construction and cure time, increased trade coordination on a limited site, and potential context-specific winter weather hindrances, the team chose to use a buckling restrained-braced (BRB) frame system. The steel-brace system was designed to work in conjunction with the CLT floor slab and glulam post-beam arrangement. The steel for the frame was sourced specifically for the project due to the engineers concerns that the typical steel-brace components were designed for much heavier types of the buildings (Forest Business Network 2018). The team also directly coordinated with Timberland, the framing subcontractor with an internal steel division, so that Timberland would directly fabricate and install the BRB system in conjunction with the timber package. Thus, the assembly of the entire structural system was optimized as a singular subcontractor would conduct not only 3D clash detection between the two material systems, but they would also facilitate efficient labor scheduling resulting from the same crew erecting the building's whole structure. The BRB frame system was constructed in three-story high increments so that the CLT could be threaded by a crane through the steel frame for fast assembly. After the CLT floors were completed to the required height, the next three stories of BRB framing were added. Uniquely, the CLT was prefinished in the factory by Structurlam which further enhanced the project's onsite construction schedule and proved be particularly critical through a historically wet and snowy Oregon winter. The factory-finished panels were directly lifted into place from arriving trucks, minimizing potential damage and staining while also eliminating the need for additional weather protection or finish work onsite. The factory pre-finishing by Structurlam is unique because it went beyond typical means of service for a mass timber company and required a significant amount of labor and space investment by the manufacturer. However, the intensive process directly facilitated onsite success as it not only minimized onsite panel labor but also allowed the construction team to continue structural assembly through inclement weather conditions without costly setbacks.

As new forms of advanced fabrication engender the creation of increasingly high-

precision building products such as CLT, a key concern for project teams is how to best coordinate the precision of such building systems with other project systems of significantly lower precision. The CLT elements for Carbon12 were significantly more precise than the steel frame and concrete foundation - the CLT precision being approximately 1/8" while acceptable tolerances for concrete could range from 1/2" to 1". As such, the project team coordinated with the structural engineer to fabricate steel 'buckets' (Fig. 5,6) that allowed the high-precision wooden elements to rest on the less-precise steel. The glulam beams were adjusted - trimmed to fit if necessary - to accommodate fluctuations in the steel and then bolted to the buckets to tie back to the primary steel structure.

This particular design solution is important to recognize for its key benefits to the construction coordination and assembly process. The project team recognized in advance that the steel, despite its factory fabrication, may not perfectly meet the wooden elements in the field due to factors such as creep, thermal expansion/contraction, and human assembly imprecision. Therefore, the intentional design of steel bucket joints allowed the element-to-element connections to be slightly adjusted on site. Such a process questions the utility of highly precise digital models that cannot simulate the human error or climatic factors that may influence material performance/accuracy on site. In this case, direct manufacturer interfacing regarding assembly logistics, detailed logistical planning for assembly, and in-the-field construction workflow improvements provided a streamlined construction process. For Kaiser+Path, extensive weekly pre-design meetings between the architect, builder, mass timber manufacturer, and framing subcontractor were necessary to coordinate the successful design, integration, and assembly of the BRB & CLT hybrid system of Carbon12.

Figure 5,6. Carbon12 Detail, Beam - Steel Core Connection with adjusted glulams. Source: (Kaiser+Path n.d.)

3.7. The Canyons: Construction speed and logistics

As a direct evolution of the ideas and processes that drove the design and construction of Carbon12, The Canyons was also designed with a CLT-based structural system. Construction speed and precision with low-carbon materials were each important drivers for the project team. Unlike Carbon12 that employed a hybrid mass timber and BRB-frame structural system, The Canyons is constructed of a unique combination of light-frame wood and CLT floor slabs. The hybrid wood assembly with light-frame structural walls - bearing and shear - and CLT floor slabs was chosen due to cost concerns and code-related obstacles. The concrete foundation, housing underground parking and topped with light-gauge metal framing for ground floor retail, is superimposed with light-frame timber walls and CLT floor panels from levels two through six. A multi-story exposed CLT atrium spanning nearly the entire length of the building, approximately 120 feet, and bisecting the main building mass down its North-South centerline, was a particularly challenging spatial element to permit and to construct. Excluding the exterior work-units, which are constructed with traditional building strategies, the project is in essence a double-loaded corridor arrangement with the timber corridor/atrium being an experiential focal point for the occupants.

As noted previously, integrated workflows between project team members that optimize on-site construction logistics are key to the success of fast-build, CLT-based mass timber construction systems. In response to this necessity, the multi-disciplinary project team spent a substantial amount of effort early in the project planning process to achieve a rapid construction timetable while also maintaining a comprehensive moisture mitigation plan. Unique to the project, the light-frame wood walls were originally designed to be prefabricated for fast, modular onsite installation. The team recognized from their experience on Carbon12 that the CLT assemblies could be constructed on site very quickly compared to other building systems. Thus, a clear challenge for the project team was to match the construction speed of CLT with that of the structural light-frame walls to keep the project on schedule, to minimize onsite CLT storage time, and to reach topout as fast as possible. The original intent was to have simple prefabricated walls, including wall frames and rough sheathing, "chase" or rapidly be constructed after CLT panel installation for assembly and schedule efficiencies. Assembly of the residential floors would occur sequentially beginning with the units east of the atrium after the atrium panels were completed. CLT panels would be installed from south-to-north on the east units with the prefabricated wood frames being craned into place immediately afterwards, just as CLT panels would begin to be installed simultaneously on the west units. Trade crews would then be coordinated to follow closely afterwards to create MEP penetrations, etc. in a fluid sequence.

However, during the design development project phase, the prefabricated nature of the light-frame wall elements were

Figure 7. The Canyons CLT and light frame integration. Source: (Marcus Kauffman, Oregon Dept. of Forestry n.d.)

changed due to project cost implications and means and methods complications. Without affecting the overall design intent or drawings, the construction strategy was shifted to traditional onsite timber framing, with the added consideration that light-frame studs would be precut for faster onsite assembly. This strategy facilitated faster assembly times than could be accomplished with traditional wood framing, but ultimately the light-frame wall construction method slowed the structure's overall construction speed as this framing strategy required an entire floor's wall assembly to be completed before the subsequent level of CLT could be craned into place (Fig. 7). As a result, onsite labor efficiency was significantly reduced and potential weather damage to stored and installed CLT panels onsite increased. An intensive amount of pre-construction coordination and review was also required by relevant parties due to the nature of pre-cutting the studs, similar to other types of prefabrication. In addition to a construction sequence plan for the structure, R&H had a predetermined internal strategy for panel shipment and laydown that they directly coordinated with Structurlam. Key project documents related to the CLT shipment and assembly included the following: (1) CLT shop drawings complete with handling instructions, panel identification, panel schedules, plan sheets, specifications, a tolerance listing, and a responsibility statement that included panel unloading guidance; and (2) elevation drawings of the shipment trucks loaded with panels and number coordinated to corresponding shops. The construction crew averaged approximately three days per floor for CLT assembly and six days per floor for light-frame wood construction. The project has already set a number of benchmarks for innovative wood construction (Fig. 8 and 9) in the United States and is on schedule for successful completion in Summer 2020.

In summary, the early coordination between Kaiser+Path, Structurelam, and the other project team members was highly desirable to develop a successful approach to panel fabrication and construction logistics. The Canyons was a direct furtherance of the design and construction intelligence utilized on Carbon12, yet was unique in a number of its challenges. The digital technology workflows for the project were defined less

Figure 8,9. The Canyons CLT and light frame integration. Source: (Marcus Kauffman, Oregon Dept. of Forestry n.d.)

by high-tech uses of simulation and analysis software, but rather the diversity of file types and multiple team members through which the information had to flow. An emphasis was placed on direct person-to-person coordination.

4. DISCUSSION

4.1. Opportunities for off-site fabrication and integration

Relative to The Canyon's prefabricated wall assemblies, the construction speed challenges that the project team experienced may be mitigated through higher-end workflows that pair Revit data with advanced robotic manufacturing. If the team continues to refine the hybrid-timber construction logistics and costs for advanced fabrication are managed, technologies such as the robot-based fabrication of timber-frame modules pioneered by the ETH's Gramazio Kohler Research Lab may be of particular utility (Gramazio Kohler, n.d.). Additionally, relative to factors that are unpredictable on site such as human construction error and weather, integrated cloud-based models across the project team that allow for construction changes to be quickly coordinated could be particularly useful. For example, with integrated digital tools, the construction team can use mixed-reality overlays, site scans, and shared digital models across the construction team to account for, and subsequently fix, construction inconsistencies.

4.2. Opportunities to enhance design-cost modeling

Based upon the authors' experiences designing mass timber buildings in Europe and the United States, including The Canyons, a further integration of cost and design models could be beneficial across the mass timber industry to help streamline the design-to-construction process, specifically after initial project bidding. The aforementioned lack of Revit model integration between the architects and contractors on The Canyons presents an opportunity to link decision making with real-time design-to-cost updates. After initial project bidding is typically completed and the general contractor and primary subcontracting teams have been selected, BIM design data could be linked to cost calculations in real-time for major project components. Such a linking of information is uniquely relevant to large prefabricated buildings like The Canyons due to the extreme degree of pre-project coordination necessary. Architectural offices have shown an interest in such streamlining through projects such as Model-C by Generate and B2 by SHoP.

CONCLUSION

Effective information exchange among project constituencies can help CLT-based mass timber projects overcome the unique barriers to construction that exist in regions of the world without well-established mass timber industries. Additionally, a close integration between project team members early in the design process is critical to successful project completion in such contexts. Both Carbon12 and The Canyons have overcome design, permitting, and construction barriers, many of which stem from the lack of experience with CLT construction in the United States and the general infancy of the mass timber construction industry at a global scale. If urban populations increase globally as projected, case study projects such as Carbon12 and The Canyons can provide valuable information for AEC professionals in support of the widespread construction of new, low-carbon, multi-family urban housing.

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PAPER #5.10

A PARAMETRIC STUDY OF DAYLIGHTING IN HIGH-RISE RESIDENTIAL BUILDINGS IN DHAKA, BANGLADESH

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ABSTRACT

Daylighting has gained significant attention in the contemporary building industry to support a sustainable living environment. This is a challenge in the ever-increasing density of urban contexts. Empirical research shows that daylighting needs to be incorporated in regularly occupied spaces, including residential buildings. Surprisingly, residential buildings are designed largely ignoring daylighting necessity in compact urban contexts in developing countries. It is imperative to ensure enough daylighting ingress in residential buildings for improved health outcomes and comfort conditions. Daylighting in high-rise residential buildings in a dense urban context is still a less explored field in empirical research. This research presents an analysis of daylighting ingress relating to urban street canyon configurations of high-rise residential buildings in the dense urban context of Dhaka, Bangladesh. A parametric study is used to investigate the impact of building and street canyon geometry on daylight autonomy in high-rise residential buildings. Six residential building typologies are analyzed concerning how varied geometry of these typologies and the width of urban street canyons impact daylight ingress. The key aspects to analyze daylight autonomy in this study are building geometry, surrounding obstructions, orientation, and urban street configurations. These are computationally analyzed and visualized utilizing software, such as Rhinoceros, Grasshopper, and environmental plug-ins such as Honeybee and Ladybug. Observations from the study are used to understand how the geometric aspects of street canyons impact daylight autonomy in high-rise residential buildings in the dense urban context of Dhaka.

KEYWORDS

Daylighting; density; urban; high-rise; residential.

INTRODUCTION

Daylighting is as old as architecture itself and has a significant influence on building design. Before artificial lighting replaced natural light, the provision of daylight in every space was a necessity. Throughout history, daylight has influenced the building forms in numerous ways. The interaction between building design and daylighting depends on the importance of the availability of daylight in the building. The required illuminance quantity and quality are defined by the typology of a building. Building form determines the possibilities of daylight utilization and illuminance distribution patterns (Nancy et al. 2000). The factors related to building forms that influence daylighting design are - the ratio between exterior façade area and total floor area, building height, floor depth, floor-to-floor height, interior walls, and other obstructions (Compagnon 2004; Mayhoub and Carter 2010). Moreover, designing for daylight in a dense urban context asks for external urban factors, such as external obstructions, height and width of urban canyons, and other geometric aspects of the buildings (Cheng et al. 2006; Compagnon 2004).

Problem Statement

Urban densification and the construction of high-rise buildings are very specific problems related to daylighting in urban environments. In dense urban areas, the tall buildings that are built in direct proximity to each other, cover part of the sky, shade the windows from daylight and therefore, reduce daylight ingress and duration of sunlight. Moreover, tall buildings form street canyons, and these canyons reduce daylighting ingress inside the buildings. The use of artificial lighting is the only substitute in these cases. The negative psychophysical impacts of artificial lighting are well researched and proven (Boubekri 2008). Moreover, dependence on artificial lighting accounts for a substantial amount of energy use.

The development of high-rise buildings is a consequence of urban densification, expanding urban population, and economic growth. This is an ongoing issue, particularly countries in Southeast Asia. In many Southeast Asian cities, such as Dhaka, Mumbai, Hong Kong, Kuala Lumpur, high-rise residential buildings are abundant (Farea et al. 2012). According to Ahsan et al. (2016), the number of high-rise buildings has increased by three times between 2010 and 2016, whereas in Bangkok and Kuala Lumpur, the number has doubled over the same time (Ahsan 2016). Thirty percent of these high-rise buildings in Dhaka is of the residential type, and this number is increasing (Ahsan et al. 2014). The current number of high-rise housing may be much higher.

The Context of Dhaka

Dhaka, the capital of Bangladesh, is a fast-growing metropolis in south Asia and the 9th most densely populated cities in the world (United Nations Department of Economic and Social Affairs 2016). An influx of internal migration and spontaneous growth of population turned Dhaka into a densely built populous city with a demographic of 8.5 million people as of 2016 ("Atlas of Urban Expansion - Dhaka" n.d.). The built-up area density was 552 persons per hectare in 2014, and it is increasing every year ("Atlas of Urban Expansion - Dhaka," n.d.). The city suffers from extensive uncontrolled densification horizontally, and very recently, vertically in both planned and unplanned developments, resulting in a very compact urban form. The growing trend of constructing taller buildings is creating the problem of very dark and narrow urban street canyons (height: width aspect ratio 8:1 – 10:1). The two-way urban sprawl with no consideration of livable environmental factors, such as daylighting, etc. and proper infrastructure, including housing, has made Dhaka one of the unlivable cities of the world ("Global Liveability Ranking," n.d.).

It is a matter of concern that a majority of the existing residential buildings in Dhaka are built neglecting the adverse effect on occupant's psychophysical well-being, comfort, and overall urban environment (Ahsan, 2016). The high-rise buildings take advantage of the setback rules that require the buildings to have a minimum distance from the site-lines. These buildings obstruct admission of daylight forcing the occupants to rely on artificial means of lighting (Ahsan et al. 2014). This creates the problem of very dark interior living spaces in these buildings and the increased use of artificial lighting (Ahsan et al. 2014). This poses the following research question: How do building and related street canyon geometry affect daylighting in high-rise buildings in a dense urban context such as Dhaka, Bangladesh?

Review of Scientific Research and Recommendations on Daylighting

Parametric methods have been utilized in many pieces of research that intend to solve the complex problem of daylighting design utilizing available data and taking advantage of the flexibility of user manipulation (Eltaweel

and Su 2017). Daylighting design is dependent on many divergent criteria such as the latitude, longitude, sun-path, sun angles, dynamic sky conditions, solar irradiations, which makes the task complex and challenging. The parametric method can provide the utility of processing and connecting all the relevant data using specific software, which makes the process of analysis and decision making easier.

Over the past couple of decades, several studies have been undertaken to evaluate daylight ingress using parametric methods. Compagnon (2004) proposed a method to evaluate daylighting in urban areas by looking at irradiance values on building roofs and facades. This method has limitations as it does not consider the fact that daylight ingress is dependent on the depth of the building. In another research by Strømann-Andersen and Sattrup (2011), building depth and related urban canyons were analyzed. Their correlational study investigated building scale, urban density, and passive energy factors and established a relation between urban geometry and building operational energy, assuming a homogeneous urban setting. In PLEA 2006, Cheng et al. (2006) introduced another approach to investigate daylight availability by looking into daylight factors and urban density. This study presented the potential of daylighting simulations for urban design. However, the daylight factor approach is not a climate-based daylighting metric.

In recent years, climate-based daylighting metrics based on annual hourly indoor illuminance data are repeatedly investigated, promoted, and validated by researchers (Mardaljevic, Heschong, and Lee 2009) (Reinhart, Mardaljevic, and Rogers 2006). The Illuminating Engineering Society (IES) introduced Lighting Measurement protocol LM-83 that provides recommendations for using spatial daylight autonomy metric (sDA) to evaluate daylight availability in buildings. According to the IES recommendation, if a point in the work plane of an interior space receives daylight above 300lux at least 50% of the occupied time ($sDA_{300,50\%}$), it is considered 'daylit' ("Illuminating Engineering Society – The Lighting Authority" n.d.). According to LEED V4, the recommended $sDA_{300,50\%}$ level for an interior living space is at least 55% of a regularly occupied floor area ("LEED Green Building Certification | USGBC" n.d.). This is also adopted by the WELL building standard ("Light | WELL Standard," n.d.).

Research overview

This research intends to investigate the existing daylighting situation in a dense urban residential context of Dhaka, Bangladesh. The study is done first, at the building level, and then extended to the urban level. Six types of building geometry are tested at a building level to see the effect of building geometry. Then, the author investigated five rectangular building types at an urban level study. The urban level study focused on urban canyon configurations such as the width of streets, street adjacency to the longer side of building façade, and orientation. The research employs specific parameters to simulate hypothetical urban scenarios. This investigation helps to understand and identify the effects of building geometries and urban street canyons on daylighting in a dense city. Consequently, building orientations are also studied to understand how the buildings and urban canyons relate to each other. From this investigation, it is to be determined what geometric aspects of buildings and urban street canyons affect daylighting ingress in heavily obstructed high-rise residential buildings and whether a parametric exploration can help designers understand how daylighting ingress in densely built cities can be improved.

1. METHODOLOGY

1.1. The Climate and the Sun

The tropical city of Dhaka has a mainly direct sunlight climate. Conventionally, the principal daylighting strategy is window design with considerations for visual and thermal comfort. In dense areas with high-rise development, overshadowing cuts down a significant amount of incident daylight, and window design becomes a secondary concern. In such cases, urban street canyons and the shape of the buildings can be strategic areas for daylighting design. This research explored these specific strategies concerning daylighting in Dhaka. For this exploration, it is crucial to understand the sun's positions and angles throughout the year concerning the location of Dhaka.

The latitude of Dhaka is 23.8° North, and the longitude is 90.4° East. The Sun path diagram and solar chart presented in Figure 1 graphically show the year-round solar positions. These diagrams indicate that the sun altitude angles are high. The altitude angles for Summer and Winter solstices are 89.64° and 42.76°, respectively (calculated by the SunAngle program - https://susdesign.com/sunangle/). The sun path and solar chart diagrams are intended to show how the sun's position throughout the year affects the facades facing the west, southwest, south, southeast, and east, while the north facades have diffused daylight. The solar position is a critical factor for the daylighting design in Dhaka because of the high solar angles.

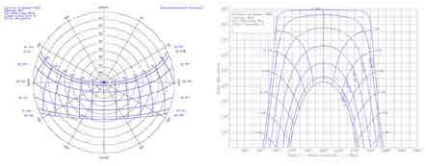

Figure 1. Sun path diagram and solar chart for Dhaka. (Source: http://solardat.uoregon.edu/unChartProgram.php).

1.2. The workflow

This research adopts a computational approach to analyze daylight availability in Dhaka. A parametric workflow is created based on existing scientific research. To calculate the sDA at a building level, the Radiance-DAYSIM approach is used and validated in many research (Saratsis, Dogan, and Reinhart 2017; Reinhart and Wienold 2011). Ladybug and honeybee plug-ins for rhinoceros-grasshopper use the Radiance engine to simulate daylight availability. The parametric workflow shown in Figure 2 is used to model, simulate, and evaluate building geometry and related urban street canyons. The workflow is divided into four sequential phases: (1) modeling the geometries and environment, (2) define and iterate the geometries which include defining the analysis geometry, creation of windows, walls, floors and ceiling, (3) annual daylight simulation, and (4) evaluation based on dynamic daylight availability metrics.

Typical meteorological year (TMY) weather data for Dhaka, Bangladesh, is used for the dynamic sky and daylight conditions.

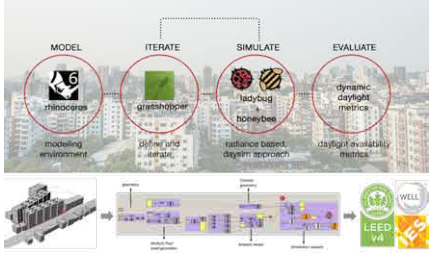

Figure 2. The computational workflow. (Author 2019)

1.3. Urban Geometry

The characteristics and form of urban residential buildings are a result of ever-evolving codes and regulations as well as climatic, socio-cultural, political, and technological factors. Dhaka's urban housing scenario is not any different from that. In this research, urban geometry is analyzed at the building level and the urban level. Several residential building form typologies are seen in Dhaka. Some typologies are adapted from the old courtyard houses with living spaces in the perimeters of the buildings with a central courtyard. Other typologies are variations and combinations of the central courtyard and vertical shafts at the outer shell of the buildings. The author identified six common residential buildings form typologies based on their geometry, which is shown in Figure 3. These are simplified massing diagrams for the typologies of residential building forms. The primary geometric types are square and rectangular forms of the building mass. Diagrams show the shapes of the buildings with external cuts and internal lightwells modified from existing residential buildings in Dhaka. Exterior protrusions and details such as windows, shading devices, are not shown. The number of dwelling units ranges from 4-8 per floor. At the urban level, the rectangular typologies were studied with varied urban canyon configurations. One example is shown in Figure 4.

1.4. The Parametric Research

The computational analysis is done in two levels –

1. Building level simulations:

A series of simulations were run for fourteen floor levels for each building typology. The total floor area is 8800 square feet in all six cases. For this set of simulations, the author set the building geometry as isolated objects on a ground plane with no obstructions. The freestanding geometry sDA values serve as references for the urban level analysis.

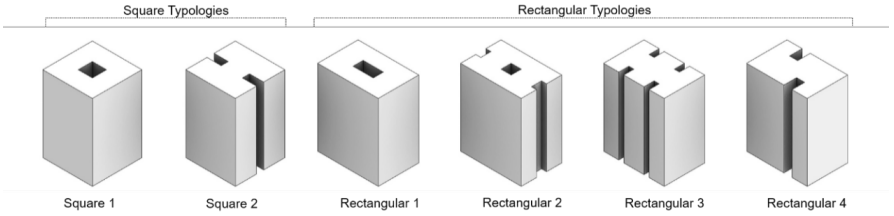

Figure 3. Six residential building form typologies. (Author 2019).

Figure 4. Example of a 3X3 grid geometry (R3 type) at the urban level. (Author 2019).

	Parameters	Details
Building Level		
	Building geometry	Shape, form
	External cuts and internal lightwells	Shape, area
Urban Level		
	Urban street canyons	Width of the adjacent street
	Canyon orientation	N-S vs E-W
	Context	Relative compactness or dispersion
	Obstruction of solar penetration	Overshadowing from adjacent buildings

Table 1. Building and Urban Level Parameters. Source: (Author 2019)

2. Urban level simulations:

For the urban level simulations, only rectangular typologies were studied. Another geometric type with no external or internal lightwell is included in the study (R0) to see how it performs in comparison to the other four rectangular types. Each of five the rectangular typology is simulated and analyzed in hypothetical 3 X 3 grids of repeating geometry with streets. The urban level study for five rectangular typologies are done in the following scenarios –

i. North-south building orientation, 20' streets
ii. East-West building orientation, 20' streets
iii. North-south building orientation, 30' streets
iv. East-West building orientation, 30' streets
v. Wider East-West streets
vi. Wider North-south streets

The proposed simulation approach features parameters in the parametric modeling environment to allow for an understanding of daylight availability and increasing simulation complexity. These variables affect the annual simulation analysis either by adding to the accuracy level or by impacting the daylight availability. Table 1 summarizes the parameters explored in this study. The Radiance parameters are set at the following levels- the ambient bounces (ab) at 5, ambient divisions (ad) at 1000, ambient resolution (ar) at 300.

The computational methodology used here, while effectively producing relevant results, makes some important simplifying assumptions for simulation to minimize calculating irrelevant objects and shorten the simulation time. A key assumption is that there are no interior walls, partitions, structures, furniture, or other internal obstructions in the building. Another key assumption is, the massing of the building is simplified, not considering the façade treatments such as exterior protrusions, verandas, other overhangs, or shading devices concerning the windows. It should be noted that the sDA computed in this exploration is not the actual sDA required by LEED that complies with IES LM-83 since there are no shading devices, such as blinds, applied in the parametric model. The sDA metric is not originally intended for residential development and there are very limited guidelines for evaluating the daylighting performance of residential buildings. The exterior wall thickness and the building elevator and stairwell core were not deliberately defined in the geometry. The sDA calculated in this research is the output of the Honeybee annual daylight simulation and is referred to as sDA henceforth. ASE metric was not tested because shading devices are

not incorporated, and this research focuses on daylighting ingress concerning building and canyon geometry. Further research is needed to analyze visual and thermal comfort. Within the limitations imposed by these caveats, this computational framework can be used to effectively calculate research sDA values and generate data necessary for this research.

2. OUTCOMES

2.1. Building level simulations

Figure 5 shows annual daylight autonomy false-color graphics on the tenth-floor level for all six building typologies for comparison. The effect of changing floor levels on $sDA_{[300lux]}$ $_{[50\%]}$ percentages is shown in Figure 6, where the graph presents the sDA values on all the floors except the ground parking level. These data visualizations demonstrate that the sDA percentages for a specific floor level in all building typologies vary within a small range and the variation is highest in the 14th-floor

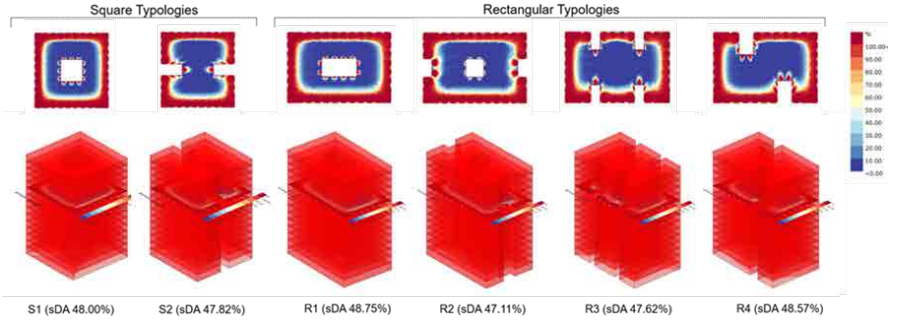

Figure 5. Building level study for daylight availability- example level 10th floor (Author 2020).

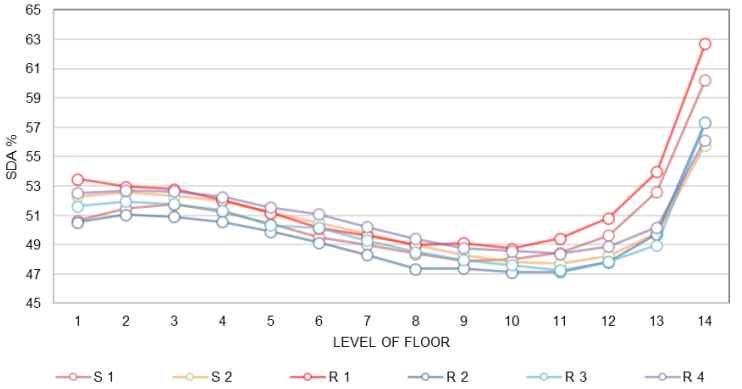

Figure 6. Floor-by-floor sDA plot for the six typologies (Author 2020).

level. The R4 type presents the minimum difference in floor-to-floor sDA percentages, whereas the R1 shows the highest variation. Although type R4 has the longest perimeter and thus more glazed surfaces, the upper floors get comparatively lower percentages of sDA than R1. It can be speculated that R1 type has uninterrupted facades that benefit from the unobstructed direct sunlight. Figure 5 also shows that these exterior cuts decrease the direct sunlight ingress. The other types have wider shaded regions between red and blue extremes, mostly near the windows, whereas the R1 type has uninterrupted red color adjacent to the perimeter and the less shaded area between the two extremes. A similar effect can also be seen in S1 and S2 types. These external cuts may be beneficial to reduce glare and overexposure to direct sunlight. The impacts of having these external cuts were also explored in the urban level investigation discussed later. The sDA percentages in all cases are somewhat at a good level principally because of unobstructed direct sunlight exposure. It is intriguing that in an isolated geometry, the lower floor levels receive more daylight compared to the middle levels. One assumption can be made here that this is due to the diffused sunlight reflected from the ground surface penetrating the building interiors through the glazed openings. The upper floors receive more daylight than the lower floor because of sunlight exposure, whereas the lower floor levels do not receive direct sunlight when the sun is at a higher position in the sky.

In the isolated geometry study, the diffused daylight from the ground, the sun positions, and the external cuts in the façades play crucial roles in daylight ingress. Interestingly, the data also shows that the shape of these typologies does not have any significant effect on spatial daylight autonomy for isolated buildings, and all the typologies seem to have an almost similar level of daylight ingress year-round (Figure 6).

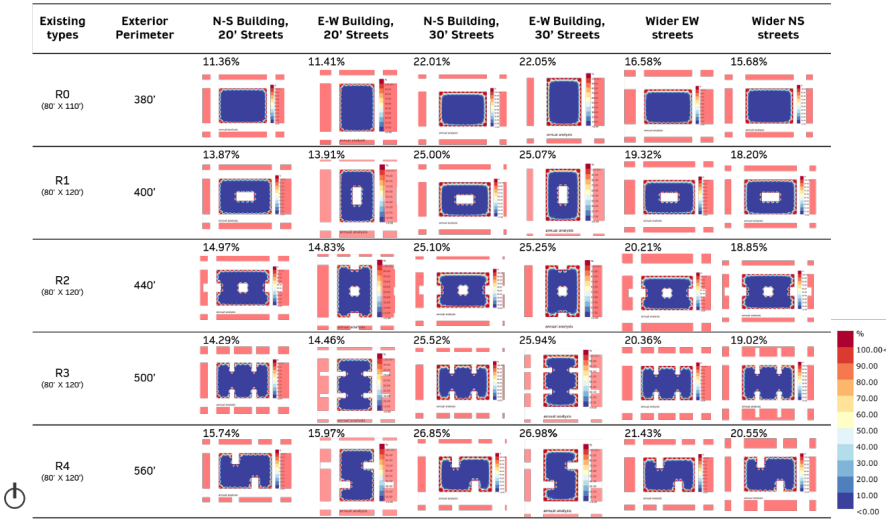

Figure 7. Urban level Study for Daylight Availability: Investigated floor- level 10. (Author 2020)

2.2. Urban level simulations

Figure 7 shows the data visualizations from the thirty annual daylight simulations for the 10th floor of the five rectangular types in the six hypothetical urban scenarios. Predictably, the matrix depicts that having a longer building perimeter, and thus, having more glazed surfaces allow more daylight ingress. Therefore, type R4 performs slightly better than the other types. In contrast to the building level study, type R1 did not perform better than the other types in the urban level study. The external cuts may be more useful in urban scenarios than isolated geometry because the diffused light reflected or scattered from surfaces of nearby buildings influence daylight ingress. There are slight improvements in the sDA with an increase in the perimeter length and glazed surfaces. On the other hand, increasing street widths around the building from 20 ft (6 m) to 30 ft (9 m) resulted in significantly higher spatial daylight autonomy percentages. This outcome reinforces the hypothesis that the geometric configuration of urban street canyons, in this case, the width of the street canyon, plays a vital role in daylight autonomy. In comparison, building shapes seem to have less effect on daylight autonomy. Moreover, having different street widths shows slight variations in the sDA which shows that having the longer side of the building along the wider street performs better in terms of daylight ingress.

CONCLUSION

The daylighting analysis in this research indicates that, in the extreme urban scenarios of Dhaka, the width of urban street canyons has a significant effect on daylight autonomy. For example, a ten feet width increase from a twenty feet street increases the sDA calculations at least 60% from the respective cases with twenty feet streets. In comparison, building shape and form has some, albeit minimal, impact on daylight ingress. For example, up to a 13.5% sDA increase is observed for buildings with external cuts (R4) compared to buildings with internal lightwell (R1). A conclusion can be drawn considering these findings, that it is critical to address the width of the urban canyon while designing for such density. Additionally, the urban street widths adjacent to the longer façades of the high-rise developments are critical for daylighting in the living spaces of residential apartments built in density, along with other factors traditionally addressed in daylighting design. Therefore, the regularly occupied spaces in residential buildings of Dhaka, such as the bedrooms, study areas, and family living areas, should be located along the longer side of the building façade to benefit from daylight. The building level parametric study shows that the internal lightwells in high-rise residential buildings performed poorly regarding daylight ingress, allowing daylight ingress only on the top 4-5 floors in a 15 storey building, whereas the external cuts are effective for all floors. Further research can be done on the different floor levels to see the difference at the urban level. Additionally, investigations can be done to investigate realistic geometric configurations of urban canyons with more simulation complexity to further explore daylighting in dense urban areas.

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PAPER #5.11

APPLICATION OF ARTIFICIAL NEURAL NETWORK IN SOLAR RADIATION PREDICTION FOR REAL-TIME SIMULATION

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ABSTRACT

Solar radiation is one of the essential energy sources in our life. The availability of solar radiation as a parameter is important in getting the most effective use of solar energy resources in design or energy simulations. Acquiring real-time solar radiation data is costly; most of the available data are historical. Predicting solar radiation is considered an essential process for developing real-time weather data required to run real-time building simulation to track the building systems' performances. Artificial Neural Networks (ANNs) have a good application history, especially in predicting solar radiation, which increased in the past years due to its ability to solve complex and nonlinear tasks. This paper aims to use an ANN model to predict hourly global solar radiation using only temperature and humidity, which can easily be accessible in the Building Automation System (BAS). An ANN algorithm had been developed in a previous study (Gaballa & Cho 2019), which shows that using predicted global solar radiation to run building energy simulation during the summer season gives a good accuracy based on the ASHRAE Guideline 14. In this paper, the ANN model mentioned earlier is tested throughout the entire year. The ANN model has some variables, i.e., the number of hidden neurons, the number of epochs, and the learning rates. For each season, the variables are calculated to give the most accurate results with minimum error difference. TRNSYS software is used to calculate direct and diffuse solar radiation from the predicted global solar radiation. After the prediction method, a new weather data file is developed according to the predicted data using the EnergyPlus weather converter tool. The EnergyPlus program is used to simulate a case study office building. Using two weather files (measured and predicted), a comparison between the measured and predicted cases is discussed.

KEYWORDS

Artificial Neural Network; solar radiation prediction; real-time building energy performance.

INTRODUCTION

Every day, technologies become more advanced to solve daily and significant problems. Artificial Intelligence (AI) is one of the advanced technologies used in various fields. This paper discusses how AI technologies can help in diagnosing the building`s systems efficiency.

Simulation software makes the process of making the right decision easier; it helps in making that in the early design stage to save time and money. After the construction process, it is still hard to diagnose the building`s systems using simulation software since it uses historical data. That is why developing real-time weather data is necessary.

Solar radiation data is considered one of the most effective parameters in simulation (Qazi et al., 2015); also, it is the most important renewable energy source on earth (Gana and Akpootu, 2013). According to Wang et al. 2011,

there is a shortage of solar radiation data preventing a great use of solar energy. For this reason, solar radiation data is essential. While the measuring process is costly, predicting solar radiation became necessary for real-time building performance. Not only for that purpose, it also helps in many other different industries such as, sizing PV planets (Egido, and Lorenzo, 1992) and increasing agricultural productivity (Dohleman & Long, 2009). According to Gungor and Yildirim, 2012, global solar radiation data is the required information as an input parameter for developing solar energy systems.

In this study, an ANN model is used for global solar radiation prediction, which had been revealed from different studies that ANNs are superior in prediction problems (Mubiru and Banda, 2008). Only easily accessible data from Building Automation System (BAS) is used as input parameters in the ANN algorithm, which is temperature and relative humidity to predict hourly global solar radiation. The main goal of this paper is to measure the accuracy of running real-time building simulation using the predicted weather files, which is developed using the predicted solar radiation from the ANN model. The simulation process using EnergyPlus is performed to run two different scenarios using two different weather files, the measured 2018 and the predicted 2018 weather files. A comparison using cooling and heating loads are analyzed for the entire year to see the efficiency of the ANN algorithm.

1. PREVIOUS STUDIES AND GOALS

ANN models are found to have applications in different fields of science and technology. ANN algorithms extract the information and learn from data, so it can be used to solve nonlinear problems. A study conducted by Amit et al. 2014, concluded that ANN techniques have more accuracy in comparison to the conventional methods in predicting solar radiation. The ANN prediction accuracy is found to be dependent on a combination of input parameters, training algorithm, and architectural configuration.

Previous studies used a combination of different parameters which influence the solar radiation prediction such as longitude, latitude, altitude, time, solar zenith angle, air temperature, wind speed, relative humidity, cloud cover, rainfall, etc. Historical data of these parameters in a specific location is used as input to the ANN to predict solar radiation at this location. However, this paper aims to focus on easily measured data from the BAS, which are temperature and relative humidity to be used as ANN input parameters.

It was found through the prediction process in the ANN model that there is no rule for selecting a specific number of hidden neurons or learning rate; otherwise, a try and error is performed. Such as a previous study done by Chiteka and Enweremadu in 2016, the author suggested some numbers (3, 7, 10, 13, and 20) for hidden neurons to be tested. While in this paper, an optimization process is performed to test all possible combinations of three variables; the number of epochs, the number of hidden neurons, and the learning rate.

Previous studies interested in real-time building performance used onsite measurement tools required to develop weather files. Some other studies used the Seo model (Seo, 2010) to calculate solar radiation data that requires more than six parameters, which is not readily available. This paper aims to use the ANN prediction model to develop a new weather file to be used in simulating the real-time building performance.

2. RESEARCH METHOD AND ASSUMPTIONS

2.1. Data acquisition

One of the most effective steps in the ANN algorithm is how to deal with the data set required to run the algorithm. In this paper,

2018 weather data files for Raleigh-Durham, NC, weather station represent real measured data. Temperature, humidity, and solar zenith angle picked from the 2018 weather files are used as a testing data in the ANN model to predict the global solar radiation. Data were divided into four seasons. Hourly global solar radiation in each season was predicted separately. In this way, it makes the prediction process more accurate as the set of data becomes more precise to each other. The training data is differentiated for each season. For spring, summer, and fall, the training data set are picked from Typical Meteorological Year (TMY) for Raleigh-Durham weather files. While for winter, it is selected from the 2017 Raleigh-Durham weather files as it gives more accurate results than using TMY weather files. By running a separate ANN algorithm for the four seasons, a predicted global solar radiation is possible after an optimization process. This process includes the calculations of the most accurate variables that affect the ANN model. The variables are the number of neurons, number of epochs, and learning rate. After the optimization process, the hourly global solar radiation for the whole year is available. TRNSYS software is used to calculate the direct and diffuse solar radiation from the predicted global solar radiation through the Perez model. Then, the EnergyPlus converter program is used to develop a new EnergyPlus weather (EPW) file to be called (Predicted_2018) weather files using the predicted global radiation from ANN and calculated direct and diffuse from the Perez model.

2.2. ANN algorithm optimization process

Generally, there are three basic methods in Machine Learning (ML), such as supervised learning, semi-supervised learning, and unsupervised learning (Muller and Guido, 2017). The summary of a detailed definition and abilities for the three methods was published by Seo B. et al. (2019). Artificial Neural Network (ANN) is considered one of the supervised learning that belongs to ML (Mitchell, 1997). ANN uses the processing of the human brain as a basis to mimic its behavior, trying to learn from previous tasks to solve complex patterns and prediction problems. To learn from experience, ANN uses two algorithms; feedforward and backpropagation (Puri M, 2016).

ANN consists of three layers; input layer, hidden layer(s), and output layer in order. A random weight factor is assigned to each layer of the input layers. Each layer has connections to the next layer, but there are no back connections; this process is called feedforward. The backpropagation turns over this process to train the algorithm by calculating the error and adjusting the randomly assigned weights backward. The whole process that is repeated is called an epoch, which aims to reduce the error value. There is an essential parameter in the backpropagation process called learning rate, which settles the weights` changes at the end of each epoch (Rezrazi et al., 2016). An activate function is used to simulate the behavior of the neurons, which differentiates depending on the application of the algorithm. In this paper, the activation function used is the sigmoid function, which gives values between 0 and 1; this kind of feature is commonly used for non-linear problems (Kyurkchiev and Markov, 2015).

The performance of the ANN model is mainly dependent on the input parameters, as Rezrazi et al. (2016) mentioned that the selection of the most appropriate input variables is essential to improve the algorithm efficiency. This paper aims to predict the hourly global solar radiation using easily accessible data from the Building Automation System (BAS), such as temperature and relative humidity. An ANN model was developed depending on these data set and mentioned in more detail in the previous study (Gaballa and Cho, 2019). This ANN model uses temperature, humidity, solar zenith angle, and time as input parameters to get the desired output, which

is the hourly global solar radiation (Figure 1). This model is used four times for the four seasons separately using different input data sets.

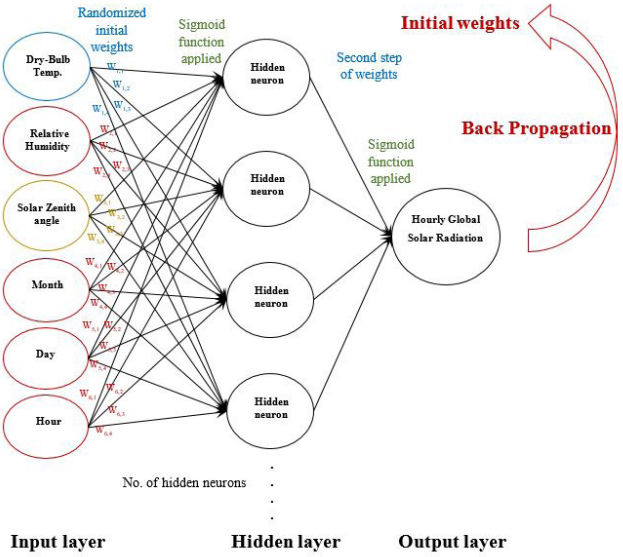

Figure 1. ANN architecture

An optimization process is performed, which includes a calculation of three different variables; the number of hidden neurons, the number of epochs, and the learning rate. The optimum variables for each season were calculated to be used in the ANN model to predict the most accurate global solar radiation. Through the optimization process, a range and a distance for each variable were given. The range for the number of hidden neurons, learning rate, and the number of epochs is as follows; 10:100, 0.01:1.0, and 100:1000, respectively, while the distance was 10, 0.01, and 100, respectively. Table 1 shows the optimum variables` value for each season.

Season	Number of hidden neurons	Learning rate	Number of epochs
Spring (March 1-May 31)	60	0.82	200
Summer (June 1- Aug 31)	80	0.03	600
Fall (Sept 1-Nov 30)	10	0.07	600
Winter (Dec 1- Feb 28)	20	0.02	100

Table 1. The optimum values used in the ANN model

Figures 2- 5 show comparisons between the predicted and measured global solar radiations for each season individually. The horizontal axis shows the date and time every hour, while the vertical axis shows the global solar radiation in Wh/m2.

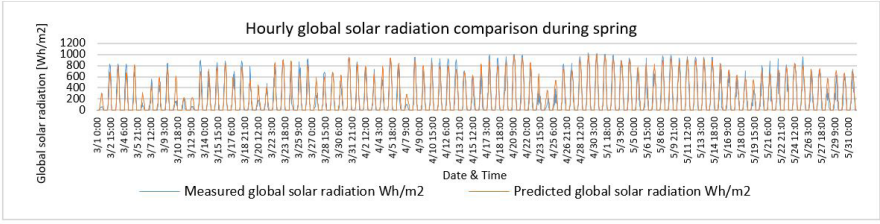

Figure 2. ANN results from comparison during spring

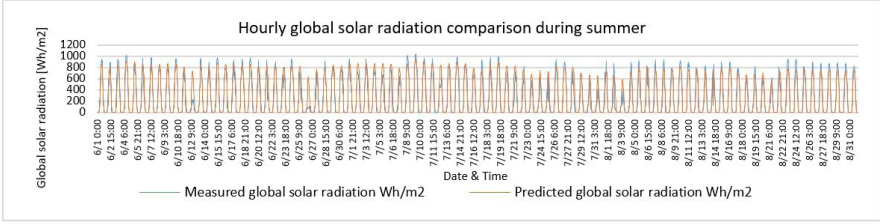

Figure 3. ANN results from comparison during summer

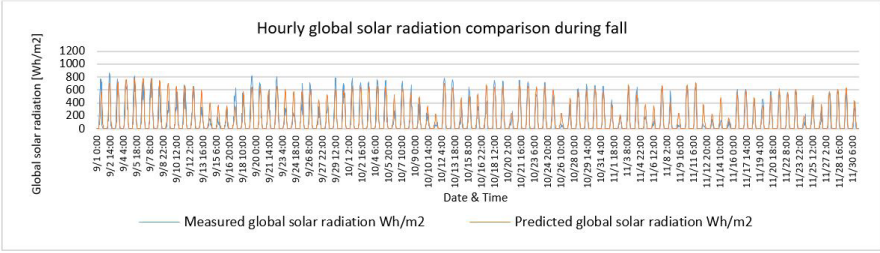

Figure 4. ANN results from comparison during fall

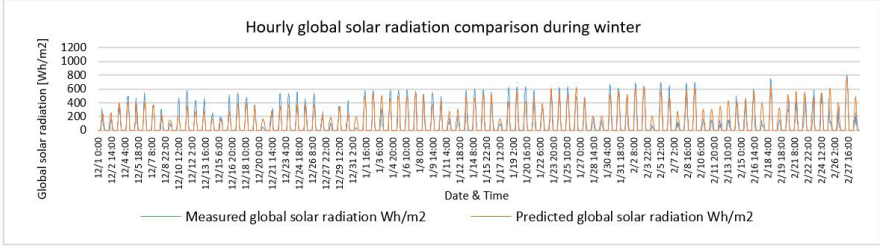

Figure 5. ANN results from comparison during winter

2.4. Simulation

EnergyPlus (US DOE, 2010; Crawley et al., 2001) is one of the most popular software programs used for the whole building energy simulation and analyses (Basarkar M. et al., 2011). In this paper, EnergyPlus V8.9.0 is used in simulating two different scenarios through two different weather files; the predicted 2018 weather files through the ANN model and the already measured 2018 weather files.
A commercial building located in Durham, NC, was chosen as a case study building. The building consists of three floors with a total area of 4,024 m2. There are 29 different zones divided into the three stories; in the EnergyPlus software, each space was assigned to the related zone. The building has 1,690 m2 glazing area with a window to wall ratio of 42%, as shown in Figure 6.

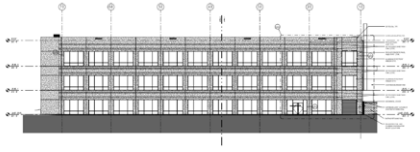

Figure 6. EPA building west Elevation

EnergyPlus model inputs need full information of the building; geometry, materials, openings, location, HVAC system, etc. The two scenarios are considered the same for the building`s configurations except for the weather files used to run the simulations. The simulations were performed for the whole year to make a comparison.

3. RESULTS AND DISCUSSION

As mentioned before, this study aims to measure the effectiveness of using the ANN model in prediction by comparing the two cases, using the measured and the predicted weather files. Heating and cooling loads are selected as indicators to make this comparison. The CV(RMSE) and NMBE are calculated to measure the uncertainties between the two cases. Table 2 shows these percentages between the two cases for the entire year, and as shown, cooling and heating loads differences meet the requirements of ASHRAE Guideline 14 as less than 30% for CV(RMSE) and less than 10% for NMBE (ASHRAE, 2014). Figure 7 shows the total loads comparison for the entire year and the difference between predicted and measured loads.

Loads	CV(RMSE)	NMBE
Heating loads	23.3%	10.5%
Cooling loads	13.7%	-5.9%

Table 2. Statistical measures between measured and predicted loads for the entire year

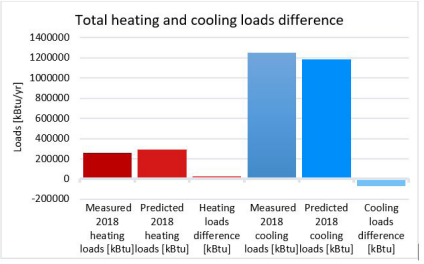

Figure 7. Total heating and cooling loads comparison

Loads are calculated for each season separately to make a clear comparison. Table 3 shows the CV(RMSE) and NMBE for each season. The results show that in summer and winter season, cooling and heating loads are more efficiently predictable while in the swing seasons, the accuracy decreased but still within limits. For more clarity, Figures 8-13 show comparisons between the measured

and predicted loads for each season with zero load values ignored.

Loads		CV(RMSE)	NMBE
Spring	Heating loads	33%	11.8%
	Cooling loads	18.7%	-8.6%
Summer	Cooling loads	9.4%	-3.9%
Fall	Heating loads	26.9%	10.7%
	Cooling loads	16.2%	-7.5%
Winter	Heating loads	18.9%	10.1%

Table 3. Error difference between measured and predicted loads for each season

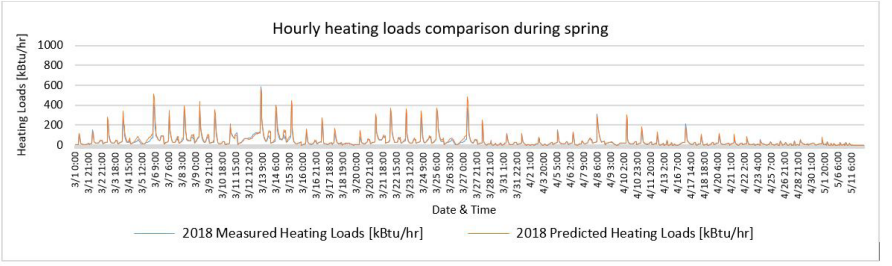

Figure 8. Heating loads comparison during spring

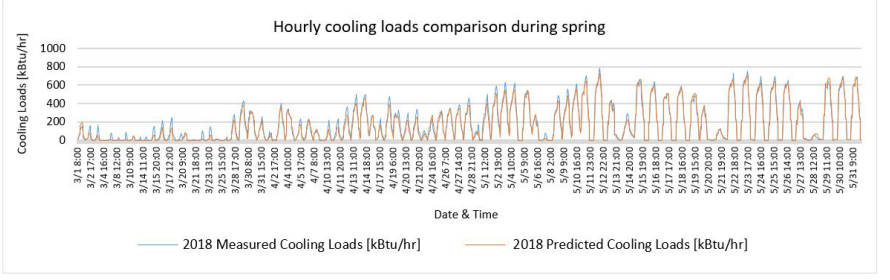

Figure 9. Cooling loads comparison during spring

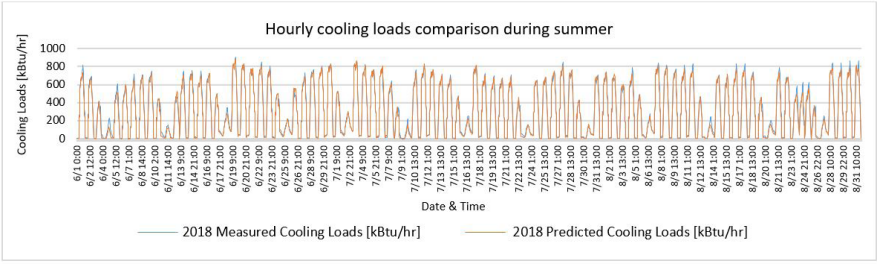

Figure 10. Cooling loads comparison during summer

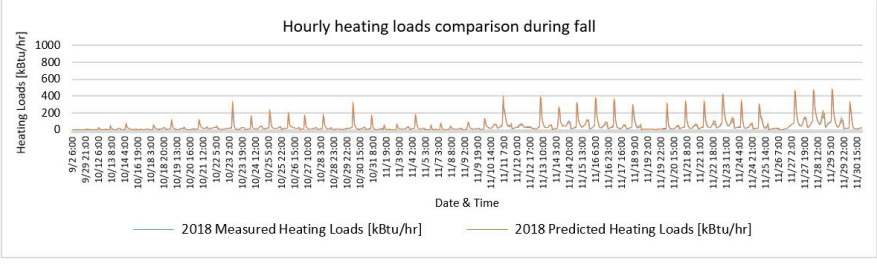

Figure 11. Heating loads comparison during fall

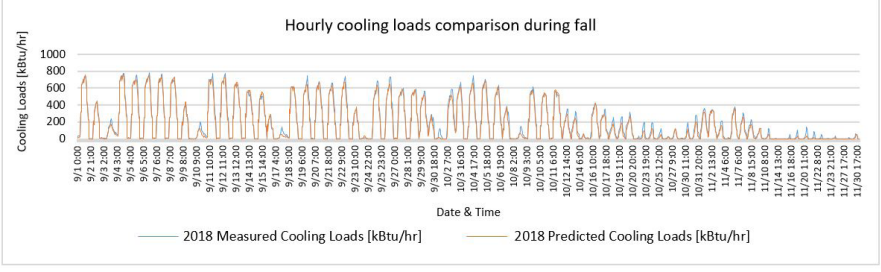

Figure 12. Cooling loads comparison during fall

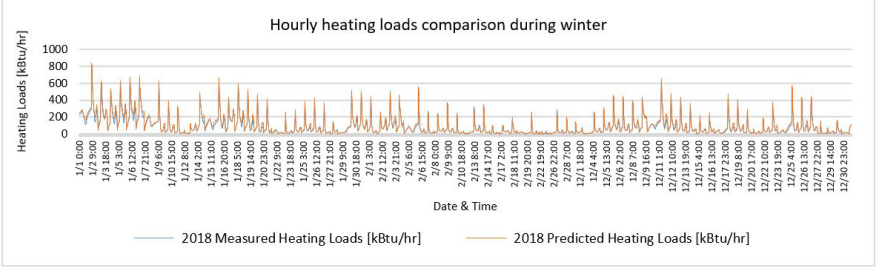

Figure 13. Heating loads comparison during winter

CONCLUSIONS AND FUTURE WORK

This paper presented an ANN algorithm for solar radiation prediction, which makes developing real-time weather files possible. Only temperature, relative humidity, and solar zenith angle are used as input parameters, which means that the ANN model uses only readily accessible measured data from the BAS to predict global solar radiation. Real-time building energy simulation is demonstrated using the developed weather file (Predicted_2018). The simulation is performed using EnergyPlus software for the whole year. A comparison between the measured and predicted building performance is provided using two weather files, measured 2018, and predicted 2018 weather files.

The results show that the cooling load's difference is 13.7% (CV(RMSE)) and -5.9% (NMBE), while the heating loads difference is 23.3% (CV(RMSE)) and 10.5% (NMBE). Looking deeply into each season, for summer, the CV(RMSE) for cooling loads difference reaches only 9.5%. Besides, in the winter season, the CV(RMSE) for the heating loads difference is only 18.9%. These results are found to meet the tolerance range addressed in ASHRAE Guideline 14.

In conclusion, this method gives a reasonable error difference, which makes it possible to predict real-time building performance. Building operators can compare these predictions with the actual measured data and identify any potential problems that happen in the building systems to take any actions required early.

Two different methods were used in calculating direct and diffuse solar radiation from the predicted global solar radiation, EnergyPlus converter software, and TRNSYS software. Although the two programs use the same Perez model, the results are significantly different. For instance, CV(RMSE) for cooling in summer, the EnrgyPlus converter shows 21.9%, but TRNSYS 9.5%.

For future studies, the pros and cons of different methods used in calculating the two derivatives of solar radiation from the global solar radiation should be presented.

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PAPER #5.12

THE SPATIAL BLOCK: NATURAL VENTILATION AS AN ARCHITECTURAL INSTRUMENT

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ABSTRACT

The housing deficit is a global problem. In Turkey, the governmental agency 'TOKI' has proposed solutions to inadequate and unaffordable housing. However, it has been widely criticized that its residential projects are based on 'standard regulations' and 'repetitive, high-rise typologies'. This approach is discussed by researchers because of its limited exploration of contemporary needs of people. Also, the limited and low quality architectural and urban conditions in these projects marginalize the living standards of the residents.

Sprawling rapidly throughout different climate regions in Turkey, one of the permanent complaints of TOKI residents is related to indoor thermal conditions. As consequence of this 'homogenization effect', overheated and underheated conditions are experienced. In these 'naturally ventilated buildings', few considerations are given to the surrounding environment and it is ignored how the residential units perform under extreme seasonal circumstances.

Through post-occupancy evaluations, this paper investigates a TOKI built in hot and dry climate. Also, it brings new 'typological' alternatives analyzed through energy simulations and computer fluid dynamics (CFD). Results illustrate the dynamic of thermal stress, and alternatives of using prevailing winds in consonance with building form to alleviate these problems.

Summer heat stress periods and cross ventilation limitations are studied through Indoor Temperature, PPD and ACH analyses performed IES-VE software. The link between thermal comfort and indoor microclimate in TOKI housing can be better with the reformulation of its residential typologies by proposing a 'Spatial Block' approach.

KEYWORDS

Post occupancy evaluation; hot and dry climates; natural ventilation; residents' satisfaction; CFD.

INTRODUCTION

Informal settlements appeared in cities due to the housing demand of high population in many countries during the industrialization period (Keles 2006, Majale 2008). This phenomenon is described as over-crowded, temporary, probably illegal and unhygienic by Uzun et al. (2010). In the case of Turkey- with the last decade migrations mostly from Syria- the population has reached to 82 million today (Fig.1). Parallel to the urban-rural balance shift, the structure of cities has changed. This generates a serious pressure on urban areas, where housing demand has emerged, and informal settlements appeared through the years.. The current housing deficit in Turkey has been solved through a governmental institution called the 'Mass Housing Administration' (Toplu Konut Idaresi Baskanligi / TOKI). Since 1983, TOKI has replicated a high-rise typology all over the country with the purpose of providing ownership to higher number of people. Gur and Dostoglu indicate that 70 % of TOKI users prefer these projects due to the low cost compared to other housing possibilities (Gur et al. 2011).

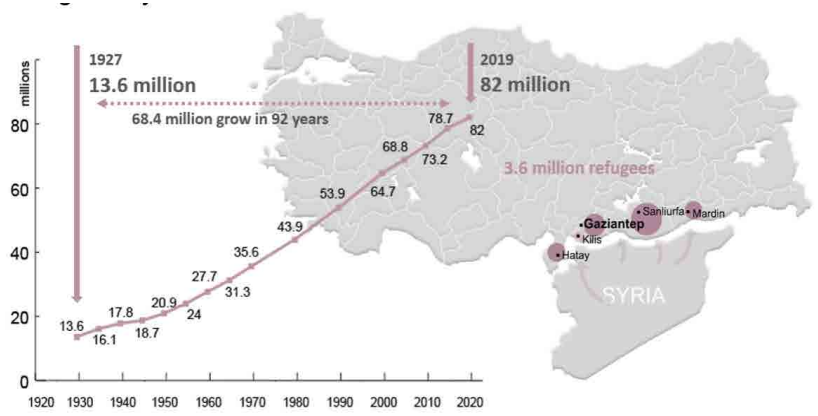

Figure 1. Population growth in Turkey. Source: (The graph was created data from Turkish Statistical Institute)

Applications of TOKI Administration to meet low-income people's necessities within financial margins result that the projects have serious limitations in terms of other aspects. Therefore, TOKI housing has become the object of multidisciplinary research. Although TOKI provides better infrastructure and hygienic environments for these groups, post occupancy evaluations (POE) by various researches show that design decisions on urban form, residential typology, and building enclosure create negative outcomes (Bay 2019; Savran 2014; Turan 2010; Karaca 2008). As Choguill (2007) mentioned, 'meeting the needs of the present without compromising the ability of future generations to meet their own needs', will not be successful in long term. For sustainable environments, housing problem should be discussed with multidimensional perspectives such as the involvement of the community in all phases (planning, constructing, maintaining), environmentally friendly material selection, quality, affordability and providing ideal density. Although there are many studies about TOKI housing in social and political sciences, there has not been much investigation about these projects in terms of their environmental sustainability. Applied research conducted on energy efficiency in these buildings is relatively limited. From the literature review, it is concluded that a key research area in TOKI project is their sustainability which is a research gap. For example, how natural forces such as sun or wind can be used to improve their indoor conditions. Therefore, this paper moves along the idea of using the environmental forces to satisfy comfort demands of communities.

The objectives of this paper are:

(1) To identify the current conditions of a TOKI housing project on a hot and dry climate.

(2) To study natural ventilation and aerodynamic flow effects to improve indoor conditions.

(3) To interpret residents' opinions about their units.

(4) To investigate residential typologies that can be more adequate for hot and dry climates in Turkey

1. STUDY CASE AND ITS PROBLEMS

In Turkey, one of the most common complaints expressed by the TOKI residents is their thermal dissatisfaction directly related to their specific weather conditions. This study is conducted on a TOKI residential project in the city of Gaziantep. Located in the South-Eastern Anatolian region, Gaziantep is a city with a hot and dry climate. In the studied project, residential units are overheated and cause higher level of dissatisfaction in the summer months. Buildings in Gaziantep have high cooling loads in warm seasons. As a climate zone 3B (ASHRAE 90.1) and Csa- Mediterranean Climate (Köppen), summer temperatures are above 30°C while winter are cold (Turkish State Meteorological Service). In this sense, a weather data analysis developed in IES VE shows that in at least 2600 hours per year (30% of the time), there is no high humidity that can cause thermal stress in the city. In this sense, low relative humidity, high evaporation and temperature differences between day and nighttime during summer months favor the potential of using the city's southwest prevailing winds for natural ventilation of buildings. (Fig. 2). Under these weather circumstances, natural ventilation techniques favor the connection between better living conditions and better thermal environment at lowered cost, particularly on the reductions to mechanical cooling (Olgyay, 2015). This paper explores building form as a manner to improve the relationship between human thermal comfort and indoor microclimate in TOKI housing. The case study 'TOKI Etiler project' is composed by six rectangular towers each one with 12 stories (Fig.3). These are the highest structures in the middle of a low-rise neighborhood. In the recent time, the city has had a growth rate of 56% receiving the highest number of Syrian refugees in the country. With nearly two million of inhabitants, the city's housing demand is expected to rise quickly in the coming years.

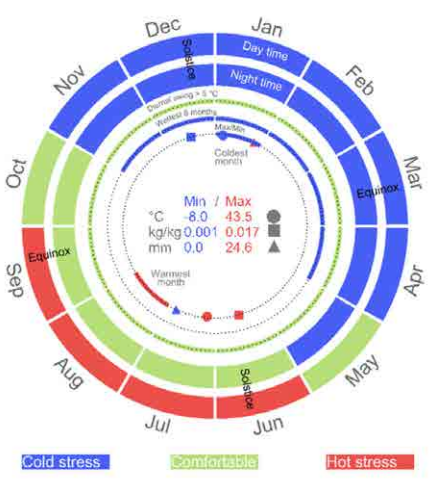

Figure 2. Weather analysis in Gaziantep locating in a region with high cooling demand. Source: (The graph was created in IES-VE by the author)

Figure 3. TOKI Etiler Project in Gaziantep. Source: Author, 2019

2. METHODOLOGY

This research employs a mixed methods approach to integrated qualitative and quantitative data collected during a field study carried out in the TOKI Etiler Project. Three methodological steps are used: (1) Computational Fluid Dynamics (CFD) simulations, (2) Post Occupancy Evaluation and (3) a Generative Design Process. First, energy modeling was used to observe the real conditions in the studied project. The second step surveyed the residents about their environment to obtain information regarding the performance of the residential typology. In the third step, an iterative design process was used for producing an alternative typology for this mass housing project to enhance passive cooling in this hot and dry climate region.

2.1. Computational Fluid Dynamic (CFD) simulations

In this study, three 'key performance indicators': indoor temperatures (T), air renovation in units (ACH), and percentage of people dissatisfied (PPD) were used for comparison between a baseline and a proposed case. In addition, typical flow regimes and their interaction with the high-rise typology is observed through computational fluid dynamics (CFD) through airflow diagrams. CFD simulations (external and internal) were tested in IES-Microflo. The time lapse of external simulations is a 5-month period (from May to September while the time lapse of internal simulations is applied single instances in time in specific days. Three dates which have the highest airflow rate were selected: May 17, June 14, and September 21) For external airflow analysis, wind direction, meteorological wind velocity and exposure type were used as inputs to obtain streamlines in a CFD grid. Through a graphical analysis of velocity profiles, the difference of airflow rate on windward and leeward facades was observed along the buildings. For the weather data, the typical meteorological year (TMY 15) file for Gaziantep was used.Ç For this step, three external analysis were conducted in Microflo that is based on Finite Volume Method. It uses steady state three-dimensional convection-condition heat transfer and flow model. First, aerodynamic flow effects were investigated in the baseline model. After a preliminary test series on generic courtyard buildings, a mid-rise with an equivalent urban density is proposed as an alternative typology. A graphical analysis of velocity profiles is done for different levels. The difference of airflow rate on windward and leeward facades was observed. Then, three consecutive test series examined the flow behavior in courtyards with gradually changing 'width to height ratio' and openings. After observing courtyards with the same orientation as the TOKI towers in Etiler project, the series were repeated with courtyards aligned to the prevailing winds. It showed that narrower courtyards (w/h of 3.75) have a larger funnel effect, proportional to a more constant flow acceleration of the prevailing streams. Same steps were performed in the development of the proposed case. In this process, the aim was to find possibilities that can enhance the interconnection of airflow across courtyards. So, eight courtyard models were analyzed through velocity profiles. Obtained results of speeds on inward and leeward facades showed that homogenous profiles were targeted between first and top levels.

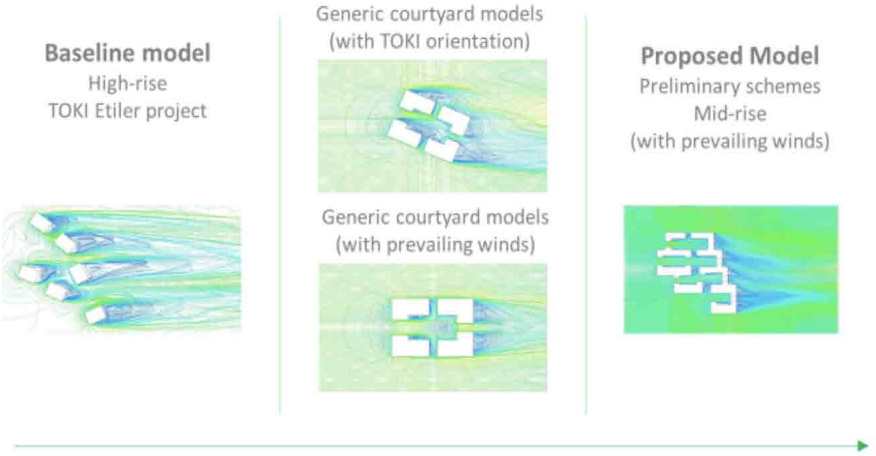

Figure 4. External analysis steps in IES-VE. Source: (Author 2020)

2.2. Post occupancy evaluation

The main goal of this step is to understand objective and subjective factors which influence the TOKI Etiler residents' satisfaction. A sample of 143 residents representing their household (50 % households of the project) responded to a questionnaire. This was a random sample that the probability of a subject being selected depended on those who were at home during the surveying time and were interested to be surveyed. Majority of respondents expressed that without open spaces and major climatic control, families try to adapt their lives into the high-rise. The complaints about life in towers specifically about units, surroundings lack functionality and thermal control, generate community disintegration particularly senior residents. In this project, a minority of families with more economic resources invests in space conditioning. However, these express that it is used only for overheated periods when other neighbors rely on open windows to deal with the harsh summer. Overall, windows are opened to enhance cross winds through the units, this is the most used alternative. Also, responses to questions on window indicate the windows in the unit that are frequently opened during the daytime. Balcony doors are the type that remains open for a larger period of time, since these have the larger opening area. Contrary to its common use for ventilation, some of these doors' balconies are modified by residents, limiting airflow from outdoors due to reduced opening area. Related to thermal sensation, residents manifest in a high proportion a 'warm' sensation in winter (with a central heating system). However, during the summer month more that 60 percent of people express a thermal sensation "above neutrality" already with a "light" clothing value. In addition, only 25 percent of residents express an acceptable satisfaction with their indoor thermal conditions. However, a dissatisfaction of 80 percent about their outdoor areas shows the lack of climate control of this project (Fig. 5). Moreover, in SPSS software, the interdependence between air flow

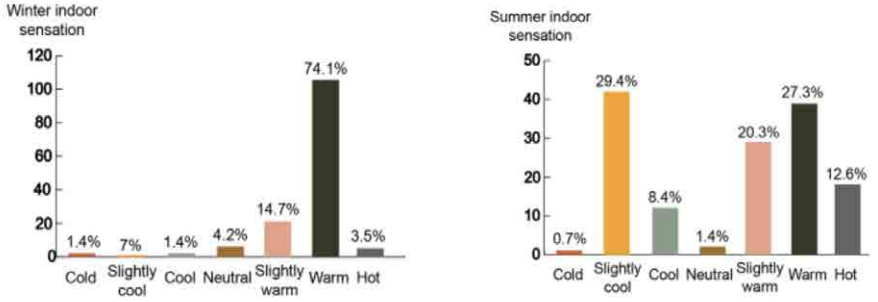

Figure 5. Thermal sensation of residents in winter and summer. Source: (Author 2020)

performance and thermal sensation is investigated. A positive correlation shows that when air flow increases in units, there is also an increment of 0.357 in the thermal satisfaction. From coefficient table, 'adjusted R square' shows that 12 percent of the variance of the thermal sensation is predictable from air performance.

2.3. Generative design process

Previous methodological steps made evident the potential of a residential typology (building mass) that can take advantage of its form to enhance passive cooling. In this sense, a scenario called "Spatial Block" was proposed. While energy and external CFD analysis of TOKI project provided information of how to assess the baseline model, generic models with courtyards shaped the concept of 'porosity'. The effect of voids for decreasing cooling loads in multi-story buildings was mentioned by Muhsin et al. (2017). This concept is tested through not only courtyards also terraces, porches and balconies as transitional spaces. Furthermore, the air flow potential the porous structure is explored through generative design techniques. For this step, the Grasshopper plug-in for Rhinoceros that allows processing the following algorithmic and geometrical operations was used (Fig. 6). First, by using five courtyards whose width to height ratios were determined through previous steps, a building mass was generated. This model was comprised of 5mx5m cells – 25 m² cell was

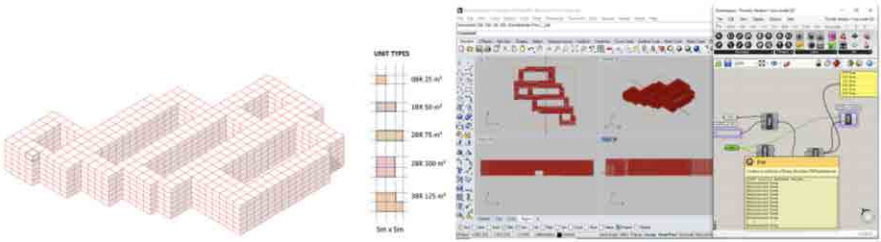

Figure 6. Generative design process. Source: (Author 2020)

Figure 7. Mass porosity ratio from 10% to 90%. Source: (Author 2020)

defined as an optimum area per person. The combination of cells represents apartment units. Under the influence of prevailing winds, cells were subtracted to generate a 'porous' volume that allows cross ventilation. At a building scale, arranging void spaces as vents was conducted through data validation. With a random selection, 'cells were omitted from the geometry. After the development of a culling list, three components that take Boolean values (true/false) generate a list of 'selected' cells. These are subtracted cells from the massing. A ratio of porosity (10% to 90%) are controlled through 'slider components' that determine the percentage of reduction (Fig. 7). Through this step, 'diverting effect' was clearly seen between courtyards at ground level. In a subsequent step, prevailing winds were formulated as a 'generative vector' that based on its magnitude, direction and sense perforate the 'building volume'. So, cells intersected by this vector were omitted from the massing by determining the distance from it which are defined as 'area of influence'. These processes are oriented to displace, reorient, and re-scale iterations that can be analyzed through CFD simulations to reach a fitness proposal (Fig. 8). After outdoor CFD in IES-VE analysis and urban density study in Grasshopper, a model with 40 per-cent porosity was selected. Stronger airflow moving through the courtyards and apartments was observed that in more porous models. These void spaces of the building volume/ mass provide similar velocities across each one of the floors and units around a courtyard and enhance the interconnection of wind with their boundary. Also, this causes the increment of air exchanges in the units. Under this choice, the speed levels and outdoor temperatures in ground and first levels get similar to the values obtained from level 2 to level 4. Without less mass on top levels, openings influence a full flushing courtyards area that is dependent of having width to height rations larger than 2.4.

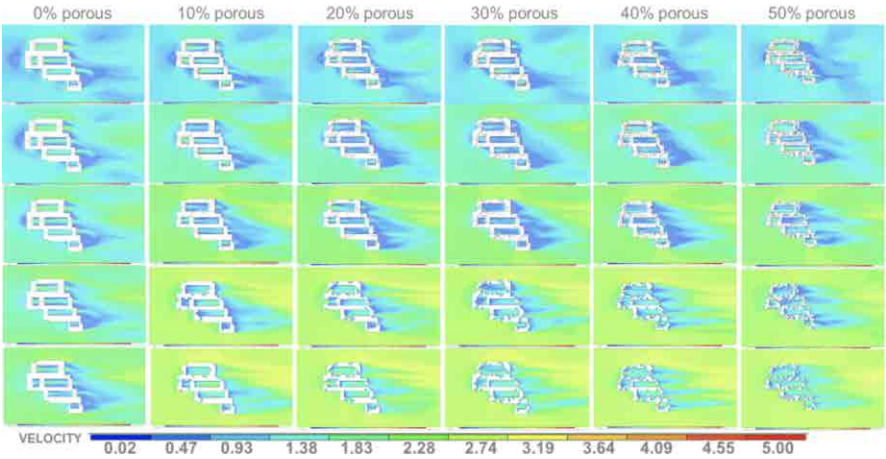

Figure 8. Porosity on massing via CFD analysis. Source: (Author 2020)

3. FINDINGS

Air flow and heat transfer processes occurring withing and around buildings were observed through CFD analysis. Specified boundary conditions (local climate conditions, internal energy sources such as people), surface temperatures of external walls were added for model accuracy.

Comparisons between baseline and proposed model through indoor temperatures, predicted percentage of dissatisfied and air changes showed that proposed courtyard building model reached the higher ventilation performance. Proposed model favors predominant westerly winds through mainly funnel and diverting effects when compared with the TOKI building. Indoor summer peak temperatures are lowered through building form, also operative temperatures are lowered corresponding to higher percentages of satisfaction. In terms of ventilation rates, 33% of improvement on ACH is obtained compared to the baseline model (Table 1).

Date	T (ºC)		ACH		PPD (%)	
	B (Level 3)	P (Level 3)	B (Level 3)	P (Level 3)	B (Level 3)	P (Level 3)
May 17	22.8	20.8	1.8	2.46	6.7	6.3
Jun 14	22.3	21.2	4.6	9.6	10.5	9.3
Sep 21	23.1	21.7	2	3.96	9.3	7.7

Table 1. KPI comparisons on three selected days

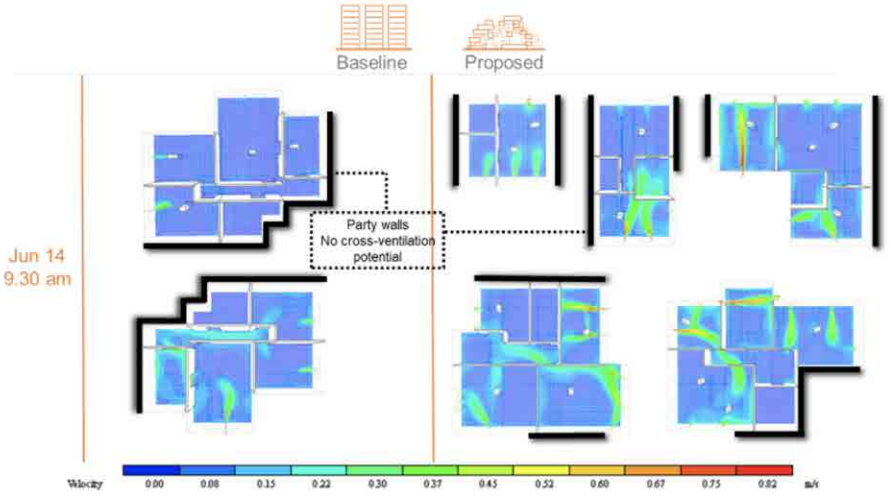

Figure 9. Comparison between baseline and proposed model on June 14th. Source: (Author 2020)

After external analysis, internal CFD simulations allowed to see airflow intensity and behavior in units. The TOKI project and the proposed model were compared on three selected days: May 17, June 14, and September 21. These days have the largest natural ventilation potential along summer. Among these months, June is the month when the velocity is the highest (Fig. 9). It affects cross ventilation inside units. Although airflow between rooms is observable in the TOKI southeast unit, all proposed units show higher performance. Overall, increased façade surfaces in the proposed projects make cross ventilation more effective in units. On the other hand, party walls in the TOKI projects prevent the cross-ventilation potential and limits rooms for only single-sided ventilation.This formula does not have any direct physical meaning but weighs the criteria following the

4. RESULTS

Under the analyzed case study, the conclusion of this paper is that the proposed typology is better by achieving various improvements and thermal comfort due to the application of cross ventilation. After outdoor and indoor analysis in different iterations, the 40 percent porous structure was selected. It provided a balance between urban density and air flow performance. Moreover, it has the potential to bring public housing closer to human needs and to the environment. Using renewable sources such as prevailing winds with the configuration of the new typology helped to alleviate thermal related problems in consonance with building forms derived from vernacular architecture in this region. Besides KPI's on natural ventilation, also urban density aspects are compared. Between projects, there is a difference of 11.2 square meter area per person. In TOKI model 13.8 square meter domestic pace per person increased to 25 square meters in the proposed case. Although number of people per hectare is slightly decreased in proposed units, multifunctional communal spaces have a potential of positive impact on this community.

CONCLUSION

This paper shows an improvement to the problematic presented in a public housing in Turkey. Lessons from vernacular architecture allow regulating harsh conditions of the climate. It proves the reformulation of well-known techniques can be still used for contemporary buildings. The usage of rule sets allowed to generate site-specific outcomes withing the context limitation, allowing the proposed model to take full advantage of and contribute to the environmental and connectivity characteristics of the surroundings. This generative approach resulted in a building mass calibrated towards environmental and social sustainability. The model based on courtyards shows a significant role in climate control and resident satisfaction. This model that is compelling enough with social aspects that were mentioned previously does not cause a stigma about social housing in the society. These are connection to the street, well-defined green areas, community spaces and different programs that will provide a sustainable solution for poorer communities.

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PAPER #5.13

TUNING THE MASSES: CLIMATE SPECIFIC ENERGY OPTIMIZATION GUIDELINES

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ABSTRACT

In the United States, residential structures consume 21.5 quadrillion Btus annually--approximately 20% of the country's energy consumption-- and an equivalent percentage of carbon emissions. Most of these houses are not designed to be high performance buildings, and are built quickly to code minimums, where simple energy modeling programs, Res-Check for example, validate compliance. The goal of this project is to create an easy to use, accessible, and open-source framework to improve building performance specifications in the schematic design phase, with the goal of complying with a high-performance building standard.
Programs such as Department of Energy's (DOE) Zero Energy Ready Homes (ZERH), and LEED for Homes aim to offer simple, prescriptive checklist design methodologies, while organizations like Living Building Institute and PHIUS offer performance-based programs that can require the expertise to achieve their standard, and in PHIUS' case require a specific, costly compliance software. There needs to be an option that helps bridge the gap, in terms of being open source and more accessible to non-specialists.
By using direct search optimization methods, this study developed a tool to determine residential energy benchmarks to enable designs to meet high performance standards such as PHIUS. these are determined through thousands of iterations on ten different house geometry typologies in the nineteen distinct climate zones in the United States. These newfound limits on performance ranges get a new, climate specific script that will tune a mass, and provide the designer with simple, project geometry and climate-distinct building specification to incorporate into the building's design.

KEYWORDS

Optimization; energy modeling; climate responsive design; parametric modeling.

INTRODUCTION

Building performance standards and codes are dominated by points systems that may or may not actually produce higher performance buildings. A limited number of these standards are performance based, where the standard is based on an energy consumption target, such as PHIUS, PHI, or LEED. These are relatively complicated standards to meet and require energy modeling to meet these standards. Designers of high-performance houses are increasingly moving away from prescriptive design standards and toward system that rely on modeling to prove performance that meets energy use targets. These methods require special software and skills, as such, are beyond the reach of non-specialists interested in understanding whether a building form can meet high-performance standards
Performance based tools allow for building energy optimization. These types of programs and methodologies allow for the design team to evaluate many options in terms of enclosure, glazing, mechanical system, lighting and domestic water heating, and compare them to a series of output metrics such as carbon emission production, cost of higher end insulation and systems,

and energy consumption- in both energy (i.e. Btus) and monetary value. One way that energy performance modeling tools differ from prescriptive energy efficiency methods is that they are based on a specific building geometry (shape) modeled in specific climates or locations.

Optimizing a building's performance specifications through an energy model increases the quantity and quality of possibilities for achieving high performance outcomes. The performance-based tools, especially those running iterative parametric optimizations, create multiple options that can meet the design criteria. But this tool is frequently reserved for qualified professionals, and it is not accessible to most people working on home building projects. Approximately two percent of American houses are designed by architects (Conroy 2007), compared to those designed solely to be the contractor or built from a set of available plans. Herein lies the goal of this project, to make a simple, climate-specific optimization tool that almost anyone can run on a pre-designed 3D mass. This allows for architectural flexibility, whether the project is a new and fanciful architectural design, or a simple spec home from a pattern book or set of hardware store plans. These geometries, or house forms, can be input into the script and get sets of building performance specifications as feedback on the design. Many contractors have the form in mind already, but just lack the tool set to determine the building performance specifications to design to high performance building standards.

There are some assumptions built into the design tool, based on practices are conventional and have worked well in the past. When challenging and building norms, it is important to provide references for the revised idea. The tool will be provided with a supplemental user's manual, which includes instructions for using this optimization framework, some collected anecdotes about best high performance home design practices, and some details that may be handy when it comes to applying the newly created building performance specification to the final built house.

Climate specific standards are critical in terms of high-performance home design, because an understanding of how the building interfaces with the climate that has the largest impact on the building's overall energy performance. The more tuned a building is in form, materiality, and passive strategies, the less energy it will consume, especially for space conditioning (Olgyay 2015). In this paper we will describe the development and pilot testing of a new tool for climate specific housing design guidance. The pilot study tested one specific climate zone as a precursor to the final tool, which will include all climate zones in North America.

1. METHODS

Climate specific building envelope specs started in the 1970s in the United States and have been greatly developed by organizations like PHIUS, and that PHIUS+ now represents the gold standard. These strategies are all based around energy conservation as the first step, and meeting the remaining loads with smaller, highly efficient mechanical systems. Therefore a standard based around passive design principles first will likely need a few different methods of rating the buildings, and in the case of the PHIUS+ criteria, there are three key pillars: heating and cooling demand limits, a source energy limit for all building energy consumption, and a prescriptive airtightness requirement. This creates a standard that requires some complicated modeling in order to comply with the goals and may be less accessible to all homebuilders. A defining feature of the PHIUS criteria is that it is climate specific. Every project complies with the PHIUS+

criteria is built to these climate specific criteria (Klingenberg, 2015).
The US Department of Energy's Building America Program, and the resulting Zero Energy Ready Homes (ZERH) standards provide much of the prescriptive minimums for the PHIUS+ guidelines. Like the more rigorous PHIUS+ guidelines, the ZERH is focused on energy conservation methods first, by setting an airtightness minimum, and climate zone specific minimums of the thermal performance of the building enclosure. As this program is purely prescriptive, there is no complicated modeling compliance. This is likely due to a goal to saturate the market with the standards, while PHIUS standards prove to be more niche.

2. HYPOTHESIS

This pilot study poses three hypotheses. First, greater amounts of thermal insulation are required for climates with more heating degree days. Second, compact geometries with less surface area use less energy than complex geometries with more surface area. Third, houses with more southern glazing perform better than houses with more southern glazing in Chicago's cold, humid climate.

3. ANALYSIS

To test and determine the appropriate ranges of input specifications for the Chicago, USA pilot study climate zone, 11,520 modeling iterations were performed to create a broad spread of data to analyze and parse through. Chicago was selected due to its large number of households, potentially yielding a large impact, and the climate is one of familiarity to the authors. The modeling methodology described below has been performed for this climate zone only and will be continued for six additional climate zones with few revisions for the furthering of this study. The refined data will be built into the resulting design product, a climate specific optimization script for any single-family residential structure in that climate zone.

4. METHODS

The parametric modeling for this study was performed in multiple stages in order to ensure the lack of errors that potentially occur from the design of the study or the myriad of software utilized and to allow for parallel computing on multiple machines. Based on the study of existing, built high performance homes, it can be understood that an energy conservation first approach, with efficient mechanical systems to meet the reduced loads is a clear and direct path to higher performance homes. This conservation first method relies on some of the understood best building science practices, with simulation of specific elements to create a refined design. For this study, the enclosure was the focus of this load reduction first study, and the wall insulation value, roof insulation value, window thermal resistance, and window to wall ratio of the glazing on each of the four orientations creates seven variables, with the house geometry as the eighth.
The building massing models were drawn using the Rhinoceros 3D modeling program, and then using Ladybug, Honeybee, and Colibri, plugins for the Grasshopper parametric design interface for Rhinoceros, the variables were iterated and IDF files, the input document for the EnergyPlus simulation engine were written. Originally, the simulations were to be performed directly using the Honeybee plugin to communicate with EnergyPlus, however this proved to be error prone and time consuming, so EnergyPlus was used in its native format for the remainder of the study. It is important to note that all PHIUS+ compliance is

done solely through the WUFI energy simulation engine, so EnergyPlus would not be permitted for compliance. However, the PHIUS+ targets were determined using BEopt, a platform that uses EnergyPlus as the simulation engine.

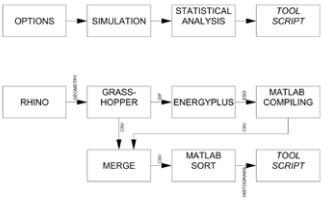

Figure 1. Flow chart detailing the overall process for the study. The top flow chart represents the overall flow of the study, while the bottom details the software used and interactions between programs.

4.1. Geometry and Grasshopper script

Five different home geometries were selected to create a variety of inputs for the study (see Fig. 2). The aim of this variable is to ensure the results are not a climate-specific response to only one house shape. The five house types selected are based on common American housing forms and are as follows: T-1 two story Georgian, T-2 two story foursquare, T-3 ranch, T-4 craftsman bungalow, T-5 L-shaped gable. See Figure 1 below. These were modified to all be approximately 204 m2 (2200 sqft) to meet the benchmark size from the US Department of Energy's Zero Energy Ready Homes (ZERH) program for a three-bedroom home (DOE 2019).

4.2. Variables Iterated

Four of the five home types are modeled with three thermal zones with the first floor, second floor, and unconditioned attic each separated out for ideal air load analysis, as most two-story single-family homes are split into zones by floor. The ideal air load analysis is to allow for the selection of an efficient mechanical system later in the design process and focus on tuning the passive space conditioning loads to start. The T-3 ranch house was split in half to create two thermal zones (a public and private wing of the house) as this style is typically a one-story house layout. The occupiable zones then had parametrically determined window to wall ratios applied on all four orientations in 0.10 (10%) increments. East and west facades were eligible for 0.10 and 0.20 options, the north 0.10, 0.20, and 0.30, and the south could have 0.10, 0.20, 0.30, and 0.40 as the window to wall ratio. All windows matched the same performance specification, and the southern windows had shading overhangs determined automatically through a script based on the tuning point of the solstices, as to wholly shade a southern

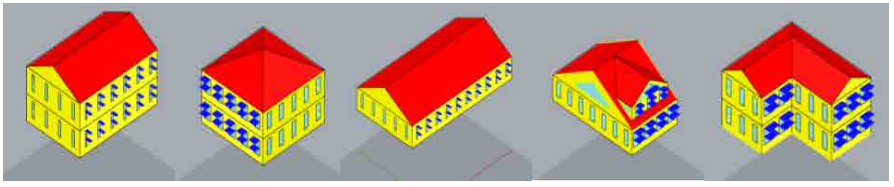

Figure 2. House types, from left to right: 1. Georgian, 2. American Foursquare, 3. Ranch, 4. Bungalow, 5. L-Shaped Gable. These were selected for their diversity of shape and orientation and are commonly found across the United States (Howe 2002).

facing window at noon on the solstice. This practice is commonly recognized as a good starting place for shading overhang design (Kwok 2018).

Windows for the Chicago pilot study all had a Solar Heat Gain Coefficient (SHGC) of 0.50 and a Visible Transmittance (VT) of 0.70, from the PHIUS Climate-by-Climate Recommendations for Window Performance (PHIUS 2019). The houses were modeled with three different window U-Factors:0.568 W/m2 K (0.10 Btu/hr ft2 °F), 1.703 W/m2 K (0.30 Btu/hr ft2 °F), and 2.839 W/m2 K (0.50 Btu/hr ft2 °F) for the entire window assembly, including the frame. The houses were modeled different opaque wall U-factors: 0.284 W/m2 K (0.05 Btu/hr ft2 °F), 0.189 W/m2 K (0.033 Btu/hr ft2 °F), 0.114 W/m2 K (0.02 Btu/hr ft2 °F), and 0.071 W/m2 K (0.013 Btu/hr ft2 °F). These assemblies were modeled with the insulation as a no mass material sandwiched between a 13 mm (0.5 in) layer of gypsum board on the interior and 25 mm (1 in) of stucco on the exterior to add a slight amount of thermal mass to the wall, to more accurately resemble typical building assemblies. The houses were modeled with different roof assembly U-factors: 0.071 W/m2 K (0.033 Btu/hr ft2 °F), 0.284 W/m2 K (0.05 Btu/hr ft2 °F), 0.071 W/m2 K (0.013 Btu/hr ft2 °F), and 0.057 W/m2 K (0.01 Btu/hr ft2 °F). Each of these assemblies was also equipped with the 13 mm (0.5 in) gypsum board on the interior for some thermal mass. These houses were modeled with cold roofs, where the insulation is at the ceiling of the highest occupiable space in the building.

The airtightness of the of the house has been kept constant at 0.0002 m3/s per m2 (0.039 cfm/ft2), and the slab on grade modeled as a 100 mm (4 in) concrete slab with insulation underneath, for a total assembly U-Factor of 0.278 W/m2 K (0.05 Btu/hr ft2 °F), representing a reasonable building construction and airtightness compliant with the PHIUS+ 2018 requirements.

4.3. Energy Simulation and Data Analysis

With the input variables of the simulation defined above, the output metrics considered are ideal air loads for annual heating and cooling energy, normalized per building area, or *EUI*, and the total insulation R-Value in the house normalized per the respective enclosure area. This total insulation factor is labeled *R- Points* and is used as a cost and embodied carbon analog. In a more advanced study, cost and embodied carbon of the building enclosure can be computed, but as this is an early analysis tool, these specific enclosure assemblies have not necessarily been decided yet.

The IDF files written by the Grasshopper script were then computed on multiple machines to batch run in EnergyPlus, allowing for four simulations to run simultaneously on one single machine, and save time compared to the previous method in data storage. To compile the 11,520 iterations' output files, a MATLAB, a numerical programming environment, script was written. Then, the resulting data was compiled into a larger spreadsheet including the input variables.

4.4. Data Sorting

A second MATLAB script sorts through this data and prompts the user for the upper heating and cooling limits, and the total number of *R-Points* permitted. The space conditioning limits are determined by the PHIUS space conditioning criteria, and the *R-Point* limit is lowered to find the range of the 10% of compliant options. This script filters the data that is beyond the set range allowances and creates a new table with the parsed data including the total number of the iterations after the limits are applied. These represent the high-performance options in that climate zone. The MATLAB function *fitensemble* was used to apply an ensemble of learning regressions to the data that

provides the user with a table that describes the importance of each input variable to the user. Histograms of the input parameters are also plotted, to detail the frequency of occurrence of the input variable. This is the determining factor of what ranges the input variables will be used in the *tool script*.

5. RESULTS

Although writing EnergyPlus IDF files, running the simulations, and aggregating the data is quite time consuming, analyzing the results was relatively quick by comparison. The resulting data provided the modified input ranges for guidance as to where to put the limits on their energy optimization script, or the *tool script*.

5.1. Setting Limits

Limits on energy consumption can come from many sources, but for this pilot study, the annual heating demand and annual cooling demand from the PHIUS Space Conditioning Criteria Calculator has been used (PHIUS 2018). For the 204 m2 (2,200 ft2) homes used in this pilot study with an expected occupant load of four occupants, the calculator provides the performance specification for compliance with PHIUS+ 2018 standard. For the Chicago climate shown, the annual heating demand limit and annual cooling demand limit are 31.6 kWh/m2yr (10 kBtu/ft2yr) and 34.7 kWh/m2yr (11 kBtu/ft2yr) respectively. These are entered when prompted by the data sorting MATLAB script along with a R-8.8 m2K/W (R-50 ft2 °F h/Btu) normalized *R-Point* limit. The result is a table that has 1,057 iterations remaining, approximately 10% of the total iterations. The aim here is to determine buildings that are compliant, yet do not require excessive insulation, typically resulting in higher costs and higher embodied carbon.

5.2. Variable ranges

The remaining 1,057 iterations have been analyzed for variable importance, with the window thermal resistance, wall insulation value, and house geometry (in that order) showing dominance in effect on the space conditioning energy demand. These ranges are then used to influence a second, climate specific script to optimize homes for that climate zone. These input ranges represent the best practices in the climate zone, specifically the representative city, and confirm existing knowledge and other studies examining passive building strategies approaching the point of diminishing returns. These ranges are plotted on histograms shown in Fig. 4,5,6,7.

Based on this pilot study and across the input variables given, buildings meeting the early design PHIUS threshold have 0.189 W/m2 K (0.033 Btu/hr ft2 °F) to 0.114 W/m2 K (0.02 Btu/hr ft2 °F) walls, 0.071 W/m2 K (0.033 Btu/hr ft2 °F) to 0.071 W/m2 K (0.013 Btu/hr ft2 °F) roofs, well insulated windows and a minimal amount of glazing. While this study aims to be geometry agnostic, it is important to note the histogram for the house type. There are no house type 3's in the results, and a strong showing of house type 4's, with house type 3 as the ranch house, and house type 4 as the bungalow. This is likely a factor of the compactness of the bungalow relative to the other designs, and the ranch having the highest surface to volume ratio in this housing geometry selection, which is a strong driver of energy consumption, especially in heating dominated climates like Chicago. This means that none of the ranch house geometries met the limits in the statistical analysis.

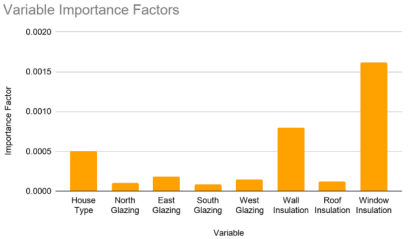

Figure 3. Chart depicting the relative importance of the different input variables for Chicago, IL. The primary factors on space conditioning for this climate are window insulation, followed by wall insulation and then house type, or building geometry.

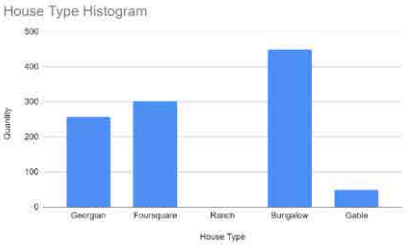

Figure 4. House type histograms. The resulting count of house geometries present after limiting the results. Note that there are no ranch houses that met the limits set. The strong presence of bungalow geometry confirms the advantage of a compact enclosure area.

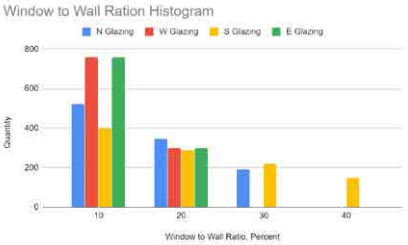

Figure 5. Window to wall ratio histograms. Note the strong trend towards lower glazing areas on all facades.

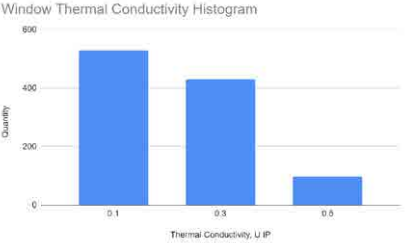

Figure 6. Window U-factor histograms. The lower the U-factor, the greater the prevalence. This confirms the PHIUS specifications about window U-factors. It also ties in with the high importance of window insulation relative to other aspects of the building.

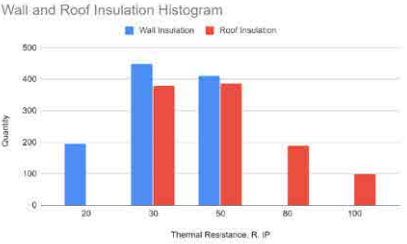

Figure 7. Histograms corresponding to the wall and roof insulation types. There is the hypothesized bell curve forming around R-30 walls and R-50 roofs.

5.3. Regression Analysis

A fitness ensemble of regressions was applied to the data as well and determined that the most important variable in the design is the window insulation, followed by the wall insulation, followed by the overall building geometry, see Fig. 3. The window ranges for this pilot study are likely to be a little high compared to the ranges of windows installed on most residential structures as the ZERH guidelines recommend that the window to wall ratio does not exceed 15% (DOE 2019).

5.4. Resulting Script

The result of this direct search optimization is a climate specific script to tune residential structures for a specified climate zone. In the case of this pilot study, that climate zone is ASHRAE 5A, Chicago, IL. Based on the resulting histograms, Fig. 4-7, the input variables were pared down for this climate. The house geometry variable is eliminated, as this script takes in user defined geometry. East and west glazing are limited to 10%, being a built-in factor in the script. North and south glazing are left with the options of 10% and 20%, so there are two options in each of those spots. The wall insulation is varied in two options, 0.189 W/m2 K (0.033 Btu/hr ft2 °F) and 0.114 W/m2 K (0.02 Btu/hr ft2 °F), and the roof three options, 0.071 W/m2 K (0.033 Btu/hr ft2 °F), 0.284 W/m2 K (0.05 Btu/hr ft2 °F), and 0.071 W/m2 K (0.013 Btu/hr ft2 °F). Windows were also limited to two options, 0.568 W/m2 K (0.10 Btu/hr ft2 °F) and 1.703 W/m2 K (0.30 Btu/hr ft2 °F), with the constant SHGC of 0.50 and a VT of 0.70. Three roof options, two wall options, four glazing options, and two window options results in 48 variations for the input house to be varied through, and based on an approximately 45 sec runtime per variation, the user can have 48 options, the majority of which are likely compliant with the PHIUS+ 2018 criteria in 36 mins.

CONCLUSION

Even though this is only a pilot study, the resulting script or *tool script* is developed. The pilot study will inform the development and refinement of the finalized script that includes a wider range of climate zones. At this point, the ability for the user to input any geometry for a residence of their own design, and get quick options that would comply with the rigorous PHIUS+ 2018 standard should prove valuable, especially in the early design phases. The results provide options that would comply with standards such as PHIUS+ 2018, but also the total number of results that comply with the standard is a good indicator as to how well the geometry alone performs. Out of the 48 iterations in the current *tool script,* a well-designed building geometry would have a majority, say 36 (75%) of the iterations return with a compliant result. A less efficient shape, maybe with a low compactness ratio would likely have less compliant results, or perhaps none. When further developing the *tool script*, it would be wise to have this information including the surface to volume ratio displayed as feedback on the design. The data from this pilot indicates that the script developed can provide useful information to users about the potential of their design idea (as represented by a massing strategy) to meet high-performance standards.

Future Work

Further studies are to be done in six more climate zones, to build a library of these tools to aid in the design to PHIUS+ 2018 criteria around the United States. However, before expanding out, a few things should be looked at further within this study. Primarily, it would be wise to have more finely graduated steps in the variables, for better accuracy. For example, maintaining the current spread of variation in wall assemblies, but having seven options instead of the mere four done in this pilot study. The ranges of window to wall ratio should be adjusted as well, moving the south from 10% to 40%, to a range of 5% to 25%, in 5% increments. These window to wall ratios would better align with the common residential construction done currently and follow the ZERH guidelines. It would also be worthwhile to test this method using energy simulations other than EnergyPlus, to see if that influences the results, as other engines like TRNSYS and WUFI handle some building physics aspects differently. This

study focuses on North American climate zones, but can be expanded internationally, as many of the climate zones in the world are represented by and analog in North America. A graphic, user-friendly interface would be developed to ensure accessibility for all users.

ACKNOWLEDGEMENTS

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PAPER #5.14

THERMAL PERFORMANCE OF A NOVEL MASONRY BLOCK MADE FROM RECYCLED GYPSUM DRYWALL WASTE.

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ABSTRACT

Developing new product applications for waste recycled from building construction and demolition (C&D) provides environmental and economic benefits. However, challenges remain for recycling certain low-value C&D materials, such as gypsum drywall waste, which is banned from landfilling in some areas due to hydrogen sulfide emissions during decay. The gypsum and paper components in drywall have low thermal conductivity relative to concrete and brick, suggesting a novel insulative masonry block system made from recycled gypsum drywall waste could have higher thermal performance than conventional concrete masonry units (CMU). The authors have developed such a system, referred to as Drywall Waste Block (DWB), and have previously published investigations of DWB engineering properties including compressive strength, water absorption, bulk density, and thermal conductivity. This paper describes investigation of resistance to heat flow of a reinforced DWB wall assembly, using a calibrated hot box apparatus as specified in ASTM C1363-11. The hot box apparatus was designed and fabricated as a cost-effective alternative to commercially testing services, affording rapid iteration during the research and development phase of novel building products made from unconventional materials. Some aspects of the apparatus design, fabrication, and characterization are discussed. Thermal performance of the DWB wall relative to a comparable CMU wall is discussed, as are areas for further research.

KEYWORDS

Construction & demolition waste; drywall recycling; drywall waste blocks; new technologies & materials; insulative masonry systems.

INTRODUCTION

Industry studies show waste from building construction and demolition (C&D) is a growing problem (US EPA 2016) and that recycling C&D waste provides many environmental and economic benefits (CDRA 2017). Challenges remain for recycling some C&D waste materials, including gypsum drywall waste, which has limited uses and low value as a recycled commodity (CDRA 2017) (King Co. 2017). Lack of demand for recycled drywall waste is a barrier to increased recycling (Lederman 2015). Drywall waste recyclers have unused capacity, and would like new markets for recycled drywall products (CDRA 2017) (King Co. 2017). To divert increased amounts of waste from landfills, new applications for recycled drywall waste need to be developed and brought to market.

The authors have developed proprietary mixtures and methods for producing a masonry block system that utilizes recycled gypsum drywall waste. Previous investigations have shown these Drywall Waste Blocks (DWB) approach ASTM compressive strength and water absorption standards for conventional concrete masonry units (CMU), with lower density and lower thermal conductivity than CMU.

However, the construction industry is typically slow to adopt new building products in the absence of demonstrated cost and performance advantages (Sorrell-Neal 2018). Processing drywall waste for DWB production is simpler than other drywall recycling methods, and DWB can be manufactured using standard CMU machinery and curing methods. Therefore, cost-per-unit is expected to be competitive with CMU. Establishing superior performance vs. CMU in the area of thermal performance may further adoption of DWB, increase recycling of gypsum drywall waste, and divert more drywall waste from landfills.

Gypsum drywall panels consist of a gypsum core (calcium sulfate dihydrate: $CaSO4•2H2O$) sandwiched between paper facing and backing layers, and are widely used as an interior finish material in both residential and commercial construction (Crangle 2018). Drywall is inexpensive, relatively easy to install, and inherently fire resistant. However, installation methods produce significant waste during construction, typically 10-12% of installed material (Crangle 2017).

Where permitted, drywall waste is usually disposed of in municipal landfills. In 2016, the most recent year for which figures are available, some 8.8 million tonnes of drywall waste were landfilled in the United States alone, approximately 9.1% of the landfilled waste from building C&D (CDRA 2017). Under anaerobic conditions common in landfills, decaying drywall waste emits hydrogen sulfide gas ($H2S$). At low levels, $H2S$ is detectable as an offensive 'rotten-egg' odour, and has health impacts at higher concentrations. Landfilling drywall waste from construction is now banned in some locations (Lederman 2015), (King Co. 2017).

Methods for incorporating drywall waste in building materials have been reported in literature, including use of recycled gypsum drywall waste as a supplemental cementitious binder in concrete (Naik 2010), and use of gypsum drywall waste as a binder in controlled low strength materials (Raghavendra 2015). Cited benefits of incorporating drywall waste in new building materials include reducing $H2S$ emissions associated with landfilling, and substitution of waste-derived binders for Portland cement, reducing energy use and $CO2$ emissions.

Gypsum has inherently lower thermal conductivity than both Portland cement and conventional concrete aggregates (Asakura 2013). Investigation of insulating composites of gypsum and natural and artificial fibres have been reported (Belayachi 2016), (Mounir 2015). Previously published investigations of DWB engineering properties found thermal conductivity for a homogeneous sample of DWB material to be as low as 0.149 W/mK, well below the range for typical concrete and brick masonry (Drake 2019). Because masonry wall construction is typically heterogenous, thermal performance for a heterogenous wall assembly is often lower than measured performance of a homogenous specimens.

ASTM 1363-11 describes procedures for investigating resistance to heat transfer of wall assemblies by means of a hot box apparatus, including schematic designs and performance parameters for such an apparatus. Hot box testing by certified test facilities have lead- and turn-around times complicating rapid iteration of preliminary investigations, and can be prohibitively expensive (Seitz 2015). Nor is there a commercial supplier of lab-scale hot box apparatus. Facilitating further investigation and optimization of DWB wall assemblies required the design and fabrication of a cost-effective hotbox testing apparatus, meeting ASTM 1363-11 standards where practical.

There are few published reports of design and fabrication of an affordable, lab-scale hot box testing apparatus. Seitz and MacDougall report successful construction, commissioning and characterization of such an apparatus, and its initial use to test plastered straw-bale wall sections (Seitz 2015). Costs of $37,135 CAD are reported for

the completed apparatus, including $9,135 CAD for construction materials, sensors, and data acquisition. The reported design is not self-contained, relying on enclosure of the entire apparatus in an environmental chamber. Metering wall plus flanking losses between 94-96% of total heat input to the hot box are reported, likely due to the temperature differential between the metering chamber and the climatic chamber being identical to the differential between metering chamber and ambient temperature surrounding both chambers.

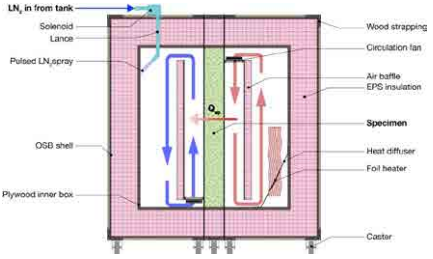

Figure 1. Schematic diagram of calibrated hot box as constructed, with heating, cooling, and air circulation systems, typical air flows in the chambers, and heat flow through the specimen, Qsp.

1. MATERIALS AND METHODS

1.1. Hot box apparatus design and fabrication

Figure 1 illustrates the calibrated hot box apparatus designed for investigation of DWB assemblies. The apparatus accommodates specimens approximately 1.5 m¬2, the minimum area required by the ASTM standard, and consists of two temperature-controlled chambers: a metering chamber ('hot' side), held at typical indoor temperature (i.e., 21° C); and a climatic chamber ('cold' side), controlled to simulate a range of outdoor temperatures. When separated by a test specimen, measurement of power required to maintain hot side temperature can be used to derive surface-to-surface thermal resistance, R, to heat transfer through the specimen, Qsp, provided the temperature of both chambers can be held in narrow bands around respective set points, and that heat transfer along other paths is understood and minimized. Determining metering chamber heat flow corrections is accomplished by characterizing the hot box apparatus with a specimen of known resistance.

To reduce error, heat lost through the metering chamber walls, Qmw, and flanking losses around the edges of the specimen, Qfl, is designed to be a small fraction of Qsp; the ASTM standard is ≤ 10%, with 1-2% preferred (ASTM 2018). This can be done by keeping the chamber wall area small, insulating the walls of one or both chambers to keep resistance to heat flow high, and minimizing or eliminating the temperature differential between metering chamber and ambient lab temperature. Noting the loss percentages reported by Seitz and MacDonald, it was determined a self-contained design would offer the best control of temperature differentials.

Chamber construction. Hot and cold side chamber inner walls are 19 mm plywood, painted with flat grey acrylic paint for emissivity > 0.8. Air circulation baffles in each chamber are 6 mm medium density fibreboard (MDF), insulated with one 51 mm layer of Type 1 expanded polystyrene foam (EPS). Chambers walls are insulated with four layers of 51 mm Type 1 EPS, bonded with polyurethane glue, seams offset and taped to minimize air leaks. Chamber apertures are gasketed with 16 mm closed cell foam. An outer wall of 11 mm oriented strand board (OSB) reinforced with 19 mm plywood strips protects EPS insulation and provides a mounting surface for hardware and controls. Test specimens are installed in an insulated frame constructed in the same fashion. During operation, the framed specimen is clamped tightly between the two chambers by means of adjustable-tension draw latches

attached around perimeters of the chamber apertures and the specimen frame.

Heating and cooling systems. Metering chamber heat source is a 205 W / 120 VAC foil resistance heater, attached to a galvanized steel heat diffuser located behind the air baffle. The climatic chamber is cooled by pulsing liquid nitrogen (LN2) from a low-pressure tank (~172 kPa) through a thermostatically-controlled solenoid valve. LN2 is used rather than mechanical refrigeration due to lower up-front costs. Both chambers are equipped with four 1.44W computer fans for air circulation.

Instrumentation. Electronic Innovations EI1022 temperature sensors (operating range -40°C—110°C; accuracy ±1° C) are installed in the air circulation paths of each chamber for thermostatic control of heating and cooling systems. An additional EI1022 sensor, shielded to minimize effect of air currents, is installed near the outside surface of the metering chamber to monitor ambient lab temperature. Specimen temperature is monitored with nine Texas Instruments LM34CAZ temperature sensors per side (operating range -17°C—110°C; accuracy ≥ ±1°C), arranged in an evenly-spaced grids. Grids of four LM34CAZ sensors are installed on each air baffle, facing the specimen. The metering chamber exterior wall is instrumented to act as a heat flux transducer using 42 thermocouple junctions (T-type, 24 gauge, special limits sensitivity), alternating between inside and outside of metering chamber and connected in series. All sensors are attached to surfaces with foil tape topped with black duct tape to increase emissivity.

Controls and data acquisition. A LabJack T7Pro data acquisition and control module, expanded to 56 input channels with LabJack Mux80 multiplexer and two LabJack CB37 terminal boards, is used for all monitoring, controls, and data acquisition. A LabJack RB12 relay board with Opto22 relay modules is used to pulse power to the LN2 solenoid valve and heater. Kipling3 software is used for configuration and custom Lua scripting. LJLogM software is used for data acquisition and recording. Data logging interval is 100 ms, averaged and recorded every two seconds.

Expenditures. Final costs for the hot box apparatus were $15,823 USD, of which $3,900 USD was for construction materials, cooling, heating and air circulation systems, instrumentation, and data acquisition; and $11,923 was for fabrication and commissioning labour. The LN2 lockset tank is rented for $30 USD per month, and cost of LN2 is $1.10 USD per liter.

1.2. Hot box apparatus operation

Minimum test run duration. To establish a minimum duration for test runs (outlined in ASTM C1363-11 sec. A10.3), a 3 mm MDF panel was installed in a specimen frame, instrumented, and sealed with self-adhesive polyethylene plastic film and tape to minimize air permeability. Real-time monitoring using LJLogM software was used to determine when the system reached initial steady-state, (i.e., hot and cold side temperature sensors stable around respective setpoints, with no more than ±0.5° C fluctuation, and calibrated panel and baffle sensor readings within ± 1°C of each other), and when the system returned to steady-state following a 1°C change in the climatic chamber set point. Time to return to steady-state following perturbation was found to be ≤ 10 minutes. Although a so-called 'time constant' calculated according to the ASTM standard would be shorter than the time to return to fully to steady-state, it was decided characterization test runs for a minimum of 60 minutes following initial steady-state were practical and exceeded the ASTM standard of six consecutive time constants.

Characterization. A characterization panel of 1219 mm x 1219 mm x 153 mm was constructed using three layers of 51 mm Type 1 EPS foam. The panel was mounted in the specimen frame, and instrumented and sealed as above. Once operating procedures were established, a total of five characterization

Test No.	t_h (°C)	t_c (°C)	Δt (°C)	t_a (°C)	Q_h (W)	Q_f (W)	Q_{aux} (W)	Q_{cp} (W)	$Q_{(mw+fl)}$ (W)	$Q_{(mw+fl)}/Q_{aux}$ (%)
001	29.5	-14.3	43.8	26.5	12.3	5.8	18.1	14.9	3.2	17.7
002	30.9	-9.2	40.1	25.9	12.2	5.8	18.0	13.0	5.0	27.8
003	29.1	1.6	27.5	26.1	7.1	5.8	12.9	8.9	4.0	31.0
004	29.2	11.9	17.3	25.0	5.3	5.8	11.1	5.6	5.5	49.5
005	31.2	17.2	14.0	26.3	5.3	5.8	11.1	4.6	6.5	58.6

t_h: panel surface temperature, hot side; **t_c**: panel surface temperature, cold side; **Δt**: temperature differential (t_h - t_c); **t_a**: ambient lab temperature; **Q_h**: heater power input; **Q_f**: fan power input (from manufacturer's data); **Q_{aux}**: total power input (Q_h + Q_f); **Q_{cp}**: heat flow through panel; **$Q_{(mw+fl)}$**: heat flow through metering chamber wall and around panel (Q_{aux} - Q_{cp}).

Table 1. Characterization panel results

tests were performed, at nominal temperature differentials of 35°C, 30°C, 20°C, 10°C, and 5°C.

Characterization test runs are summarized in Table 1. Heat flow through characterization panel, Qcp (W), is calculated using:

Equation 1.

$$Q_{cp} = \frac{A \bullet (t_h - t_c)}{R}$$

Where A (m2), is the characterization panel area, th and tc (°C) are temperatures of panel hot and cold sides, and R (K m2/W), is resistance to heat flow of the panel per manufacturer-supplied data. For the EPS panel used to characterize the hot box apparatus R = 4.5 K m2/W.

Heater power input to the metering chamber, Qh, is calculated by taking a one-minute moving average of on/off time as recorded by the data acquisition model and multiplying by heater power, Wh, for the length of time heat balance within the system is observed in steady-state.

1.3. Waste block materials and methods

Mixing, forming, and curing. Gypsum drywall waste (GW) was sourced from local building construction and demolition sites, and included a typical variety of types and thicknesses. Demolition waste tested negative for asbestos (third-party certified lab). Waste drywall boards were reduced to convenient size by manual breaking, then pulverized using a hammer mill equipped with 5 mm screen (Figure 2a).

Blocks measuring 75 mm x 305 mm x 153 mm were formed on a custom-made hydraulic block press (Figure 2b), at formation pressure of 7.6 MPa, resulting in block dry density of approximately 1.2 g/cm3 Blocks were cured for seven days covered with polyethylene sheet, followed by ≥ 56 days of drying at ambient lab temperature and humidity.

A single-wythe DWB wall section measuring apx. 1219 mm x 1219 mm x 153 mm was constructed, consisting of 15 courses of block, mortared with 7 mm joints of Type S mortar (ASTM C270). All cores were fully grouted with fine aggregate grout meeting ASTM C476-18, and the two perimeter cores were reinforced with nominal 13 mm steel reinforcing bars (1070 mm on centre). The assembly was allowed to cure and dry for ≥ 28 days at ambient lab temperature and humidity before mounting in specimen frame for testing (Figure 3).

A series of five tests were conducted, at nominal temperature differentials selected to match characterization conditions. Due to lower ambient lab temperatures and sensor sensitivity limits, actual differentials were less than for characterization tests.

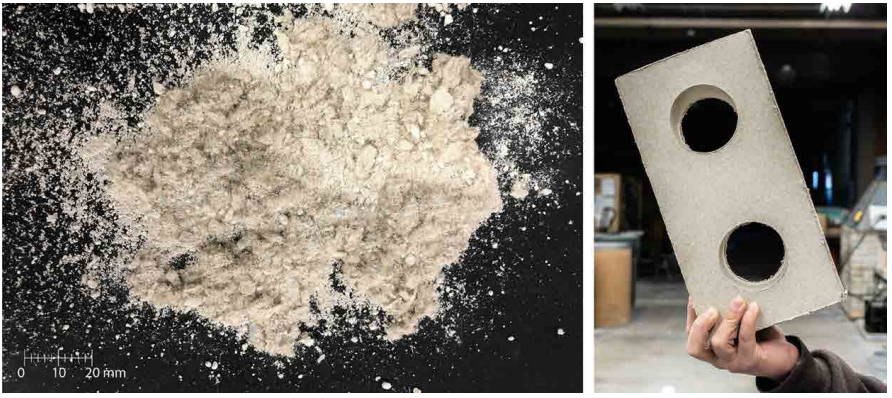

Figure 2a. Shredded drywall waste from demolition; Figure 2b: prototype DWB masonry.

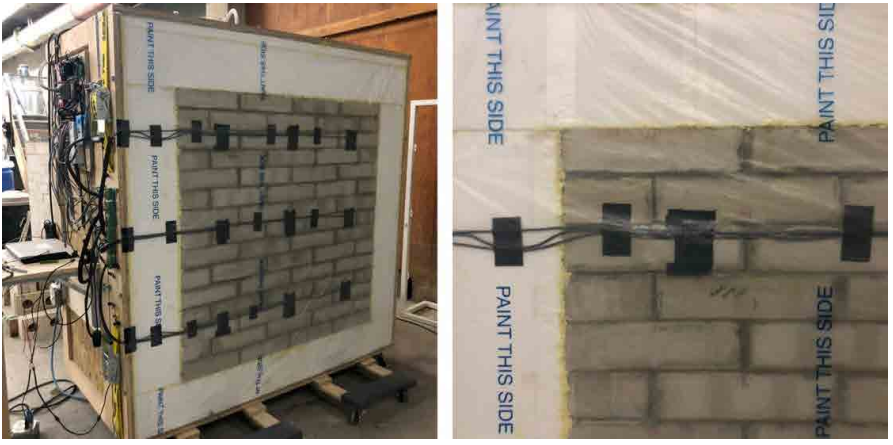

Figure 3a. DWB specimen wall prior to testing. Figure 3b: Wall detail. Wall has been instrumented, mounted in frame, and frame is clamped to climatic chamber.

2. RESULTS AND DISCUSSION

Results from DWB specimen test runs are summarized in Table 2. Note these test runs were conducted on the same DWB specimen wall, with the variables under examination being the temperatures of specimen hot and cold sides (th and tc), and the consequent temperature differential between them. Resistance to heat flow, R (Km2/W), is calculated using:

Equation 2.

$$R = \frac{A \bullet (t_h - t_c)}{Q_{sp}}$$

Where A (m2) is specimen area, th and tc (°C) are temperatures of specimen hot and cold sides, and Qsp (W) is the net flow of heat through the wall, equal to metering wall and flanking losses, Q(mw+fl), minus the metered input of heater and fans, Qaux.

Test No.	t_h(°C)	t_c(°C)	Δt(°C)	t_a(°C)	Q_{aux}(W)	Q_{sp}(W)	$Q_{(mw+fl)}$(W)	R(Km²/W)	R_{dwb}:R_{cmu}
105	14.2	-6.0	20.2	14.1	35.4	28.5	6.9	1.05	4.0 : 1
091	20.5	6.4	14.1	16.9	32.2	23.0	9.2	0.91	3.5 : 1
104	14.3	0.6	13.7	12.5	34.1	25.4	8.7	0.80	3.0 : 1
090	21.0	13.7	7.3	14.4	30.9	25.0	11.9	0.43	1.6 : 1

t_h: specimen surface temperature, hot side; **t_c**: specimen surface temperature, cold side; **Δt**: temperature differential (t_h- t_c); **t_a**: ambient lab temperature; **Q_{aux}**: total power input; **Q_{sp}**: heat flow through specimen; **$Q_{(mw+fl)}$**: heat flow through metering chamber wall and around panel; **R**: resistance to heat flow of the specimen; **R_{dwb}:R_{cmu}**: ratio of DWB R to published CMU R.

Table 2. DWB specimen wall results.

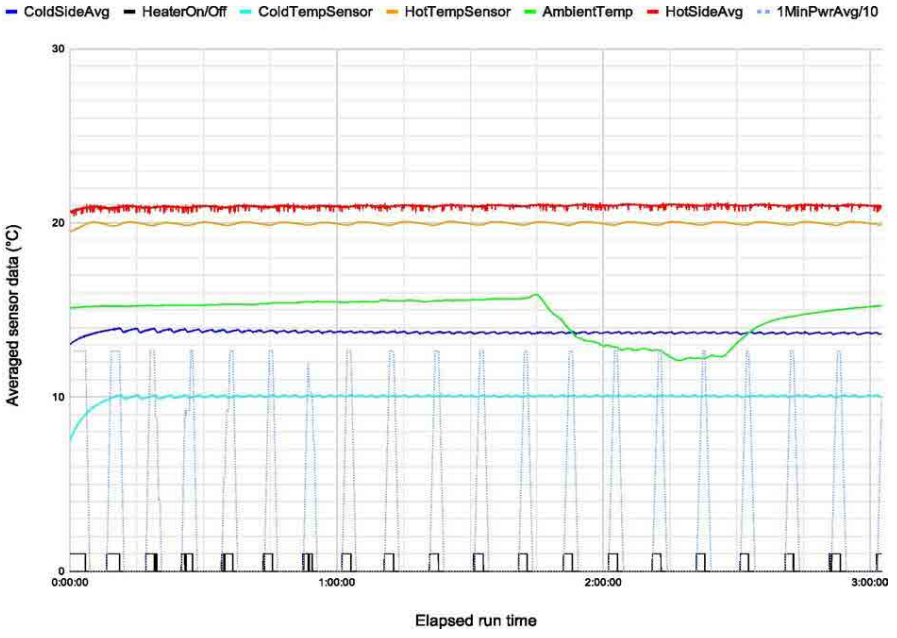

Figure 4. DWB wall specimen test no. 090. Steady-state observed after approximately 00:30:00 minutes.

Figure 4 illustrates temperature and power levels logged during a typical DWB specimen test run. Fluctuation of average temperatures measured across specimen hot and cold sides ("ColdSideAvg" and "HotSideAvg"), is ≤ 1°C, as required by ASTM C1363. Sensors used for thermostatic control of heating and cooling systems ("HotTempSensor" and "ColdTempSensor") also show recorded fluctuations ≤ 1°C, as required by ASTM C1363. Dip in ambient lab temperature starting ~ 1:45:00 due to exterior building doors being opened.

The value of R for the DWB specimen, calculated using power input Qaux and Equation 2, is regarded as relative, not absolute. As expected, heat flow through both the characterization panel and the DWB specimen increased as temperature differentials increased. As expected, heat flow through metering chamber wall to surrounding lab, Qmw, and flanking losses through the specimen frame, Qfl, both decreased as temperature differentials increased; test runs with higher differentials have less potential for error than test runs with lower differentials. Losses, Qmw+fl, are a higher percentage of total heat transfer than allowed by the ASTM standard, but significantly lower than losses reported for the apparatus designed by Seitz and MacDougall. Losses calculated during characterization using Equation 1 are relatively sensitive to an exact value for characterization panel R; since R is calculated from manufacturer's data rather than established empirically, this is a possible source of error. However, when R is calculated for the DWB specimen using Equation 2, the inverse is true, and the calculated value for R is relatively insensitive to the exact value of Qmw+fl.

Calculated R for the DWB specimen is up to four times higher than published values for nominal 152 mm thick, unreinforced single wythe wall assemblies of normal weight CMU with fully grouted cores (NCMA 2013). Because steel reinforcing rod has greater conductivity than concrete mortars and grouts, it is likely that R for a steel-reinforced CMU wall would be lower still, i.e., thermal performance of DWB specimen relative to reinforced CMU would be even greater. Construction and testing a reinforced and fully grouted CMU wall to directly compare thermal performance is an area for further research. The apparent correlation in Table 2 between higher R, higher temperature differentials, and lower cold side temperatures is also an area for future research.

CONCLUSIONS

The constructed hot box apparatus meets ASTM parameters for temperature control. Data acquisition and controls were found to be reliable. Flanking losses and metering wall losses were higher than prescribed, likely due in part to a metering chamber area proportionally greater relative to specimen area than would be the case for a larger apparatus. This could be mitigated by increased air-sealing of box sections and specimen contact with frame, as well as increased insulation of hot box chambers and specimen frame. Use of an LN2 cooling system permits rapid temperature changes and precise control, with low upfront costs, but operating costs are high (~$11 USD/ hour for test runs with ≥30° C differentials) and eventual replacement with mechanical refrigeration is planned. Nevertheless, the design represents a cost-effective alternative to commercial testing facilities, and is practical for use as a design tool in educational and R&D facilities.

Results of initial investigations favour the conclusion that DWB wall assemblies have higher resistance to thermal conductivity than CMU, even when using conventional reinforcement, mortar, and grout. This is further evidence for the potential of DWB as a high-performance, low-cost alternative

to CMU, and concomitant diversion of problematic C&D waste from landfills.
Hot box testing of DWB assemblies that utilize lower-conductivity reinforcement, mortar, and grout is an area for further research, with the goal of developing DWB wall assemblies that approach or equal thermal performance previously found for homogenous DWB specimens. Such assemblies could potentially meet energy code standards for non-residential construction, without requiring additional insulation. This would represent considerable reduction of labour and material costs. It is also appreciated that lower-conductivity reinforcement, mortar, and grouts may be higher performing with regard to embodied energy and carbon footprint.

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PAPER #5.15

INDOOR ENVIRONMENTAL ANALYSIS OF A LEED GOLD-CERTIFIED OFFICE BUILDING IN ASHRAE CLIMATE ZONE 6

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ABSTRACT

Building quality and performance can be assessed in terms of indoor air quality, thermal comfort, lighting quality, and acoustic comfort, collectively referred to as "Indoor Environmental Quality (IEQ)." User satisfaction in buildings has been clearly linked to productivity, lower absenteeism, and employee retention among other outcomes. Conducted as part of a larger Post-Occupancy Evaluation (POE) of a LEED Gold certified office building located in Wisconsin, USA (ASHRAE climate zone 6), this study takes a comprehensive approach to analyzing the IEQ of the building by employing a questionnaire conducted in parallel with measuring several indoor environmental parameters. The field measurements were used to explore, understand, and validate the outcomes of the survey.

The building is approximately 90,000 square feet including both private offices and open-plan spaces, plus other facilities. It is conditioned through a centralized HVAC system that separately supplies the three 2-storey wings and controls indoor temperature, relative humidity, and fresh air supply based on a pre-programmed algorithm. A total of 126 answers were collected out of 200 employees, representing a response rate of more than 60%. The questionnaires were collected and analyzed using the online survey tool: QualtricsXM.

The results show that office design layout and orientation play a key role in occupant satisfaction and productivity. Employee thermal comfort was strongly impacted by their location in the building. This was due to a mixture of design and operational issues, which also strongly impacted the building's energy use. As is expected in open plan design, issues with noise and privacy were also identified. The results however showed a high level of satisfaction with air quality, which was supported by the field measurements. The findings will inform architects, engineers, and researchers in their efforts to promote more efficient and healthy office spaces and to run POEs of existing office buildings.

KEYWORDS

Indoor Environmental Quality (IEQ); office building; Post-Occupational Evaluation (POE); LEED Gold; health.

INTRODUCTION

One of the key factors to improve occupants' health and productivity in the workplace is Indoor Environmental Quality (IEQ) (Fisk 2002; Hedge 2000; P. Wargocki 2000; Choi and Moon 2017; de Dear, Brager, and Berkeley 1998). In order to provide a healthy and comfortable indoor environment, buildings need to use energy for heating, cooling, ventilation, etc. Based on this thought, IEQ and energy efficiency go together while designing a sustainable and healthy building (Geng et al. 2019). Additionally, these two parameters are two key factors while certifying a building with the Leadership in Energy & Environmental Design (LEED). Generally, occupants are able to identify the air quality level through their sensory perception reflects, responding with yawns

and sneezes (Wolkoff et al. 2006). However, many of these parameters are difficult or nearly impossible to people to notice while working in their workplace. For example, Carbon Dioxide (CO2) is considered colorless and odorless, then occupants are unable to identify the concentration level, which can have a very strong impact on health. In fact, a high concentration of CO2 could derive in a sick building syndrome (SBS) (Gupta, Khare, and Goyal 2007).

A common best practice to understand the correlations between occupants' opinion and IEQ measurements is comparing the IEQ measurements with a Post-Occupational Evaluation (POE) (Loftness et al. 2009; Newsham et al. 2009; Veitch et al. 2007). In fact, Formaldehyde (HCHO), Total Volatile Organic Compounds (TVOC), CO2 and Particulates (PM2.5 and P10) are crucial IEQ parameters that are often considered in the field measurements of a POE.

It is critical to have good indicators in order to detect problems, monitor progress over time while trying to reach objectives (Cole 2005; Fisk, Black, and Brunner 2011). For instance, one of the most important parameters when identifying indoor air quality due to poor ventilation rate is CO2. This high concentration will generate dizziness, nausea, mental fatigue, throat irritation, headache and eye irritation, known as well as SBS symptoms (Thach et al. 2019). Moreover, most of the parameters responsible for this SBS symptoms are affected by outdoor air quality conditions, building ventilation system operations, and indoor activities (Cheng 2017). In 2017, a study showed that indoor air quality and thermal conditions generally affect performance, impacting negatively in the ability to concentrate and to think clearly (Pawel Wargocki and Wyon 2017).

This research presents an extensive IEQ monitoring campaign together with the results of exhaustive environmental questionnaire in LEED gold-certified office building in a cold climate. Authors believe that the collection of qualitative and quantitative data in addition to a thorough data analysis is the most accurate method to assess the thermal comfort and indoor environmental performance of a building. This study measured indoor concentrations of CO2, HCHO, TVOC, PM2.5 and PM10, air temperature and relative humidity, together with the subjective occupants' opinions of the indoor environment. The results and correlations of this paper can be used to determine a detailed characterization of the air pollutants present in office buildings and the impact of the office design on air quality and occupants' productivity.

1. DESCRIPTION OF CASE STUDY

The building analyzed is the Grande Cheese Corporate Home Office located in Fond du Lac, Wisconsin (USA), 5 miles South from the lake Winnebago and 40 miles West from lake Michigan (Figure 1). Fond du Lac is 760 feet above sea level and its climate according to the ASHRAE classification (Briggs, Lucas, and Taylor 2003), is zone 6. The building was completed in 2016, and its main use is administrative (office), although there are two cheese laboratories on the first floor. The structure consists of 83,402 ft2 air-conditioned space, of which 79,967 ft2 are offices, and 3,435 ft2 are lab spaces, all distributed in three wings with two floors each, surrounding a large internal courtyard. The office building also houses a fitness center, a cafeteria, two kitchens, a coffee room, a study room, a game room and a loading deck. Over 175 people occupy the building daily with a regular office schedule from 9:00am to 5:00pm Monday through Friday, although a few of the occupants work different hours since the building is accessible 24/7. Additionally, the building is LEED gold-certified by the United Stated Green Building Council (USGBC). This

certification proves the building performance in terms of energy efficiency, water usage, air quality, and choice of building materials as well as environmental factors such as access to public transportation and responsible land use.
The HVAC system is divided in three sections that each one of them supplies fresh air, heating and cooling to each building wing. However, the two cheese laboratories, with dedicated 100% outside air HVAC, are independent of the general HVAC system. The office spaces have two different typologies, open spaces with individual cubicles, and private offices and small conference/meeting rooms. These diverse office designs generate very different occupants' satisfaction.

Figure 1. Grande Cheese LEED gold certified building. Exterior (left) and courtyard (right) views.

2. METHODOLOGY

This study was conducted in an office building equipped with a mechanical ventilation system, including air and heating cooling, and air supply devices, for maintaining comfortable room temperatures and good indoor air quality. A very detailed data collection campaign was performed combining qualitative (occupants' satisfaction) and quantitative (environmental monitoring) data. This campaign took place June through August 2019.

2.1.Questionnaire

In order to understand what type of opinion occupants currently have of the indoor environment, the research team used an analytical qualitative method with online questionnaires as main tool. The questionnaire included multiple-choice questions (using Likert-type scales) and open-ended fields, and was divided into the following sections: Individual data; personal workspace; office layout; thermal comfort; air quality; acoustic quality; building features; and general comments.
An anonymous link to access the online questionnaire prepared on the Qualtrics ("Qualtrics XM" 2019) platform was sent to occupants of all departments and was kept open for three months (from June 2019 to August 2019). The link was distributed to the participants via email and reminders were sent periodically by using the same strategy. The questionnaire was designed with the goal of extracting honest and reliable responses with the following considerations in mind: brevity and simplicity. Indeed, it was unlikely that occupants would have filled out the questionnaire if it was too difficult to understand, and responses would not have reflected the real experience.

2.2. Indoor environmantal monitoring

Indoor and outdoor temperature and relative humidity levels of the office building were monitored for the duration of the of 3 months and data gathered at one-hour intervals. The equipment utilized for the internal monitoring was carried out with the use of a pre-installed network of data loggers evenly distributed throughout the building. To evaluate the indoor environmental quality, one-time noise, CO2, HCHO, TVOC, PM2.5 and PM10 measurements were taken during a regular building operation day, in every room.

3. OUTCOMES

This part presents the results of the quantitative objective monitoring through data logger and the results of the qualitative investigation through questionnaires, in order to assess occupants' satisfaction with the indoor environment. These outcomes are divided in three sections: thermal satisfaction; acoustic satisfaction; and air quality satisfaction. As shown in Table 1, the response sample analyzed in this study was evenly distributed along the entire building, therefore, this data can be considered reliable and representative of the case study. The 1st floor on the North wing does not house offices (only common areas), therefore, there were not responses collected in that area.

3.1. Thermal satisfaction

Table 1 summarizes the 3-months indoor average temperature values monitored, showing mainly that there is a significant difference between floors. While 1st floor temperatures range between mean values of 69°F or 70°F, 2nd floor has higher values around 73°F. Based on the sustainable building design and usage, and the occupancy pattern, this 3°F - 4°F difference between floors is very substantial and worth to investigate.

Despite the temperature difference shown in Table 1, Figure 2 depicts that most of occupants feel thermally comfortable in the building (67%), and only 5% of them reported being hot. However, it is very significant that 28% of workers answered to the questionnaire reporting feeling cold (28%). This 28% is too high and does not fit in the parameters that are acceptable to consider the building thermally comfortable (Paliaga et al. 2013). Looking at floor level, there is an insignificant difference in answers between the 1st and 2nd floor, therefore, a more detailed analysis was required (Figure 3).

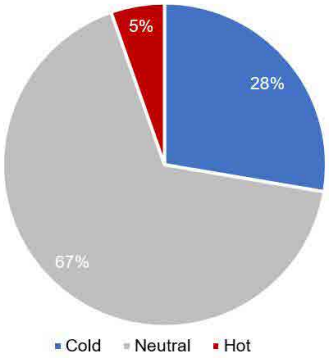

Figure 2. Total workers' subjective thermal comfort opinion.

		Questionnaire Responses	Indoor Average Temperature
1st Floor	West Wing	23%	70.3
	South Wing	25%	68.6
2nd Floor	West Wing	21%	73.2
	South Wing	23%	73.5
	North Wing	8%	72.4

Table 1. Spatial distribution of questionnaire responses, plus indoor temperature values.

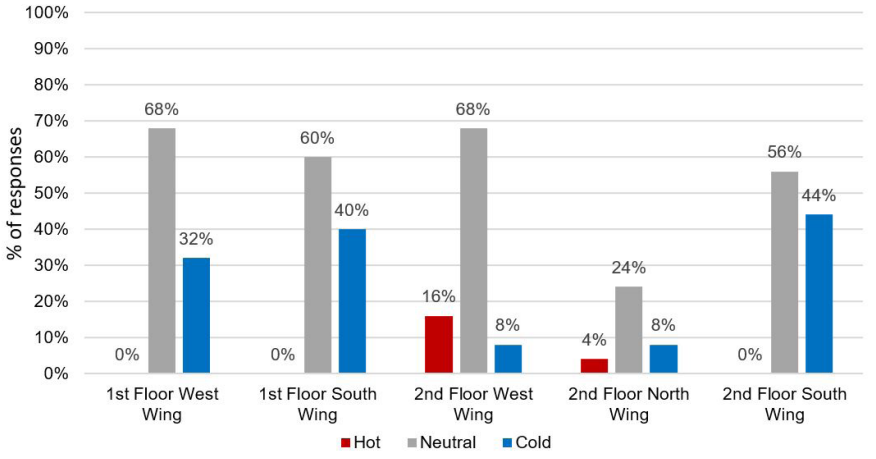

Figure 3. Workers' subjective thermal comfort opinion by building wings.

A result breakdown among different wings and floors is depicted in Figure 3. While there was no disparity between 1st and 2nd floors, building wings get very diverse answers. While West and North wings are consistent with 70% neutral, 20% cold and 10% hot answers, the South wing occupants reported being only around 60% neutral and 40% cold. This data locates the occupants reporting being cold and narrows it to both floors of the South wing. The questionnaire results also revealed that office design has a significant impact on thermal satisfaction. Occupants in closed offices feel colder (34%) than workers using an open space office (cubicles) 10%. Combining all the answers gathered, building occupants have a general opinion of being cold while being in their workplace.

3.2. Acoustic Satisfaction

As mentioned above, offices design heavily impacts on the overall occupants' experience. The acoustic performance of the building is not an exception. Figure 4 presents the results of workers satisfaction to the buildings' noise level, sound privacy and noise satisfaction based on office design. The 78% of occupants

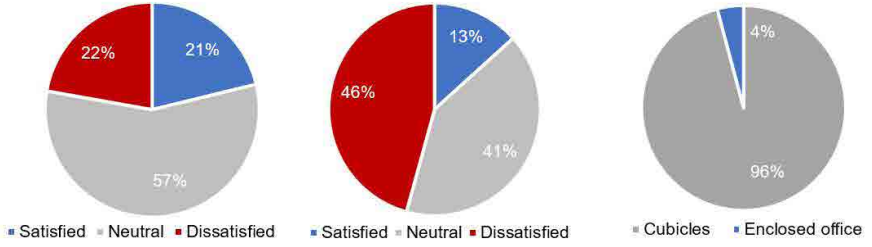

Figure 4. Total occupants' noise level (left), sound privacy satisfaction (center) levels, and location of dissatisfied occupants (right).

described their noise experience as neutral or satisfied, against 22% of the answers were negative. Regarding sound privacy, dissatisfied answers are higher reporting a 46% of negative opinions. This undesirable number of discontented occupants (46%), were located mainly in cubicles in the open office spaces. Therefore, this negative feedback is due to a design solution since, in general, open office spaces have less privacy.

3.3. Air quality monitoring

It is very difficult that occupants notice pollutants, that is the reason for mostly relying on the monitoring results instead of occupants' opinion. However, an air quality satisfaction question was included in the general questionnaire with very positive results. Figure 5 depicts the occupants' great opinion regarding indoor air quality with only 1% of the surveyed workers unsatisfied.

As a part of the indoor monitoring campaign, Formaldehyde (HCHO), Total Volatile Organic Compounds (TVOC), Carbon Dioxide (CO2) and Particulates (PM2.5 and P10) were measured throughout the entire building. Particulates are responsible for sore throat, eye irritation, and nervousness (PM10), and there is a strong correlation between PM2.5 and perceived air quality by occupants.

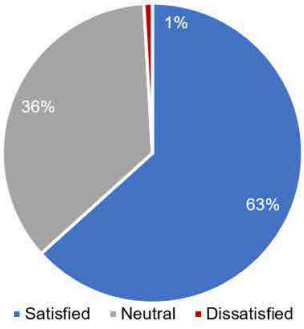

Figure 5. Total workers' air quality opinions.

The way of addressing and reducing these particulates levels is cleaning the duct system, filter replacement and cleaning carpets. Figure 6 shows the levels of PM2.5 and PM10 all rooms analyzed in the building. It is very clear that indoor levels are very low and far away from the recommended limits of 35PPM for PM2.5 and 150PPM for PM10 according to the American Society of Heating, Refrigerating and Air Conditioning Engineers ASHRAE and EPA. In fact, the outdoor readings are the higher registered with 14.1PPM (PM2.5) and 20.8PPM (PM10). Figure 7 shows other critical indoor environmental aspects that were measured such as Total Volatile Organic Compounds (TVOC), Formaldehyde (HCHO), and Carbon Dioxide (CO2). Regarding the CO2 readings registered in the building, they are very consistent ranging between 100PPM and 172PPM with the only exception of the areas where more people are concentrated such as open office spaces (294) and conference rooms (201). Moreover, in the loading deck CO2 values were 647PPM, a total of a 100% more than the second highest recorded value. This high value could be attributed to trucks that regularly park in the loading deck to deliver supplies for the labs. All these CO2 figures are below the maximum recommended value of 800PPM (Park et al. 2019). Concerning TVOCs, concentration values are below the recommended parameters except, once again, open offices, conference rooms and kitchen. However, the readings in the laboratories, cafeteria and loading deck are close to this limit of 1PPM. In particular to HCHO, all the rooms in the building have concentrations below the recommended limit of 0.40PPM, except the laboratories. It is worth mentioning that these laboratories have dedicated 100% outside air HVAC.

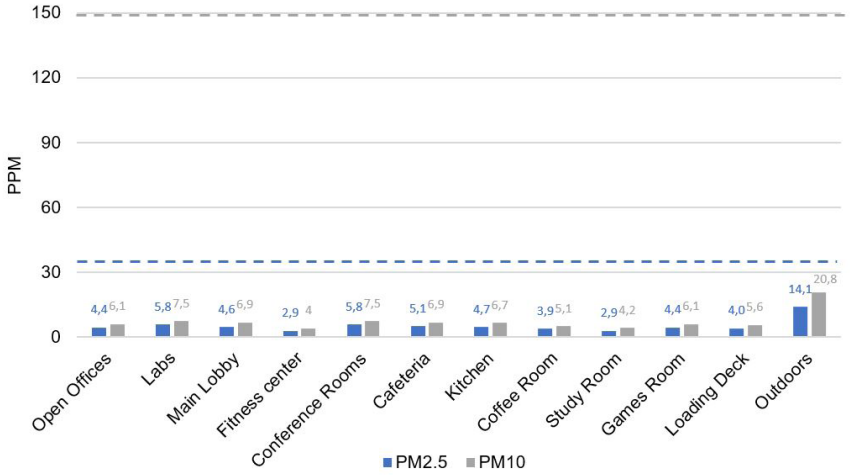

Figure 6. 2.5 and 10 Particle Matter field measurements by location.

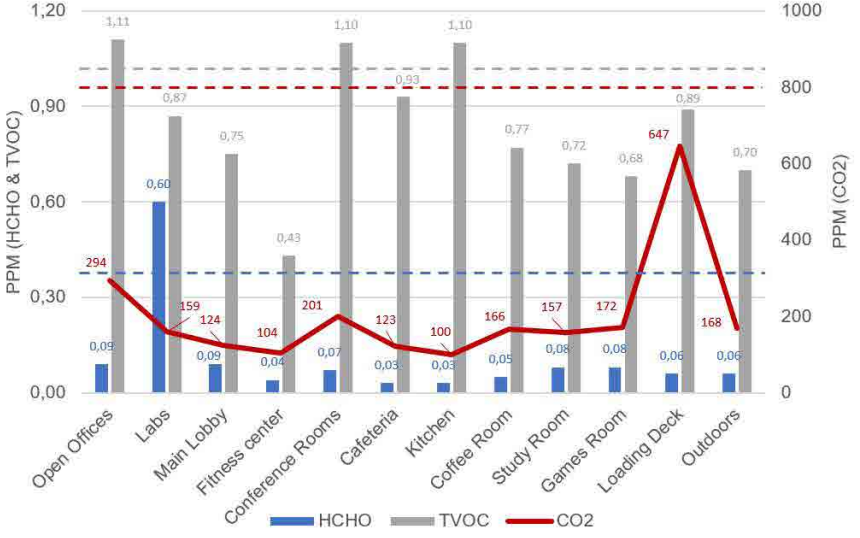

Figure 7. CO2, HCHO and TVOC field measurements and recommended limits, by location.

CONCLUSION

From user satisfaction surveys in this LEED gold-certified office building in ASHRAE climate Zone 6, 64% of occupants overall responded "satisfied", 27% answered "neutral" and 9% of occupants reported "dissatisfied" with their indoor environmental conditions.

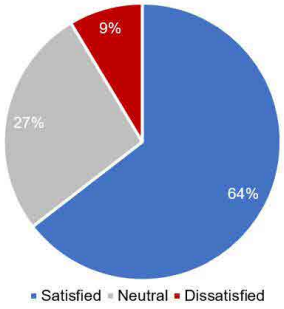

Figure 8. Total workers' overall building satisfaction based on indoor environmental quality.

While 1st floor temperatures range between mean values of 69°F or 70°F because of the impact of the HVAC system, 2nd floor has higher values around 73°F, probably due to the solar radiation. With these temperatures, 28% of occupants felt cold or very cold which is a percentage too large for high performance building. Most of these unsatisfied occupants were located in the South wing, particularly on the first floor and seating in open office spaces. Occupants also reported being cold during both seasons, winter and summer. Due to the building design and occupancy pattern, this reported discomfort could be easily addressed with location specific HVAC operation. Large office buildings are impacted by the outdoor environment in different ways and building locations, therefore, require a HVAC broken down approach for each particular area.

Furthermore, open space offices are proven to promote occupants' interaction and accountability, however, sound privacy and noise are the main two negative aspects of this design solution. Occupants seating in open office spaces reported a 46% of dissatisfaction of sound privacy. This is a design approach that has these negative consequences and there are very limited applicable solutions that can be implemented such as higher partitions, etc.

Given the measured air quality concentrations, occupant satisfaction with overall air quality is very positive. Most rooms do not exceed the recommended thresholds, only particular locations with high occupancy levels like open office spaces and conference rooms. The loading deck is a very different space form the rest of the building where truck engines are constantly running and the CO2 readings are the highest, but not exceeding the permitted parameters. When a mixed used space is located inside a building with occupants and vehicles together, a very strict ventilation strategy must be in place to reduce exhaust air and other pollutants. One of the most interesting aspects about this building is that the cheese laboratories, have dedicated 100% outside air HVAC, and are independent of the general HVAC system. These laboratories generate high quantities of air pollutants (highest HCHO level in the building beyond the recommended values) and need a very strict ventilation strategy in order to preserve optimal conditions for their operation.

As a result, it can be concluded that occupant satisfaction can help inform design decisions. Among the technical attributes of building systems, the factors mentioned above are critical for user satisfaction and health and can support workspace design. Moreover, this research demonstrates that the use of occupant satisfaction surveys could redefine user comfort thresholds.

ACKNOWLEDGEMENTS

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PAPER #5.16

ANALYSIS OF ENERGY PERFORMANCE IN A RESIDENTIAL BLOCK IN THE ENSANCHE OF VALENCIA AND PROPOSALS FOR IMPROVEMENT

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ABSTRACT

The installations and construction systems in a typical residential block in the *Ensanche de Valencia* quarter have been analysed, and the parameters that allow economic costs to be optimised have been quantified, and can be extrapolated to other similar blocks in the neighbourhood, giving us a global vision. The construction dates from 1910, affecting a total of 92 homes. We start by taking construction and energy data. Then we calculate the urban compactness and complexity and take the reference grid. Houses and premises have been asked for receipts for energy consumption. A survey has also been developed to assess the acceptability of energy saving measures. Final y, we implemented the thermography technique.
After diagnosing the real situation, we developed the analysis for the viability of building's services improvements. To conclude, the results are presented according to the convenience or not to install active systems, as well as a rethinking of the enclosures in order to minimize energy consumption.

KEYWORDS

Rehabilitation; energy consumption; building envelope; efficiency.

INTRODUCTION

Valencia is a city located in the East Coast of Spain. (Longitude 0º22'28"W Latitude 39º28'36"N). Its maximum altitude is 24 meters above the sea level. The average annual temperature in Valencia is 17.4°C. The approximate rainfall is 445 mm.
The intervention takes place in the Ruzafa district, located in the southeast of the city, which nowadays is part of Valencia historical centre, and is of outmost sociocultural importance. The permanent relationship that already existed between Ruzafa and Valencia when the former did not belong to the city, increased with its annexation, and was later reinforced due to the project for urban centre widening (in Spanish, *"Ensanche"*). Ruzafa enjoyed the title of municipality between 1863 and 1877, when it was finally annexed to the city of Valencia, and started being a residential neighbourhood with major commercial activity [1]. Figure 1 shows the urban planning scheme for the *Ensanche*, where the existing town conditions the alignments and so the pre-existences have major importance. The new building regulations coexist with a public space typical of the old town, totally different from the orthogonal plot that characterised the first *Ensanche* of Valencia, resulting in a spatial configuration with its own personality and particular conditions which are of great interest. (fig.1).
The urban organisation of this nucleus laid out around the church of San Valero and the axis formed by Ruzafa Street, which links the neighbourhood to the city centre and the unique irregular streets. Concerning the building, it is characterised by an architecture built for the middle class and bourgeoisie, based on dwellings between party walls, facing the street and the inner courtyard of the block, which has modified its regulations over time and varied its formal language

through the use of new materials. The urban regulations of the "Ensanche" provided for the construction of buildings with a maximum of three floors, but successive regulations have progressively increased this height to 8 floors in some cases [2].

Figure 1. Russafa's district. Source: (C. Jiménez 2014)

Figure 2. Building at the crossroads of Carlos Cervera and Cura Femenia streets

The model chosen is an extension block made up of 8 residential and commercial buildings with a total of 92 dwellings arranged over a ground floor plus three floors, bounded by the streets Cura Femenia, Carlos Cervera, Dels Tomasos and Cádiz (Figs.2 and 3). Energy performance data of the buildings have been taken to implement, improvement measures, aimed at minimising overall consumption [3]. The final aim is to ensure that the comfort of the occupants is achieved through the rational use of energy in the buildings. [4]

An assessment has been carried out using the CE3X tool to obtain the qualification of energy efficiency in the existing residential buildings. Energy bills have also been collected to provide evidence of their actual expenditure. Subsequently, a survey has been carried out with two different groups of questions: a first one to indicate the real environmental performance of the house, and a second one which reveals the degree of satisfaction of the user. Finally, the construction performance of the building was studied and the thermal losses along the building envelope were located using a thermographic camera.

Figure 3. Selected buildings. Source: Sede Catastro Valencia.

1. OBJECTIVES

- To evaluate the real performance of the building, an extension block in the city of Valencia that can be extrapolated as a repetitive typology to other buildings in the neighbourhood [5]
- To compare the current performance with what could be reached if a series of technological improvements were implemented to minimise consumption
- To adopt measures to improve the energy efficiency of housing
- To provide a formal opinion on the construction system used in buildings which, as a result of their age, are significantly different from current ones, mainly in the treatment of the building envelope. We emphasise on the use of passive systems (walls, windows, blinds, carpets, curtains, carpets, etc.) to act as corrective screens and reducing dependence on artificial systems.

2. METHODOLOGY

In order to achieve the proposed objectives, a methodology has been developed to obtain the necessary information and draw conclusions for possible intervention, according to the following steps: (1) Carrying out a graphic analysis of the buildings and the extensions that have been made from their original state; (2) characterisation of the building envelope; (3) carrying out surveys of the homes' residents who make up the extension block, so to get information on the conditioning systems, degree of well-being of the homes and willingness to incorporate active and passive measures in the block; (4) evaluation of real energy consumption through energy bills for both electricity and gas (owners were asked to provide the "CUPS" (Universal Supply Point Code) on their bills), which allow (5) the results of the simulator to be compared with reality; and (6) results are justified by means of thermography simulation of every internal and external part of the building envelope that form the block.

All data collected were processed and analysed using the programmes recognised by the Ministry of Industry, Energy and Tourism (MITECO): CE3X version2.1., CE3 version 2375.1015, HULC version 20151113, and CERMA version 4 to characterize the houses from the energy perspective, as well as to check whether there have been alterations in the results.

3. DATA ANALYSIS AND RESULTS PRESENTATION

Climate data:

The climate data for the city of Valencia (table 1) and the construction of the buildings under analysis have been taken into account.

Constructive materialization:

The buildings were constructed using the characteristic construction techniques of this period, thus:

- The main façades are solved with solid brick load-bearing walls of one and a

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
T avg (ºC)	11.2	11.1	13.4	15.3	18.2	21.8	24.6	24.9	22.8	18.9	14.5	11.9
T min (ºC)	6.8	7.3	8.6	10.6	13.8	17.5	20.4	20.9	18.4	14.3	10	7.5
T max (ºC)	15.7	15	18.3	20	22.7	26.1	28.8	29	27.3	23.5	19	16.3

Table 1. Climate data for the city of Valencia

half or two feet thick and joined with lime and mortar cement (thermal transmittance value U=1.22 W/m2 ºK.)

- The rear façades have half a foot of solid brick wall closing the interior doorway (U= 2.13 W/m2 ºK.)
- The dividing walls are the building's own wall separating the boundaries, made up of piled up walls of solid brick, half a foot thick, and taken with lime mortar (U= 2.42 W/m2 ºK.)
- The sloping roof is formed with purlins interposed to bard bricks. This layer is the base on which 3 or 4 cm of lime mortar is poured directly onto the Arabic tile (U= 3.45 W/m2 ºK.)
- The "Catalan" style flat roof is made up of three layers of ceramic tiles plus the floor, supported by purlins, which are in turn supported by the roof structure (U= 3.33 W/m2 ºK.)
- The floor that divides the commercial premises is made of unidirectional wooden beams and covered with a two-threaded revolving floor of ceramic pieces. The hydraulic floor is supported by a 2 or 3 cm lime mortar filling. (U= 2.42 W/m2 ºK.) [6]

Surveys of residents:

From surveys conducted to residents (Table 8), which were answered by 32% of them, it is possible to know the current status of the building (Tables 1 and 2), as well as inferring a well-being indicator (Table 3). It can also be gathered from the surveys the degree of a person's liking on the changes required for the inclusion of new measures to improve the current situation. All the information collected during the study has provided an understanding of what their needs are, and the relevance that each resident gives to them (Table 4). Finally, it is appreciated that any measure that can technically solve a deficiency, may not necessarily imply an improvement in the well-being of the residents (table 5). The ultimate aim of the proposed questionnaire is to evaluate the degree of acceptance of common energy saving measures by the residents of a block of homes. The form used for the survey is shown in table 6.

Electric radiators	54,17
Air Conditioner	37,50
LGP furnace	08,33

Table 2. Survey results on Heating Systems

Do not have	41,67
Air Conditioner	58,33

Table 3. Survey results on Refrigeration Systems

	Winter	
Bearable	65,50	%
Hard to bear	20,83	%
Pretty hard to bear	04,17	%
Very hard to bear	0,00	%
Unbearable	0,00	%
No answer	12,50	%

Table 4. Survey results on thermal comfort in winter and summer,

Completely acceptable	08,33
Acceptable	54,17
Mostly unacceptable	12,50
Completely	04,17
No answer	20,83

Tabla 4. Survey results on the acceptability of measures

Bearable	25,00
Hard to bear	12,50
Pretty hard to bear	37,50
Very hard to bear	0,00 %
Unbearable	0,00 %
No answer	25,00

Tabla 5. Survey results on uncertainty degree on the economic charges distribution among neighbours.

1. Do you home have a heating system installed?
2. If answered yes to Q1, which system do you have?

Electric radiators	
Air Conditioner	
LGP furnace	

3. Does your home have a cooling system installed?
4. Rate the comfort degree you perceive during winter

Bearable	
Hard to bear	
Pretty hard to bear	
Very hard to bear	
Unbearable	

5. Rate the comfort degree you perceive during summer

Bearable	
Hard to bear	
Pretty hard to bear	
Very hard to bear	
Unbearable	

1. Would you be willing to accept changes in your building to help improving the comfort?

Completely acceptable	
Acceptable	
Mostly unacceptable	
Completely unacceptable	
No answer	

2. How do you rate the economic cost these improvements would mean?

Completely acceptable	
Acceptable	
Mostly unacceptable	
Completely unacceptable	
No answer	

Tabla 6. Survey Questionaire Model used

Energy simulator:

The evaluation of the energy consumption demand has been carried out using, as already indicated, the tools endorsed by the Spanish Ministry of Energy, which enable obtaining the energy efficiency rating in existing residential buildings, and easing a detailed study to improve the resulting rate. In this study the simulation results were compared with the real energy consumption data, by means of the electricity and gas bills of the visited homes. The obtained model indicates that the maximum demand of energy occurs during winter time, and not that much in summer (Fig.4). In terms of the buildings' envelope, results indicate that the most generalized losses arise from the rear facades, where the is almost no isolation at all. Another construction element where significant losses are produced is through the roof of the buildings.

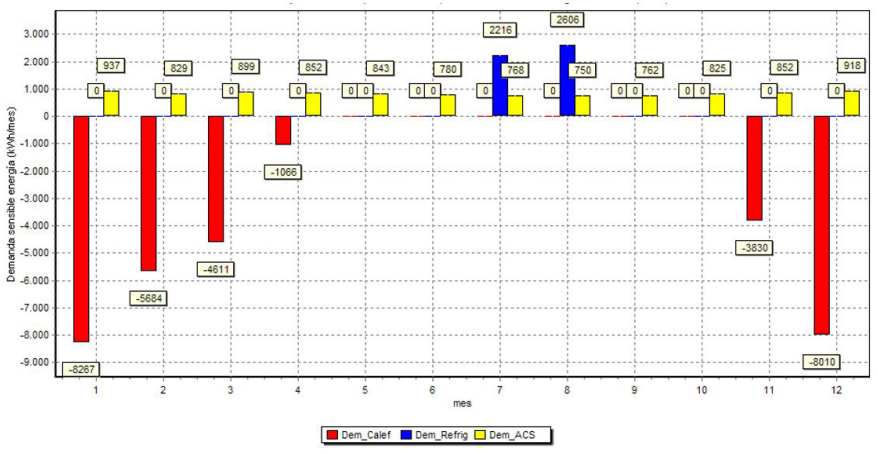

Figure 4. Energy consumption demand of a modelized building (kWh/month)

Measurements:

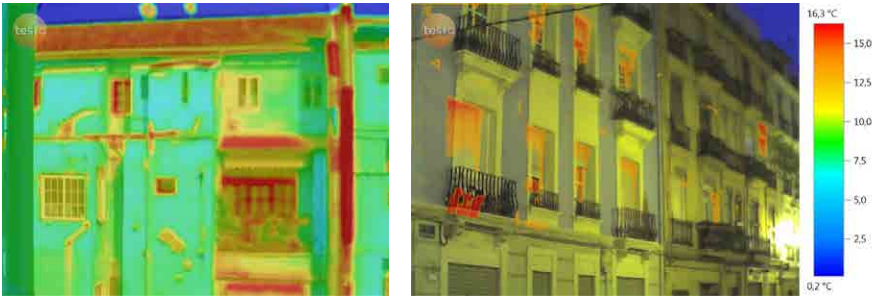

Figure 5. Thermografy measurements taken for inner and outer facades (note the effect of shadowing over facades thermal performace) Source: (Vicente Blanca 2012).

The thermographic measurements performed over the facades of the buildings under study confirm the result of the simulation modelling. The most significant losses occur through the rear facades and the wooden enclosures (Fig. 5).

4. DISCUSSION

Concerning the proposal of a global improvement of the building's thermal envelope, , it is concluded that about 10 cm of insulation would be needed, to reduce CO2 emissions, until the letter initially obtained in the energy rating, which was an E, is modified. This thickness would be required to be enlarged to 10cm for the facades and roofs and, in addition, to install low emission glass windows, to reach a qualification of D, one level above the current one [7].

A possible way to alleviate the economic effort that the building envelope global improvement would mean, considering the very long amortization periods estimated, is to make specific improvements in particular points, like only isolating the clearly deficient facades,which are those facing the inner courtyard, or to restore the windows and their shields [8].

Obviously CO2 emissions are reduced to a minor amount, but if it is related to the investment to be made in each case, from the perspective of the optimum cost of the action, it would be more feasible to consider this type of intervention, taking into account the specific climatic conditions of Valencia.

In relation to the possible position of the thermal insulation in the facades studied, it could be concluded that in the main facade which is very thick and has a high thermal inertia, the placement of the insulation is not excessively relevant. Furthermore, in the walls of the rear facades, which are very thin and have a high level of inertia, the differences between the two situations are more pronounced, although not substantial. In these cases, placing the insulation on the inside of the façade has a significantly better performance in winter conditions, but worse than in summer. On the outside, the behaviour is the opposite, that is, it works better in summer. In any case, considering that many of the main façades of the buildings in the neighbourhood are protected, if the installation of the insulation on them were planned, it would only be possible to intervene on the inside.

With regard to the façade openings, it has been observed that the original woodwork was made of wood, an important aspect given the low conductivity of said material. Nevertheless, it has been found that many of

the original woodwork has been replaced and, in the case of the solar protection, it has been altered or removed. The aim is to recover and improve the thermal behaviour of the original damaged wooden windows, including their protection (blinds, shutters, gazebos, etc.), which in many cases has been removed. In this sense, it is understood that the most interesting option would be to repair the carpentry by placing flashing to improve its behaviour with regard to air permeability and the arrangement of the corresponding glazing beads to be able to place double glazing with a chamber, so that, if the replacement of original glass is considered, normally of very little thickness, ranging between 3 and 6 mm. by 4/12/4 [9][10]

If intervention on the enclosure and on the installations is considered, it is concluded that CO2 emissions are reduced, but not enough to reach a letter C in the energy rating [11]. Only the installation of a biomass boiler could achieve a letter B. As these are through houses with two opposite facades, it favours good ventilation, an important aspect especially in summer [12]. Another system typical of this type of building for natural ventilation is the staircase itself. In order for it to work properly, in addition to the usual openings to the interior courtyards, it is vital that it also has them at the top and bottom of the stairwell, that is, in the hallway and the roof [13]. It has been observed that, in many cases, the original doors of the building have been replaced, which had practicable elements in the upper part to favour the entry of air and the consequent ventilation through the staircase. The recovery of these simple natural ventilation systems has been considered, given that the cost-benefit ratio in summer is very beneficial, but incorporating control systems over the openings so that they can remain closed in winter [14][15][16].

CONCLUSIONS

Given the difficulty created in the collection of energy data, as a result of the distrust created by the occupants of the homes and the lack of information, it has been very positive to provide the homes with intelligent meters.

There have been no relevant changes in the results obtained with the use of the software backed by the Ministry of Industry, Energy and Tourism, when characterising the energy of the homes.

In a warm climate, such as the city of Valencia, the years needed to recover the investment, if it is considered the rehabilitation of the entire enclosure, are more than 10 years. This means that energy service companies are not interested in managing the renovation of buildings with these climatic characteristics. In this sense, the most relevant result is the improvement of the thermal comfort and the quality of life of the users, more so if we consider that a high percentage of homes do not have heating systems. Another problem detected is the high number of uninhabited dwellings in the buildings of the neighbourhood. This differentiates the theoretical results obtained by means of the computer tool from the real global consumption data for each building. This situation is aggravated by the fact that most occupied dwellings are occupied by users over 65 years of age and, in many cases, they live alone. All these problems together mean that the owners are not interested in investing in their houses' rehabilitation.

The very uniformity of the cornice heights in the buildings, that make up the neighbourhood, avoids the shadows cast by facilitating the incorporation and use of renewable energies through thermal and photovoltaic solar panels, notably improving the building's energy management [17].

The division of the urban development, the similarity in construction, the occupation of the houses and the socio-economic study carried out, allows us to extrapolate the values obtained, as well as the indicators, to other blocks in the same neighbourhood.

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PAPER #5.17

COMPARATIVE STUDY OF SUSTAINABLE THERMAL INSULATING MATERIALS IN ARCHITECTURE

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ABSTRACT

The study aims to know the alternatives to thermal insulation currently used in the type of double-sheet enclosure, with or without an air chamber, and thermal insulation inside. Objective data is provided to justify the value of new eco-friendly thermal insulating materials that allow a more respectful architecture with the environment.
Ecological awareness today reaches any discipline. Architecture does not escape this concern and, therefore, new, greener materials are introduced. On the other hand, the new regulations advocate for more efficient, ecological and sustainable construction.
In this sense, the new materials come from natural sources or from recycled products, which, through simple transformation processes, achieve a new product that complies with current regulations, as well as new social and architectural requirements.
To know the characteristics of these sustainable thermal insulating materials, a comparative study of different products is carried out, contrasting their characteristics and properties. The formats that best fit the double-sheet enclosure solution are the blanket, board and bulk. The selected thermal insulators are natural cork, cotton, hemp, cellulose, sheep wool and wood fiber.
In order to determine their behavior, several technical features are studied. In addition, some environmental properties are evaluated to complete the comparison. Various studied aspects are the origin of the raw material, the consumption of energy and the level of emissions generated by the manufacture.
All values and data obtained show the thermal and ecological insulating value of the studied sustainable materials against those currently used in the construction of enclosure systems.

KEYWORDS

Thermal insulation; sustainable; recyclable; comparative study; ecological.

INTRODUCTION

Over time, humans have taken into consideration their environment regarding architectural construction in terms of the collection of materials, the climatic conditions and the adaptation to the surroundings. However, this adaptation has been abandoned mainly due to the technological developments that have been incorporated during the industrialization. From that moment on, we have arrived to a point in which the construction of buildings consumes 40% of the materials, generates 40% of wastes and consumes 40% of the primary energy in the European Union (Baño & Vigil-Escalera 2005). A great amount of this consumption takes place due to the building activity in cities. Technology has improved living conditions and has provided more suitable conditions to increase the amount of population. Nonetheless, it has now a responsible role in the development of sustainable ways to preserve and keep improving social welfare. In this sense, many courses are being taken

at this precise moment. In a long term research, bioinspired materials and artificial reproduction of existing substances are two of the most growing research fields. Regarding building conditions, thanks to the growth of a more ecological consciousness, a change towards sustainable construction is slowly taking place. This transition is necessary considering that if we maintain the current consumption rate, the stocks of the different fossil fuels will disappear: between 35 and 45 years for petrol, between 60 and 70 for natural gas and between 200 and 230 for carbon (BP 2013). Hence, sustainable construction, which is based on respecting and adapting to the environment, saving resources and energy, and considering the users, becomes a wide field of research to reduce our consumption rate. Embracing both sustainable construction and technological development, this paper outlines another approach towards what a future based on technology could be: the use of more natural, sustainable and environmentally friendly materials in the building industry.

> The use of fossil fuels for heating, lighting and ventilation of buildings is responsible for the 50% of the global heating, being transport another of its main causes (25%) (Edwards 2005, 4).

Thus, amongst the variety of natural and environmentally friendly materials, this work aims to provide further information on those which are thermal insulators, sustainable, available in the market and feasible to implement in the most common brick wall constructive technics in Spain: the double layer façade with and without air chamber. Consequently, this study is framed on the second condition of the sustainable construction (saving resources and energy) since it will delve into the study of thermal insulator materials that are suitable, have low environmental impact and have properties with high influence on the energetic behaviour of buildings. In order to consider these materials as potential substitutes of the traditional thermal insulators they will need prove of being not only more sustainable but also provided with at least as good properties as the traditional materials.

1. MATERIALS AND METHODS

The aim of this paper is to present the research made on several sustainable thermal insulators in order to review their potential as substitutes of the traditional materials. To do so, a precise methodology has been applied along the investigation. It consists of a comparison between the sustainable materials and with the traditional ones both in technical aspects and in environmental features. The first consideration emphasizes their suitability to perform as thermal insulators, since they should behave as well as de usual thermal insulators, while the second allows determining the level of sustainability and environmental impact amongst them. To accomplish this comparison, their technical features and environmental characteristics have been translated into numeric parameters. The studied technical aspects have been the following: *Thermal conductivity, λ [W/mK]:* it is an indicator of the heating transmission capacity and represents the ease of the material to conduct it. The smaller the value of λ, the better the thermal insulator. *Thickness*, *e [m]*: to achieve an equitable comparison, a certain thermal resistance is fixed, R = 1m^{2}K/W. Thus, for the same value of thermal resistance, the value of the thickness of each material is obtained

$$e = R \cdot \lambda \qquad [1]$$

Where: R = thermal resistance [m^{2}K/W]
λ = thermal conductivity [W/mK]

All the studied materials present a thickness of 40 or 50 mm as the value that would correspond with the closest commercial value available.
Hygroscopicity [%]: the capacity to absorb or spread the humidity in the air. It promotes the equilibrium of internal humidity. The higher the percentage, the better hydrophilic behaviour.
Water steam diffusion, Sd [m]: the capacity of a material to allow water steam to move through it. Materials with a good water steam diffusion are prone to expel out the steam.

$$Sd = \mu \cdot e \qquad [2]$$

Where: μ = resistance to steam diffusion
e = thickness of the material [m]
Being Sd: <4: optimal
4-7: satisfactory
7-15: bad
15-25: very bad
>25: impermeable barrier to steam

Thermal diffusivity, α [m^2/s]: it is the expression of the capacity of a particular material to transmit a variation of temperature in a specific time. The lower the value, the longer it will take the material to transmit a variation of temperature from the exterior to the interior.

$$\alpha = \frac{\lambda}{\rho \cdot C\rho} \qquad [3]$$

Where: λ = thermal conductivity [W/mK]
ρ = density [kg/m^3]
Cρ = specific heat [J/kgK]

Fungi and insect resistance: all the studied materials present this feature.
Fire resistance: it is expressed according to the Euroclasses:

A Non-combustible, no contribution to fire
B Combustible, very limited contribution to fire
C Combustible, limited contribution to fire
D Combustible, middle contribution to fire
E Combustible, high contribution to fire
F Unclassified, no specific fire behaviour

Price [€/m^2]: the indicated price belongs to the material according to the appropriate commercial thickness to ensure R = 1m^2K/W.

The environmental characteristics of each material can also be translated into tangible numbers to facilitate the comparison between their values. In that sense, the following magnitudes are the ones that have been evaluated:
Energy [MJ/kg]: total energy consumed along its life cycle.
Emissions [kgCO^2/kg]: CO_2 emissions during the whole life cycle of each material.
Biodegradability: is the ability of organic substances and materials to be broken down into simpler substances through the action of enzymes from microorganisms. If this process is complete, the initial organic substances are entirely converted into simple inorganic molecules such as water, carbon dioxide and methane (Ecozema 2020).
Recyclability: is a characteristic of materials that maintains useful physical or chemical properties after serving their original purpose and therefore allows them to be reused or remanufactured into additional products through a recognized process. All the studied materials are recyclable but the bulk format is itself harder to recycle.
After determining all the numeric parameters considered in the study, it is necessary to narrow the scope of the research and adequate it to a feasible analysis which could provide conclusions. To do so, four conditions have been applied to preselect the materials (Fig. 1): the material must be sustainable, thermal insulator, the material must be available in the market and it must be feasible to implement in the most common construction systems.
The double layer façade with and without air chamber are the most common brick wall constructive technics in Spain. This condition is applied to reduce the variety of formats of the materials to either board or blanket and bulk. The formers are meant to be implemented through fixation while the latter is used as insufflated insulator. The materials that fulfil all these requirements are potential substitutes of the traditional thermal insulators used in the building industry. The

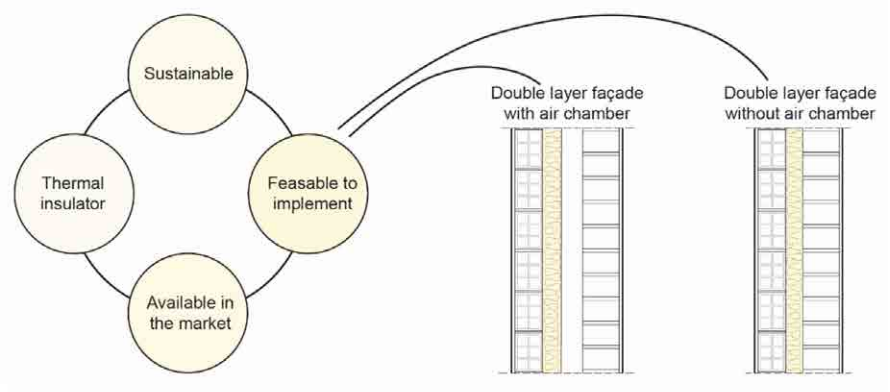

Figure 1. Conditions to select a material.

resulting ones are cork, hemp, wood fibre, cellulose, sheep wool, cotton and mineral wool. They are commented in the paper hereunder. Once the materials have been specified, the condition of availability in the market will determine which formats are studied for each material. This specification on the configuration of each of them is worth to be highlighted because it is not equivalent to all the materials. There are some that can be transformed to be implemented with different technics while others are limited to a single application (Table 1).

Materials	Format		
	Board	Blanket	In bulk
Cork	x		x
Hemp		x	
Wood fibre	x	x	x
Cellulose			x
Sheep wool	x	x	x
Cotton	x	x	x
Mineral wool		x	x
Glass wool		x	
Extruded polystyrene	x		

Table 1. Formats available in the market.

1.1. Cork

Natural cork consists of the rind of the cork oak, which is made up of death cells that are filled with a gas similar to air. This gas constitutes the 90% in volume of the cells and is responsible for the low weight and compressibility of the cork. The extraction of the material from the tree does not damage it, since this process takes place mainly in July when it offers less resistance to be detached, and it does not require cutting down the tree, providing a renewable and durable process (Barnacork 2020).
Cork presents a great mechanical strength due to its ordered cell structure that does not allow gaps between them. Thanks to its resistance against atmospheric changes and the impossibility to rot, cork does not suffer dimensional variations along its useful life (Barnacork 2012). The product is 100% natural, since it only needs water steam and an increase of pressure. The glue used to ensemble agglomerate cork should be water based and totally biodegradable (ICSuro 2020).

Figure 2. Cork: in bulk and board.

1.2. Hemp

Hemp fibre is subjected to a genetic selection process to ensure that the chosen varieties present a low quantity of THC, the main psychoactive constituent of cannabis (under 0,2%), an amount supported by the European Union (López 2018). These fibres contain lignin, which provides strength and resistance, and the absence of proteins avoids the attack by insects. Since these fibres are renewable, biodegradable and grow fast, hemp is considered a sustainable material. The life cycle consists of the growth of the plant for more than a hundred days and the extraction of the fibres by moisturizing the plant (*Tipos de aislantes. LANA DE CÁÑAMO 2020*).
It is durable, comfortable and presents an ecological process without requiring chemical agents throughout it (Rodríguez 2014). In addition, it allows the recovery of the soil where it is produced thanks to its herbicide effect (Cannabric 2008).

Figure 3. Hemp: blanket.

1.3. Sheep wool

Most of the raw material comes from shearing sheep, what is a necessary process in the life of sheep that should occur every year. This means that the basic element is naturally designed to provide thermal comfort while being elastic, hygroscopic and able to breath. Shearing one sheep can provide three to five kg of wool that should be transformed by bleaching the wool with a borax salt treatment after removing the dirt by washing it in hot water. Then, a 15% of polyester binder is added to gather all the fibres and the thermal insulator is ready to be implemented (T*ipos de aislantes. LANA DE OVEJA 2020*).
The final product is renewable, recycled and recyclable and contributes to improve the environment in a social aspect by helping to develop the wool sector (*RMT-NITA WOOL* 2020).

Figure 4. Sheep wool: in bulk & blanket.

1.4. Cotton

The thermal insulators derived from cotton are obtained from recycled textile products, thus, the raw material is not totally natural but it is completely recycled. The transformation process consists of a shredding operation to extract single fibres that are later gathered into a multi-fibre product.
For this particular material, the ecology of the process can only be guaranteed in the production but the whole process is sustainable in time. Cotton insulators need a special treatment to resist fire, fungi and insects and help to reduce the production of emissions and waste (*RMT-NITA COTTON* 2020).

Figure 5. Cotton: in bulk & blanket.

1.5. Cellulose

Once again, the origin of the basic material is not natural but recycled. It consists of newspapers that have not been sold. The whole transformation process is based on collecting newspapers to transform them by means of grounding and borax treatments into a bulk thermal insulator (*RMT-NITA CELL* 2020).
This alternative presents great resistance to biological attacks while helping to create dry environments where it is incorporated. Cellulose insulators also provide great comfort and acoustic performance thanks to their thermal lag (8-12h) (AISLAnat 2020).

Figure 6. Cellulose: in bulk & blanket.

1.6. Wood fibres

Grinded wood is the raw material used to produce this thermal insulator. Forestry and wooden industry generate wastes in form of sawdust and cutting pieces that are transformed by means of grinding and shredding either in a wet or a dry process.
Wood fibres insulators are comfortable, ecological and sustainable. Their temperature is stable before temperature variations and are suitable to be implemented in almost every constructive system. However, they are mainly produced out of Spain (GUTEX 2020).

Figure 7. Wood fibres: in bulk & blanket.

2. RESULTS

The following table contains the fundamental technical and environmental features to understand the behavior of each material. The R-values and U-values have not been included for space, as they can be approximated from thermal conductivity.

		Technical features						Environmental features			
		Density ρ (kg/m³)	Thermal conductivity λ (W/mK)	Hygroscopicity (% of its own weight)	Water steam diffusion Sd (m)	Thermal diffusivity α(m²/s)	Fire resistance (class)	Price (€/m²)	Energy (MJ/kg)	Emissions (kgCO₂/kg)	Biodegradable
Cork	Board	100	0.037	7	4.20	2.22 E-07	E	14.82	7.54	-1.72	Yes
	In bulk	65	0.040	7	4.20	3.68 E-07	E	10.55	6.75	-1.70	Yes
Hemp	Blanket	30	0.041	17	0.50	5.94 E-07	F	7.10	-	-0.62	Yes
Sheep wool	Blanket	14	0.043	33	0.50	1.81 E-06	F	7.50	18.92	1.55	Yes
	Board	35	0.035	33	0.40	5.88 E-07	F	10.29	16.64	1.45	Yes
	In bulk	20	0.041	33	0.50	1.21 E-06	B-s3d0	4.60	10.96	0.71	Yes
Cotton	Blanket	25	0.036	24	0.50	1.31 E-06	F	6.00	9.69	0.70	Yes
	Board	60	0.034	24	0.40	5.15 E-07	F	9.00	9.69	0.70	Yes
	In bulk	20	0.042	24	0.50	1.91 E-06	B-s2d0	2.20	7.46	0.46	Yes
Cellulose	In bulk	40-60	0.038	30	0.60	3.62 E-07	B-s1d0	2.12	5.55	-0.65	Yes
Wood fibres	Blanket	50	0.036	20	0.80	3.43 E-07	E	4.62	19.59	0.20	Yes
	Board	110	0.038	20	1.60	1.65 E-07	E	8.00	20.40	0.23	Yes
	In bulk	40	0.038	20	0.80	4.52 E-07	E	2.06	11.15	-0.34	Yes
Extruded polystyrene	Board	32	0.034	No	60	7.33 E-07	E	12.66	57.47	2.65	No
Glass wool	Blanket	35	0.032	No	0.40	1.14 E-06	F	7.45	44.81	2.95	No
Mineral wool	Blanket	70	0.034	No	0.40	6.07 E-07	A1	7.00	18.15	1.26	No
	In bulk	70	0.037	No	0.40	6.07 E-07	A1	6.47	20.30	1.03	No

Table 2. Technical and environmental features.

CONCLUSION

In this section, the conclusions extracted from the analysis and comparison of different traditional and alternative thermal insulators are presented, with respect to their technical and environmental features. The outcomes are divided in two parts, according to the insulator format. This decision responds to the different implementation in each case. The thermal insulators in bulk are generally used to be insufflated inside an air chamber while the blanket and board formats are meant to be attached vertically to a layer of the façade. The best in bulk insulators in a global scene are granulated cork, wood fibres and cellulose. While cork outstands due to its environmental factors, such as the fixation of CO_2 during its process (-1.70 $kgCO_2/kg$), wood fibres show better technical characteristics is aspects like the thermal conductivity (0.038 W/mK). However, cellulose insulator presents great performances in both fields and has a really competitive price (2.12 €/m^2). Regarding technical values, its thermal conductivity (0.038 W/mK) is one of the lowest of all the studied materials. It has a good hygroscopic behaviour (30%), an optimal behaviour in terms of thermal diffusivity and its fire resistance is type B. Environmentally speaking, cellulose presents a low energy consumption (5.55 MJ/kg) and a negative value of CO_2 emissions (-0.65 $kgCO_2/kg$). A quite surprising outcome of the study is that the price of the traditional insulator materials, which was supposed to be one of their biggest advantages, appears to be at the same level as some alternatives. In relation to board and blanket formats, the best options are wood fibres blanket, cork board and cotton both in board and blanket. In this case, each of the mentioned materials outstands for a reason. The wood fibres blanket presents one of the lowest prices (4.62 €/m^2) while cork board insulator presents excellent environmental features such as its negative level of CO_2 emissions (-1.72 $KgCO_2/kg$). With regard to blanket and board cotton, both present similar features. Blanket format stands out due to its low price (6 €/m^2), while board format is preeminent in relation with the thermal conductivity (0.034 W/mK). Nevertheless, both of them show comparable hygroscopic behaviour, with one of the higher values of the analysed materials (24%). Their water steam diffusion is optimal while their fire resistance is class F, the lowest. Concerning environmental performances, the energy provided during their life process is 9.69 MJ/kg and their level of CO_2 emission reveals one of the lowest values with only 0.7 $kgCO_2/kg$. Furthermore, due to their vegetable origin, they are biodegradable and recyclable materials. As a result, it is possible to acknowledge that due to its great balance between environmental behaviour, low price and good thermal conductivity, cotton thermal insulator is the most complete of the studied alternatives. Ultimately, this research can confirm that the best sustainable alternatives to traditional thermal insulators are cellulose in bulk format and cotton both in blanket and board.

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6

BLOCK 6: RESTORATION, CONSERVATION AND RENOVATION

PAPER #6.01

RESEARCHES AND PROJECTS BETWEEN CONSERVATION AND RENOVATION FOR THE FUTURE OF THE CITIES

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ABSTRACT

The paper proposes the synthesis of some recent research experiences carried out by the authors, in Genoa and Liguria Region. These researches, committed by public authorities (Ministry of Cultural Goods and Heritage, Regional Department of Culture) and public owners (the University of Genoa among others) are both theoretical and applied to single buildings or architectural complexes. Objects of the researches are, in some case, ancient monuments (in need of restoration, re-use and renovation) located in the consolidated tissue of the contemporary city. In other cases, we worked on Architectures belonging to the Modern Movement, spread off in our whole region that need to be known and appreciated by the community, as first, in order to be conserved and reused respecting their architectural, constructive, historical and social values. All the researches show a high interdisciplinary interaction and collaboration among experts in architectural restoration and conservation, consolidation of traditional buildings, history and archival researches, building physics, chemistry, ICT and digitalization, energy efficiency, thermal enhancements and technical equipment. These works have led to important operative consequences in terms of safeguarding, restoration, renovation and re-use, through the social engagement of local communities, with significant impacts on the future of the contemporary city. To quote some examples, we worked on the monumental complex of the "Albergo dei Poveri" in Genova (almost 60.000 square meters of total covered surface, built from XVII to XIX C.), preparing a general masterplan for its complete reuse and restoration (for crowdfunding). Another real case has been the historic palace Belimbau (one of the most important of the "Rolli Palaces" dating from medieval age and transformed since XVII C.). Thanks to our researches, the University obtained in this case some funds to restore the monumental rooms and open them to the city. We also worked on the ancient former church of the Jesuits' college (XVII C.), now abandoned and in need of a future destination and on the Prince Andrea Doria's Palace, one of the major Renaissance Villas in Genoa and, recently, on the Doge's Palace, in the heart of the city. Ancient and recent buildings are essential parts of the collective memory of the contemporary cities and built landscapes. Their permanence and transmission to the next generations are thus essential for a conscious, creative and not oblivious future and for human well-being. The paper deals with all these aspects going beyond the single case studies.

KEYWORDS

Conservation; renovation, cultural heritage; interdisciplinarity; digitalization.

INTRODUCTION

The expansion, for fields of interest and meanings, of the term "heritage", as suggested by the Italian Code of Cultural Heritage, leads not only the scientific community to question the values (testimonial, historical, economic, social and of other nature) conveyed by ancient but also

by recent and even very recent architectures. In this perspective also their fate and their protection, enhancement, redevelopment or, conversely, their definite oblivion and destruction, are nowadays on the fore as a matter of discussion. The continuously expanding universe of artefacts to which conservation and restoration necessarily turn their attention is in fact extraordinarily rich, for historical, constructive and formal variations, in time and space, and it escapes any claim of total and autonomous domination by a single discipline and, even more by individual technical operators. In fact, the forms and spaces of the artefacts change, according to the resources, places and historical moments of their realization, as well as their constructive principles, the techniques of working materials, the executive or installation devices adopted by blacksmiths, bricklayers and carpenters, belonging to the different material cultures involved. The causes of the processes and of degradation phenomena that afflict the buildings are also very changeable, from place to place, from time to time and from building to building, and this outlines a universe of very vast and complex problems that no single expert can face alone. We must therefore ask ourselves, since there is no answer that is valid forever and for everyone, whether we recognize and want to take those elements of our heritage as a real legacy of which to take care of, with the contradictions and shadows that every process of "patrimonialization" brings with itself. For this reason, it is necessary to raise the level of training, to allow future professionals and technicians to handle the increasingly complex demands and problems posed by contemporary society in regard with the fate of our heritage(s). The paper briefly illustrates the structure and the training objectives of the School of Specialization in Architectural Heritage and Landscape of the University of Genoa (Master-post-Master Programme), its links with the main cultural institutions and local and national bodies in charge of tutorship and safeguarding, its relations with advanced research activities and its impact on education.

1. RESEARCH AND INTERVENTION ON CULTURAL HERITAGE

1.1. An interdisciplinary path of higher education

The post-graduate training course of the School of Specialization responds to the extreme complexity of the field of architectural restoration, that involves many specialists. Among them are surveyors, analysts, chemists, physicists, technicians of different kind, restorers, expert in the various materials and constructive elements involved, structural engineers, historians, art historians and experts in artistic techniques and many others. The School, therefore, trains professionals characterized by a strong technical profile, rich in articulated and complex skills and competences but, above all, in those of cultural nature, rising their awareness and ability to rule the many aspects, sometimes even conflicting, that characterize this delicate field of study, design and practical work.

The School of Genoa has therefore a strong multi-layering and operative imprinting and the curriculum with the organization of teaching activities follow the phases and the sequence of operations that characterize a real restoration project, albeit in the "didactic" time of the two years of the course. In order to strengthen this objective, the final thesis also retraces the same analytical and planning path, put to the test in the "professional time" of about six months.

The teaching courses cover, in their articulation, the fundamental scientific, technical and cultural guidelines of restoration, nevertheless overcoming the apparent and rigid separation between the

two years of the course. The frontal teaching, the laboratory and practical experiences are therefore oriented to the acquisition of knowledge, skillsand competences necessary to carry out and to control the main and most common non-destructive analysis and diagnosis techniques on the material consistency of buildings and their behaviour over time. This involves a strong focus on documentary and archival investigations and rigorous architectural survey (through traditional and innovative techniques). Aside these, strong attention is given to chemical and physical, mineralogical-petrographic and technical-mechanical characterization of materials. Also the evaluation of the spatial and morphological characteristics of buildings, according to their potential use and compatible reuse, is crucial, as well as the exam of their technological and construction components, the analysis and diagnosis of decay phenomena, of structural instability, as well as of the environmental conditions that affect their consistency, stability, functionality and durability. Further, the School provides the knowledge and the necessary skills to design and coordinate the various forms and phases of intervention on existing buildings: from the preliminary design (of technical-economic feasibility) to the final and detailed one, including the methods of management of the entire building process. This includes the use of ICT tools, the knowledge of the construction phase, the direction and final assessment of the works, as well as the attention for fate of the restored good (planned maintenance and conservation, modes of use, management models). Within the didactic activity, at least one full day every week is dedicated to an "Interdisciplinary Laboratory". The laboratories are the instrument, the space and the occasion for outlining a path, guided by teachers, throughout the analytical-diagnostic inquires and elaborations, in the first year, and the design phases, in the second one. All activities regard a specific artefact and site, chosen in agreement with the bodies in charge of the protection and safeguard of cultural heritage or other local authorities, because of their cultural interest and on which they really intend to intervene with a restoration. By working on the selected artefact, the students have the chance to develop some clearly finalized studies and to elaborate on their basis a project characterized by correct proposals and feasible technical solutions for real needs. Moreover, the design choices must be culturally aware and coherent with the laws and regulations in force on the subject, with the different and often contradictory demands of protection, conservation, use and compatible re-use, environmental sustainability, improvement of energy and seismic behaviour, valorisation and future management of the restored good. Particular attention, during the first year of the programme, goes anyway to the use of information and communication technologies (ICT) for the cataloguing and management of data acquired during the study phases.

At the end of the first year, the students will acquire the following knowledge and develop the corresponding competences and skills:

- understand the architectural artefact, through the related studies of its geometries, building elements and materials, surfaces, structures and stability, spaces, accessibility, usability, functions and safety;
- understand the transformations of the building over times, relating the results of historical reconstructions from indirect sources and those deriving from direct archaeological analysis;
- evaluate the state of conservation of the building, as a whole and in its individual parts and construction components, recognizing phenomena of decay, damages, failures, deficits affecting materials and installations, construction elements, systems and structures;
- identify the causes and extent of damage, failures and deficits, assess the

vulnerability and level of exposure of the good to the aggression of environmental factors and related risks of different nature;
- assess the compatibility between the functions and current uses, the characteristics of the available space, the characters of the structures and the primary needs of conservation;
- manage sets of information of various kinds, complex, heterogeneous and evolving in time, through relational databases and, in general, digital data management systems (GIS, BIM, …);
- Identification of adequate criteria and guidelines for the design of the interventions of conservation, restoration and redevelopment of buildings and spaces of cultural interest.

The second year faces the elaboration of the real restoration project of the building object of interest during the first year. At the end of the second year, the student should therefore acquire the following knowledge and develop the corresponding competences and skills:
- consciously and critically use the results of the studies and of the analytical and diagnostic phases developed during the first year and integrate them where necessary;
- identify the general objectives of the project of restoration of the involved building and the strategies to pursue through a gradual focus (from the programmatic phase to the technical final report of the project and its graphical-digital and administrative elaborates);
- motivate the project's choices with reference to the contemporary methodological, disciplinary and cultural debate and to some similar significant examples of interventions carried out in recent years;
- adapt the project to the regulations (related to earthquake's resistance improvement, fire-proof, overpassing of architectural barriers, containment of energy consumption, ...), identifying solutions consistent with the conservation objectives, respecting the specificity of the protected property;
- choose the type of installations (heating, cooling, lighting, air treatment) necessary and most suitable, in relation with the conditions of use of the building, the needs of conservation and enhancement of the property and the current standards of regulation and comfort;
- choose the most appropriate materials, techniques and products for the restoration interventions, based on the specific needs of the building, the surrounding environmental conditions, their technical and commercial characteristics, in a cost-benefit conscious budget.

1.2. The Laboratory of Analytical Methods for Restoration and History of built Heritage (MARSC)

The teaching of restoration in the School of Genoa can count on the technical and operational support of the Laboratory of Analytical Methods for Restoration and History of the Built (MARSC Laboratory of high qualification of the University). The Laboratory comprehends three sections: dedicated to: analytical methods for architectural survey, archaeology of architecture and characterization of materials.

Among the research activities and the fields of applications developed by the section dedicated to the survey we can remember:
- rigorous longimetry for the three-dimensional survey of architecture and and solid modelling;
- topography for architecture;
- the rigorous analytical and digital, flat and three-dimensional analytical photogrammetry;
- simple and mosaic rectified photos for the relief of flat surfaces (ortho-photos), also deriving from clouds of points obtained through the use of laser scanners or with structure from motion techniques;

- advanced information systems for the management of the restoration project (interoperable relational data-bases, GIS, BIM, WEB-GIS);
- the treatment and quantitative analysis of digital images for the recognition of materials and decay phenomena and the simulation of the expected results of the restoration interventions;
- the construction of repertoires and repositories of adequate techniques of intervention in restoration.

The second section of the Laboratory, dedicated to the Archaeology of Architecture, is the development of the laboratory founded at the end of the 1980s by Tiziano Mannoni and is dedicated to the study of the constructions of the ancient and recent past, in their quality of direct "material sources". The section developed many methodological and applied researches within the field of stratigraphy and archaeology of architecture to reconstruct the history of the buildings and to date its materials and constructive elements. Also important are the analysis of documentary sources and the analysis of decay phenomena and structural instability conducted according to a historical perspective, in order to provide restoration designers with extensive and integrated elements of knowledge and evaluation in this field.

The third section of MARSC, is devoted to the study and characterization of the materials employed within buildings of historical and cultural interest. The areas of research regard the pre-industrial production of binders (with particular regard to dolomitic limestone), the formation of lumps in lime mixes, the role and characteristics of hydrating agents in mortars. The production and processing of iron in pre-industrial times, with attention to its structural use in tie rods is as well a research theme with the use of pigments in fresco and dry colouring

2. EDUCATION AND RESEARCH: A NECESSARY COMBINATION

Alongside the traditional educational activities, the School reserves adequate space for practical experimentation, proposing to the students an intervention of restoration and reuse of buildings and sites of cultural interest, based on real needs. The buildings and sites for each year's work belong to historical centre of Genoa or the Liguria Region that require conservation, consolidation, restoration, and enhancement and eventually a compatible re-use. In agreement with the public or private owners of the selected buildings, the students work on the analytical and diagnostic phases (first year) and in the elaboration of design hypotheses in the second year, as already mentioned. Much of the matters thought can thus be immediately reflected in the design activity, with contributions by many specialists in subjects like technical installations and equipment, safety and accessibility requirements, lighting solutions, energy saving and comfort improvement. The projects reach the definite level and executive details with the necessary technical and estimative documentation.

The buildings or monumental complexes described in the following paragraphs have been the subject of research funded at national or local level, and represented for the students the occasion to achieve methodological, technical and cultural advancements.

2.1. The Doge's Palace of Genoa: prisons and the "Grimaldina tower"

The Doge's Palace, currently the heart of the city's cultural life, was the seat of the first Genoese Doge, Simon Boccanegra, during the early medieval age. The first Palace incorporated different pre-existing buildings, in a glorious moment of the Republic of Genoa, after the victories against the Pisans (1284) and the Venetians (1298) that gave Genoa the supremacy within the Mediterranean basin.

The so-called "Grimaldina Tower", between XII-XIII centuries, knew some transformations and the addition of a new floor in the first half of the 16th century. Between the 14th and 15th centuries, the Palace enlarged, until it reached a closed configuration along the four sides of an inner and secluded courtyard (now Piazza Matteotti). The succession of the porticos and courtyards and the covered atrium belong to the 16th century constructive phase due to architect Andrea Ceresola, known as "Vannone" who designed and built also the monumental double staircase leading to the main noble floor. In 1777, a great fire almost completely destroyed the palace and architect Simone Cantoni, who also came from Ticino district like Vannone, was committed to rebuild the damaged parts among which the great rooms of the Maggiore and the Minor Consiglio, on the first floor with their covering structures and the Doge's apartment. He adopted for the roofs a solution characterized by parabolic arches in bricks, without using wooden beams (still surviving in the Minor Consiglio), thus preventing the risk of a new fire. The Grimaldina Tower is, together with the Lantern (the medieval lighthouse of the harbour), a string symbol of the political power of the Oligarchic Republic. Its inner spaces, together with others located above the Doge's Apartment, were in the past a jail where also famous prisoners were imprisoned along the centuries (Niccolò Paganini, Jacopo Ruffini...). The objective of making the spaces of the Tower accessible and ready to host a small museum (exhibiting objects found during the restoration works of the 90s of the 20th century) required the students undertake a refined analytical and design path throughout so many and precious signs of the history and memory of .the city. In this way, the School will answer to the needs expressed by the Direction of the Foundation of the Ducal Palace contributing to a wider social use of this monument of the city.

Figure 1. Doge's Palace, the Salone del Maggior Consiglio. Source: (G. Franco 2020)

2.2. Former Church of SS. Gerolamo and Francesco Saverio, former seat of the University Library of Genoa

The Church of the Jesuits' College of Genoa, currently hosting the Rectorate of the University, was built in the mid-seventeenth century by the nobleman Francesco Maria Balbi on the ruins of an older church, adjacent to the convent of the nuns of St. Augustine. The church, with a single nave and four side chapels (partly added afterword), was decorated with frescoes by Domenico Piola, one of the most important painters of the period.

With the suppression of the Society of Jesus (1773), the Republic of Genoa assigned the College and the Church to higher educational institutions; at the beginning of the 20th Century, the former church was transformed into the Natural History Museum of the University. In 1915, the "Casa del Soldato" (Soldier's House) was installed in the Rectorate also using the former church, which knew afterwards further transformations (insertion of side galleries). In 1926, Eng. Arch. Carlo Fuselli presented the first project for the insertion of the University Library inside the church; the project aimed at the division in height of the nave thanks to a new reinforced concrete ceiling at the base of the vaults, to create the books' stores below and the reading room above it. After of Fuselli' death the Superintendence for Monuments, in 1934, committed to architects Mario Labò and Giuseppe Crosa di Vergagni the design of the

University's library inside the former church, to recover and ameliorate the works already realized. The Library was inaugurated in 1935 and, in 1947, it was transferred to the state's property.

Figure 2. Frescoed apse in the former church of Saints Gerolamo and Francesco Saverio. Elaboration of the photoscan survey. Source: (MARSC 2019)

In 1966, the complex of the former Jesuits' collegium with its church was recognized as of "Cultural Interest", according to Law 1089/39, "because it preserves the original 17th century façade and, inside, valuable frescoes by Domenico Piola in the apse area". Following the recently completed transfer of the University Library to another location (the former Hotel Columbia, via Balbi 40), the church has been closed to the public since 2014 and is currently abandoned, in needs of conservation and restoration interventions with new compatible uses. The School is now working to support the local Superintendence in this perspective thus giving a real contribution to the City development.

2.3. Villa of Prince Andrea Doria in Fassolo, Genoa

The "Palazzo del Principe Andrea Doria" (the winner of Lepanto's naval battle against the Turks), built during the first half of XVI century incorporating some pre-existing buildings, is one of the largest and most important noble residences of the Renaissance age in Genoa. The Villa is known for a significant decorative cycle, realized by Perin del Vaga, Raphael's best pupil. The monumental complex, that comprehend a Italian-style garden towards the sea (with a private landing place, no more existing) and a romantic park (now completely disappeared) towards the hills on the back, was enlarged by Andrea's heir, Giovanni Andrea I. Today, the Palace still houses the Doria Pamphilij family and a museum full of masterpieces of art. The eastern wing of the Villa, partly unused, contains spaces of considerable interest, partly belonging to pre-existing residences. The students of the School of Specialization consulted public and private archives, recovering many documentary and iconographic sources about the history and transformations of the complex. They also realized a rigorous topographic and laser-scanner survey and studied the material consistency of the artefact, its constructive techniques as a primary and direct source of information about its history. This allowed us to re-write a history almost completely unknown to the city, even if it is in a focal and a crucial point of it. The Trustee Florida Doria Pamphilj that manage the complex asked

Figure 3. Villa of Prince Andrea Doria, XVI Century. Source: (G. Franco 2018)

the School to develop these researches and to provide some design suggestions for the restoration and the compatible-sustainable re-use of its east wing and its valorisation for the entire city.

2.4. "Belimbau Palace", Genoa

The Belimbau Palace, located in the heart of the ancient city and at the junction between "Piazza della Nunziata" and "Via Balbi", belongs to the system of Rolli palaces destined to host the most illustrious guests of the Republic of Genoa. It belonged to noble families until the end of the 20th century when their last descendant left it to the University of Genoa, which is now taking care of its complete restoration and reuse. The Palace was built at the behest of the nobleman Francesco De Ferrari at the end of the 16th century by incorporating some pre-existing buildings and the rests of the medieval aqueduct still visible in the body of the façade. The pictorial decorations by Lazzaro Tavarone (pupil of the great painter Luca Cambiaso who ended his life in L'Escorial in Spain) are among the most important of the XVII century in Genoa. The frescoes decorate the vaults of the atrium, of the staircase, the entrance loggia and the main room of the first noble floor (with one of the first representations of the natives of America and of Christopher Columbus kneeling in front the Queen and the King of Spain coming back from the Americas). Between the end of the 18th century and the early 19th century, the Palace underwent a major renovation of the monumental staircase and of the main façade. Over the centuries, the Palace knew several fragmentations into single apartments and suffered many modifications that make now difficult to read and completely understand its original configuration. Together with the Head of the Technical Office of the University and under the supervision of the teachers, the students of the School conducted many analytical and diagnostic activities aimed at better understanding the evolution of the Palace and its current state of conservation. The materials thus produced and the knowledge acquired thanks to them made it possible to obtain some funding by the Italian Government for the restoration of the monumental spaces of the palace, for its future public use.

Figure 4. Belimbau Palace. Elaboration form photo-scan and laser scan survey. (Laboratory MARSC 2017)

2.5. Albergo dei Poveri, Genova

The "Albergo dei Poveri" (the Poors' Hostel) in Genoa is a vast welfare complex dating from the middle of 17th century, built outside the city walls, radically modifying a natural valley. It was built for philanthropic purposes (at the behest of the nobleman Emanuele Brignole Sale) but also as a sort of seclusory for poor people. The complex, afterward incorporated into the expansion of the modern city (after the demolition of the city walls in the first half of XIX century), lost its original role and was definitely abandoned in the late Nineteens of XXth century. The complex, in force of a loan, is now in the hands of the University that is in charge of its management and already restored and reused about 30% of its covered surface for the departments of humanities and law and their didactic spaces. However, an exact knowledge of the physical state of the structure and its spaces was missing until recent years. The School of Specialization, on behalf of the Rectorate therefore concentrated the teaching activities for some years on the study of this vast and very important

architectural complex. It has been also a case study within a Research Programme of Significant National Interest (PRIN 2010-2011). It investigated the possibility that the computer tools of parametric nature, that facilitate the management of cognitive,design and management data, could be adapted to the needs (theoretical, cultural, technical and operational) of a complex reality such as an architectural and urban monument of ancient formation and stratified consistency like the Albergo. The School thus developed rigorous architectural surveys (topographic, longimetric, digital photogrammetric, Z-scan, laser scanner, Structure from Motion), a BIM and a GIS information system, for the collection and archiving of the numerous data collected. The constructive characteristics and the macro-conditions of conservation of the complex were as well investigate and recorded alongside the identification and location of the most relevant risk factors, the correlated most urgent interventions, the functional layout for the entire complex and some design hypotheses on single parts related to new possible and compatible uses. Thanks to these studies and design explorations, several new restoration interventions are now going on.

CONCLUSION

The few quoted examples of studies carried out during the years by the School of Specialization show how the University can provide real and effective contributions to the future life and quality of the contemporary cities. Knowledge and technical or professional expertise are in fact necessary for any intervention, at any scale, on the continuous material palimpsest of our cities, very often multilayered not only in material terms but also in symbolic end social ones. The quoted buildings, as many others, ancient or recent, are essential part of the collective memory of the local communities if recognized of cultural, architectural, historical and social or economic value. Their fate thus depends first on their knowledge and shared appreciation among the citizens. On this level lies a first fundamental filed of commitment for the University. We can/must in fact spread of the knowledge we can acquire whilst educating and training future professionals culturally aware and technically strong and ready to face the many challenges the destiny of these or other buildings, in strict connection with the entire urban fabric they belong to. Then University can support their public and private owners in looking for the necessary economic resources for restoring, enhancing and correctly re-using them in order to be still part of the city's life. Further University can provide several forms of design explorations of possible solutions, thus increasing the quality of the whole process, from the planning scale to the real construction sites. University can and must thus play a real role for the future of our cities.

Figure 5. The Albergo dei Poveri, front facade. (MARSC 2016)

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PAPER #6.02

A BIBLIOMETRIC REVIEW OF LIFE CYCLE RESEARCH OF THE BUILT ENVIRONMENT

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ABSTRACT

Life cycle assessment (LCA) has been used as an analysis tool to help decision-makers plan for mass urbanization and building construction; however, the research to date focuses on either the individual building scale or overall urban scale. Although several methodologies have been applied to both scales, the results have not been reconciled or synchronized. In light of this, this paper first presents a systematic literature review using bibliometric network data to assess state-of-the-art knowledge of the use of LCA at different scales from 1990–2017. Second, the paper identifies the main research foci at the building and urban scales. At the building scale, three research focal points are identified: building materials and products, design solutions, and energy consumption/ emissions reduction. At the urban scale, there are three research areas of focus as well: urbanization and infrastructure planning, urban metabolism (water/energy/ waste synergy), and complexity of urban issues. Next, the most influential papers and journals are presented. Drawing upon the findings from the literature review, major gaps in current research activities are identified as the building-centric approach, energy performance–centric approach, and lack of consideration for uncertainties. These are critical areas requiring further study and research

KEYWORDS

Life cycle assessment; literature review; urban scale; building scale; bibliometric network data.

INTRODUCTION

Addressing the ecological impacts of the built environment requires an understanding of global trends in the building sector. Life cycle assessment has been used as an analysis tool to help decision-makers plan for mass urbanization and building construction; however, the research to date focuses on either the individual building scale or overall urban scale. Although several methodologies have been applied to both scales, the results have not been reconciled or synchronized. Many studies have centered on quantifying environmental impacts at the building scale (Utama et al. 2009, Treloar et al. 2000, Fay et al. 2000, Utama et al 2008, Li et al 2011, Wang et al. 2005, Bribian et al. 2009), and robust methodologies have been established and developed. At the urban scale, certain methods have been implemented and tested to quantify the ecological impact of large built environments that include multiple buildings (Stephan et al. 2013, Kennedy et al. 2011, Davila and Reinhart 2013). However, assessments of environmental impacts of buildings and urbanization have been largely confined within their own singular scales. An overview of research activities, foci, and trends is the first step to creating an integrated framework to understand the environmental impacts of the built environment. A review of cutting-edge knowledge in the life cycle assessment (LCA) approach and studies on the built environment is meant to (1) identify the main research areas within each scale, (2) gain insight into the size of the different research focal points, and (3) identify any research gaps.

1. RESEARCH METHODS AND TOOLS

Bibliometric research is a research technique for studying science-based citation data, which originated in the early twentieth century. Citation analysis (CA) and Co-citation analysis (CCA) are very well- established branches of bibliometric research that are used to evaluate the relative importance or impact of an author, article, or journal. Since citation frequency reflects a journal or article's value, citation analysis can be conducted to establish the impact of a particular study and identify the research focus and pattern, based on citation patterns (Garfield 1972, Narin 1976, Moed 2006, Harzing et al. 2008, DeBellis 2009). Applying mathematical and statistical models in CA and CCA are primary techniques that are used to date. Rapid changes in digital technology have introduced new techniques and methods that are used in bibliometric research to capture large amounts of text data available online. For example, Text data mining (TM) is a fast-developing technique that extracts critical information from unstructured datasets—unlike citation. TM techniques involve information retrieval, text analysis, information extraction, clustering, visualization, machine learning, and data mining (Nagarkar et al. 2015). TM is particularly viable in a multidisciplinary research where co-citation patterns appear to be difficult to decipher. Integrating TM in citation and co-citation analysis helps researchers to process unstructured information, such as abstracts from a thousand papers, in the matter of a couple seconds and extract the meaningful numeric indices from the text, eventually feeding them into statistical and machine learning algorithms. Using machine- learning algorithms, the information derived from a large text dataset could be used to form meaningful and rational summaries or conclusions based on the words contained. This method/technique could be used on clusters of words or to determine the relationship between words. Put simply, text mining turns words into numbers that can be computed and analyzed.To analyze and interpret the results from CA, CCA, and TM, maps are often constructed to help visualize the data. For this project, VOSViewer was chosen for its two-dimensional distance-based map (Moed 2006). VOS stands for "visualization of similarities" and aims to locate words in a low-dimensional space in such a way that the distance between two words reflects the similarity or relatedness of the words as accurately as possible (Van Eck et al. 2009). VOSviewer constructs a map based on a co-occurrence matrix and consists of three steps. The first step is to obtain a similarity matrix; in the second step, a map is constructed by applying the VOS mapping technique to the similarity matrix; then, in the final step, the map is translated and reflected. In a VOS-constructed map, different cluster maps represent different research foci; the sizes of the nodes indicate the relevance of the items—including research topics, authors, sources, or countries—and the distance between nodes illustrates the intellectual connections.

2. THE HOME-WORK LINK

VOSviewer map was used to determine influential studies, thinkers, and concentrated research topics and their correlations. In order to identify the research areas of focus, a term map was created based on a corpus of scientific publications. The corpus of scientific publications includes 1,063 articles found in Web of Science (WOB) from 1990–2017 using the key search words, "life cycle assessment," "life cycle analysis," "buildings," and "architecture." The co-occurrence frequencies of terms (text) were determined based on a minimum of 20 occurrences of a term, and out of the 22,459 terms, 315 meet the threshold.

For each of the 315 terms, a relevance score was then calculated. Base on this score, the most relevant terms were selected, with the default choice in the program being to select 60% of the most relevant terms. Altogether, 189 terms were selected for LCA research at the building scale, with the results shown in figure 1. Based on VOSviewer clustering techniques, the terms in the dataset were divided into three clusters, with the colors indicating the different research clusters and the adjacency of nodes from different clusters suggesting the intellectual connection of different fields.

• Cluster 1 (blue): building materials, products, environmental assessment, impacts (left)

• Cluster 2 (red): design solutions/costs, sustainability/criteria, framework (right)

• Cluster 3 (green): energy consumption, emissions, reductions (lower)

These clusters represent three major research focal points: *building materials and products, design solutions, and energy consumption and emissions.*

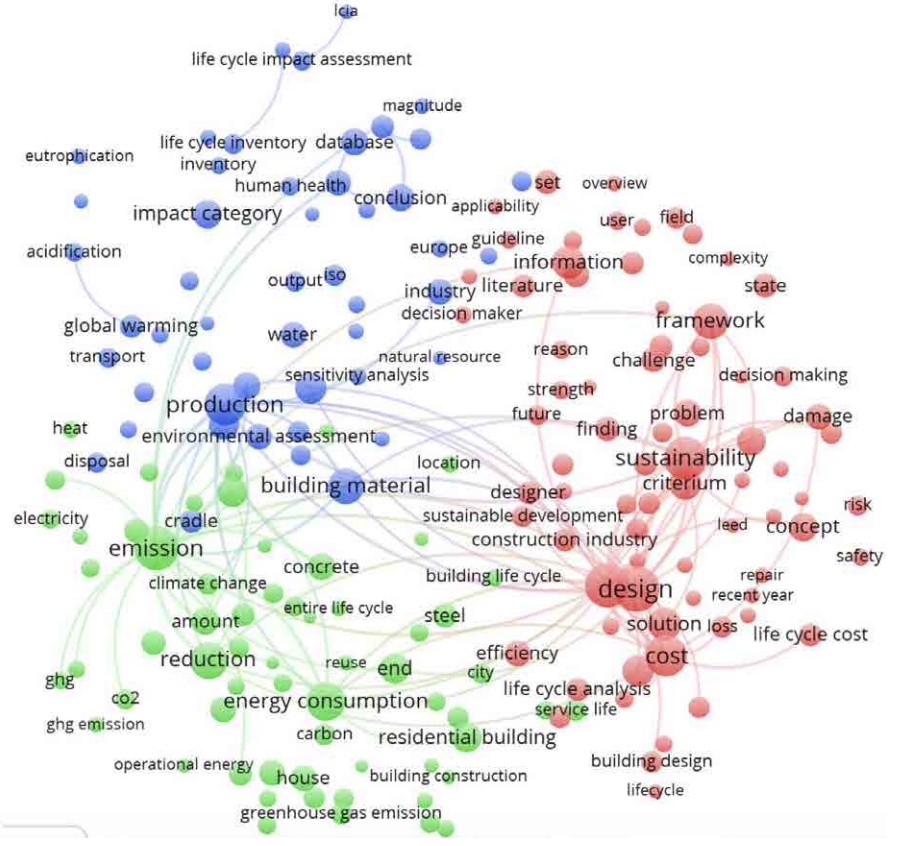

Figure 1.Term map representing the main research areas of LCA at the building scale

Cluster One: Building Materials and Products

The majority of building materials studied in academic publications concentrate on conventional materials used for base building, such as concrete and steel framing. Concrete and steel account for 20–35% and around 12–22%, respectively. Together, steel reinforcement bars and concrete account for 50–80% of the environmental impact from buildings. Consequently, one of the basic ingredients of concrete— cement—has been studied extensively. It accounts for 4–5% of overall CO2 emissions from the building industry (Chau et al. 2007, Guggemos and Horvath 2005, Bribián et al. 2009, Wu et al. 2005). Other common building materials that have been researched are brick and wood (Tettey et al. 2014). Koroneos and Dompros (2007) used data provided by a local brick manufacturer, together with published references, to study the brick production process and identify possible areas for improvement in brick production. Additionally, Ximens and Grant (2012) quantified the greenhouse benefits of wood products and found that replacing all floors and sub-floors with timber could reduce greenhouse gas emissions from buildings. Jönsson et al. (1997) studied different kinds of floor materials—including wood, vinyl, and linoleum—and concluded that solid wood appeared to be the most environmentally preferable material. The most commonly used building materials have not changed for decades, and, following 2014, there has not been much grounding-breaking LCA research about building materials. The only new, advanced material to become a research focus in the past three to five years has been nano-materials—phase- change materials and their application as paint, coating, and building envelope materials.

Cluster Two: Design Solution

The second area of focus is architectural design, which includes location, orientation, building façade design (glazing ratio), building density and massing, and related sustainability criteria. Pacheco and team members studied different design factors—such as building compact factors, orientation and shape, and building envelope—and concluded that the factors with the greatest repercussion on the final energy demand were building orientation, shape, and the ratio of the external building surface to the building volume (Pacheco and Martínez 2012). Building orientation and shape are major design decisions made in the early design stage that cannot be reverted; therefore, integrating the concept of LCA in the early design stage will help the design team to find an optimized solution for building performance while minimizing the environmental impact. Even with active research in this area, the knowledge translation has been slow. While there are several quite robust design codes for building mechanical system optimization (occurs in a later design stage), such as the ASHRAR standard, there is a lack of systematic design guidelines focused on architectural design optimization. Consequently, the opportunity to translate the research findings into practical design solutions is tremendous.

Cluster Three: Energy Consumption and Emission Reductions

This area is expected to produce results since energy consumption has a direct correlation with emissions reductions, and it is the only overlapping research focus in both the building and urban scales. This research focal point examined the construction process, operation phase, and building material-acquiring phase, and results reveal that the energy consumed during the construction phase accounts for a very small percentage and, therefore, has little environmental impact on the entire building life cycle. The main influential phase is the building operating phase, and the largest environmental impact, CO2 emissions, is associated with the operating energy (Flower and Sanjayan 2007, Norman et al. 2006, Fuller and Crawford 2011,

Jiao et al. 2011, Jones and Kammen 2014, Glaeser and Kahn 2008). The second most important consumption category is embodied energy. Venkatrama Reddy and Jagadish estimated the embodied energy of a residential building consisting of different low-energy materials and obtained a 30– 45% reduction in embodied energy (Jones and Kammen 2014).

3. FINDINGS - URBAN SCALE

The process used in section 3.0 was repeated to identify research focal points of LCA at the urban scale. The corpus of scientific publications that included the 340 articles from WOS was used to create a term map, with the keywords used in the search being "life cycle assessment," life cycle analysis," "urban," "city," and "district." The size of research activities at the urban scale is substantially smaller than those at the building scale; therefore, less occurrence frequency was used to create the term map. The co- occurrence frequencies of terms (text) were determined based on a minimum of 10 occurrences of a term. At the end, 296 out of 13,218 terms met the threshold. For each of the 296 terms, a relevance score was then calculated. Based on this score, the most relevant terms were selected, with the default choice in the program being to select 60% of the most relevant terms. Altogether, 178 terms were selected for LCA studies at the urban scale,

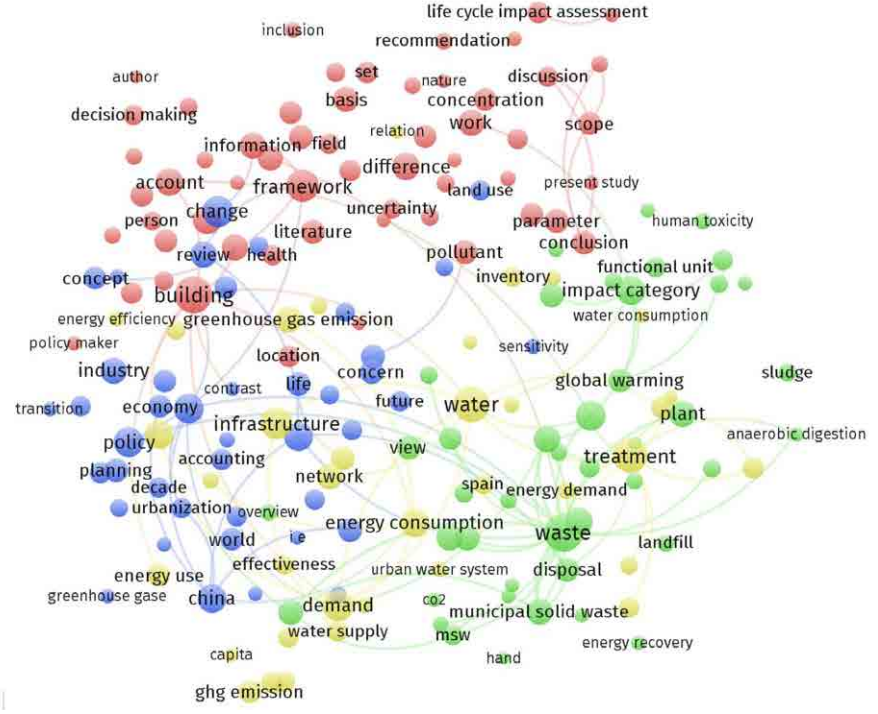

Figure 2. Term map representing the main research areas of LCA at the urban scale

with the results shown in figure 2. Four clusters of terms are illustrated in figure 2.

• Cluster 1 (blue): problems, urbanization/ planning, challenges/changes (left)

• Cluster 2 (red): building, information, framework (upper)

• Cluster 3 (green): waste, global warming, impact category (right)

• Cluster 4 (yellow): infrastructure, water/ treatment, greenhouse gas emissions (middle)

Cluster 4 is interwoven with clusters 1 and 3; in the term map, the closeness of the terms represents the intellectual connection and shared research interests and trends. Therefore, the author investigated the combination of clusters 1 and 4, with this focused research area redefined as ***urbanization and infrastructure planning***. Next, after combining clusters 1 and 3 together, one clearly defined focus area emerged: waste, water, and energy. Cluster 2, however, did not appear to have a clear leading term like the other clusters and is relatively separated from the other three clusters. Furthermore, its research terms appear to illustrate a high-scale challenge related to LCA at the urban scale, including framework and decision-making, building, and health. Accordingly, we gave this area of focus a more general description: *human factors and future uncertainty.*

Cluster One: Urbanization and Infrastructure Planning

A number of studies have examined the impact of residential and commercial density on energy use and life cycle costs within urban regions (Anderson et al. 2015). Low-density suburban neighborhoods were found to have higher energy use and GHG emissions per capita compared to a high-density urban core (Borg and Groenen 2005, Newman et al. 1989, Zhang et al. 2010). Increasing population density while maintaining low-rise building typology tends to reduce the total energy demands and associated greenhouse gas emissions per capita (Borg and Groenen 2005). Another important finding was that a reduction in house size had a positive impact on decreasing overall urban energy and material use. The composition of urban space impacts—mixed use versus single use—also demonstrates the impact of use on energy efficiency. The results found that households in urban centers had lower emissions than their suburban counterparts; however, the urban sprawl could neutralize all the benefits from urban development and redevelopment (Zhang et al. 2010, Conte and Monno 2012, Turconi et al. 2014).

Cluster Two: Waste, Water, And Energy

The second area is waste, water, and energy, which can be summarized as urban metabolism. An urban metabolism framework was developed with the aim to provide a foundational understanding of city resource uses and distribution (Naess 2009). Urban metabolism was originally developed by Wolman in 1965 as a methodology for measuring a city's overall energy, materials, water and nutrient inputs and outputs, and related processed and transformative energy and resources (Chester and Horvath 2012). Until now, the application of metabolism has been focused on energy consideration. Many studies on this have been conducted, including Ristimaki and team members who found that, in comparison to district heating, a ground source heat pump including 10% renewable energy was the most cost-effective method for an urban area with a 100-year life span (Newman and Kenworthy 2015). The shortcomings of the urban metabolism method lie in its lack of inclusion of upstream effects or a quantitative impact assessment regarding the local environment or human health. In a

recent report produced by a research team from the University of California, Berkeley, the research team assessed how the life cycle assessment method could beintegrated with urban metabolism to develop comprehensive energy and environmental inventories. Consequently, this approach could compensate the shortcomings of the traditional metabolism method.

Cluster Three: Human Factors and Future Uncertainty

The third area includes all topics relating to the complexity of urban issues, such as building-related health issues, decision-making, and associated information. Urban and built environments can be understood as complex social-ecological systems, where multiple related metabolisms interact at different scales (Berkes and Foke 1998), with the building representing just one scale in the holistic system. However, the cluster two (building) unlike others that are intertwined together, is isolated from infrastructure, planning, and energy consumption in other clusters. The disconnection of this cluster from others may be due to the emerging transdisciplinary research represented within the core of building industry: decision science, uncertainty theory, parametric modeling, and economy. The integration of multidisciplinary research is still in the infant stage, where including human factors as part of the decision-making process has been challenging due to uncertainty. Therefore, it will take some time before this research focus is mature enough to reach out to other areas. died energy (Jones and Kammen 2014).

4. DISCUSSION

In the current prevalent building-centric analysis approach, an individual building is regarded as a function unit, with individual building performance as the top priority. Analysis at the individual building scale treats the building as a stand-alone object, isolated from its context within the built environment (Anderson et al. 2015). This approach reflects the conception of the building as a consumer of resource and energy rather than as a producer of sustainability at different spatial scales (Turconi et al. 2014). Currently, life cycle energy consumption of buildings includes embodied, operational, transportation, construction, and demolishing energies. However, all of these are direct energies whereas several significant indirect energy types have not been included in the evaluation of building performance, which could represent a large missing portion. For instance, an office located in a dense urban space will result in much less energy being spent by occupants on commuting, due to widely available public transportation.

Another misleading concept, according to Pacheco's study, is the energy performance center: "A more energy-efficient building design does not necessarily coincide with more economical or more environmentally friendly designs" (Pacheco et al. 2012). The contribution of a building to sustainable development is assessed based on building performance (Kibert and Grosskopf 2012), with performance often quantified by energy performance and efficiency. Other indicators—such as indoor air quality, thermal comfort acoustic quality, visual comfort, and the occupants' well-being and satisfaction—are equally important to building energy performance (De Nooy et al. 2018, Rodríguez et al. 2013). Currently, some studies have tried to integrate those factors; however, a standardized procedure is still lacking.

The last knowledge gap involves the inclusion of temporal and human factors in LCA. Unlike other commercial products, a building has a much longer life span—about 50–75 years—and the use phase can have large environmental impacts, with multiple renovations and building upgrades related to building technology developments.

Variations within the use phase can sometimes be greater than the total impact of the materials, construction, and end-of-life phase (Burnett 2007), and the variations are often caused by the users' decisions, or human factors. The most current LCA studies of built environments use a static model that assumes the impact factor is constant over the time span. This could result in an inaccurate projection, as building materials and systems are constantly changing and improving. Instead, the measurement should have a dynamic framework, rather than a static one, to accommodate technology development.

Based on the findings from the literature review, the author can conclude that significant progress has been made over the past twenty years of life cycle studies and assessment at the building and urban scales, respectively. Very few studies have been conducted on integrated LCA for buildings within an urban context; such studies could reveal hidden factors and result in new findings.

CONCLUSION

The built environment assists societies in meeting basic needs for shelter and security. Throughout time, it has increasingly developed to provide greater scales of comfort and amenities, albeit with considerable environmental impacts (Chester and Horvath 2009). Accordingly, a comprehensive LCA framework that integrates different scales of the built environment could play a major role in promoting the reduction of related ecological impacts. Most current LCA studies are confined to their own scale and scope while lacking consideration of other related factors, such as population density, urban density, transportation accessibility, open space, and public parks. It is imperative to synergize LCA at the building and urban scales together, using an integrated framework. The potential to use an integrated framework in both urban planning and a building design context is a relatively new development. At the building scale, early adoption of an integrated framework could help designers, architects, and engineers find optimized solutions through quantitative analyses and evidence. At the urban scale, the planning process is a matter of organizing land use and optimizing resources, materials, and the energy flow within city boundaries. Therefore, a future integrated framework could be used in two ways: either as an analysis tool to aid the decision-making of government officials or as a design tool for urban planners. There is also a need for the planning and design community—specifically, architects, engineers, and planners—to work together as a synchronized unit to set up work for a higher level of LCA integration in the built environment (Chester and Horvath 2012).

This research project identifies primary LCA research activities at the building and urban scales, followed by an explanation of the main research areas of focus and an outline of the knowledge gaps. Findings from this research project include other important environmental factors and also provide a foundation for further studies of an integrated framework incorporating LCA from different scales. There are limitations in this research, as LCA was divided into two macro-scales: building and urban. Significant differences exist between different micro-scale urban contexts—such as city, neighborhood, and district—thus there are specific considerations related to each individual scale.

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PAPER #6.03

COMMUNITY PRESERVATION OF DISTRICTS: THE *BROWNSTONERS*. THE CASE OF BEDFORD-STUYVESANT

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ABSTRACT

The preservationist movement started in New York City in the mid 1960s, as a reaction to the losses of a series of historically significant buildings for the city. In response, the Mayor Robert F. Wagner, Jr. enacted the Landmarks Law in 1965, which laid the foundations for the creation of the Landmarks Preservation Commission, main municipal agency in charge of safeguarding built heritage in New York City.
In these same years, a group of intellectuals created an association to protect the brownstones, a housing typology characteristic of New York City in the 19th century. These activists called themselves brownstoners, and their mission was to fight against the massive demolitions of this type of dwelling and their subsequent replacement by modern apartment buildings.
In New York City, on top of the philanthropic contributions coming from the private sector (something typical of American culture), it is paramount the work of local associations and the same citizens when it comes to deciding which buildings and collections of them are liable to be granted landmark or historic district status.
An example of a historically deteriorated neighborhood at the heart of Brooklyn was taken, Bedford-Stuyvesant, in order to prove how community efforts can have a determining effect on the Commission's decision to have a collection of buildings designated as a historic district.
This system of heritage management that gives so much importance to community support may be a valuable contribution to the model that currently prevails in our country.

KEYWORDS

Heritage; preservation; brownstones; bedford-dtuyvesant; New York City.

INTRODUCTION: BUILT HERITAGE PRESERVATION IN NEW YORK

In the United States, public awareness about the importance of protecting historic buildings is something relatively recent. The New York Landmarks Preservation Commission (LPC) was created in 1965 when the Mayor Robert F. Wagner signed some legislation in response to the losses of several historically significant buildings.

Figure 1. Pennsylvania Station, 1911. Source: (Library of Congress, Prints and Photographs division, Detroit Publishing Company Collection 1910)

Figure 2. Row houses in the Brooklyn Heights historic district, 2012

The most infamous and controversial of these losses was Pennsylvania Station in 1963, when the building designed in 1911 by the renowned architectural firm of McKim, Mead & White (Fig. 1) was demolished to make way for the multipurpose venue Madison Square Garden. Some years later, there was another milestone, also related to a train station, Grand Central Terminal. In this case, the Commission rejected the construction of a 55-story tower above this station. The case was taken before the U.S. Supreme Court, which decided to keep the historic building as it was, victory in favor of the preservationists that strengthened the Landmarks Law and validated the preservation movement across the country. As well as protecting individual structures, this legislation also designates historic districts, interior landmarks and scenic landmarks. It is worth mentioning that, on the other side of the ocean, legal protection was granted at the same time to individual landmarks and to historic ensembles. Thus, the first historic district that was approved in New York City was Brooklyn Heights (Fig. 2) in 1965, the same year that the Commission was founded and the Law was enacted, unanimously and with great support from neighbor associations and homeowners. It is interesting how this designation was made just a year after in Europe started the concern about preserving historic centers, since the publication of the Venice Charter in 1964, where for the first time "modest works" are mentioned (Icomos 1964, 1). A consideration to consider regarding historic districts protection (or any other property subject to protection) in New York is related to the designation process. Naturally, proposals may be initiated by the same Commission members, through research they carry out regularly, with surveys which are also inventories of the city's significant buildings. However, it is noteworthy is that any member of the public can submit a Request for Evaluation (RFE). In order for the Commission to consider these requests, it is necessary that enough support from residents and neighbor associations is shown (Historic District Council 2018), as we will confirm on the example described below. Besides the governmental organizations, it is essential the work of other non-profit associations that cooperate with the advocacy of New York's built heritage, for instance, the New York Landmarks Conservancy and the Historic Districts Council (HDC), both of them having been started in the early 70s, soon after the Landmarks Law was passed.

1. THE *BROWNSTONERS*

Back in the 60s, while many white families fled the hustle and bustle of the city looking for the suburbs' peace and African American and Puerto Rican immigrants crowded in the housing projects (public housing developments), a group of middle-class educated young people (Osman 2011, 8; Schuman 1973) settled down in a neglected neighborhood in Brooklyn, focused on preserving the urban typology of the 19th century par excellence, row houses, more commonly known as brownstones.[1]

These houses were suffering a massive demolition because of their advanced state of decline, due to having been abandoned a few decades before or occupied by more people

[1] *Brownstone* is a kind of sandstone which the façades of most houses at the time were built with and, by extension, in New York any row house built around this time is termed a brownstone, be it this material or other, such as limestone or brick (Lockwood 1972, xiii).

than they should, after their subdivision into several apartments, as well as because of their location in troubled neighborhoods, with a population comprised mainly of Latin and African American immigrants that had moved to New York looking for better job opportunities (Lockwood 1972; Osman 2011; Schuman 1973).

These activists, who named themselves brownstoners, founded the Brownstone Revival Committee and gave rise to the movement known as Brownstone Revival, which soon expanded to other areas of Brooklyn[2]. They started to restore some of these houses, in an attempt to give them back their original magnificence (Osman 2011, 5). The neighborhoods that they occupied were called "Brownstone Brooklyn" (Fig. 3) and their names were coined during these years. What they were searching was a sense of belonging to a community, rather than the anonymity of the suburbs. As Osman (2011, 5-6) states:

> Brownstoning was a cultural revolt against "sameness", conformity and bureaucracy. In a city that was increasingly technocratic, Boerum Hill[3] was a "real neighborhood," a vestige of an "authentic community" lost in a modernizing society.

Figure 3. Location of the brownstone neighborhoods in Brooklyn.

In its early years, however, the organization focused on fighting red-lining, a process where banks denied loans to immigrants in these neighborhoods. However, their results were not immediate, as an article on the *New York Times* from 1976 showed. In these years also operated a sister organization, the Brooklyn Brownstone Conference, which proposed the Brownstone Savings & Loan, a new savings and loan association that provided money for buying and renovating brownstones.

In 1974 the Brownstone Revival Committee issued a publication, *Home-buyer's guide to New York City Brownstone neighborhoods*, destined to potential brownstone buyers, where they described a series of neighborhoods where these houses could be found, and offered their price and state of preservation. In addition, they started to promote their designation as historic districts. Their preservation efforts led to these neighborhoods' social and economic regeneration, which went hand in hand with a rise in property values (Osman 2011; Schuman 1973).

Another line of work of the Brownstone Revival Committee was education, which proved to be very popular, according to a 1973 *The New York Times* article. In order to help the brownstone enthusiasts renovate their new houses appropriately, the Brooklyn Brownstone Conference also sponsored the Brooklyn Brownstone Fair for several years starting in 1972, with an array of experts who could offer practical advice, among which was the Brownstone Revival Committee, along with representatives from all the brownstone neighborhoods.

This organization is still operating today, under the name of *Brownstone Revival Coalition*, offering guided tours, seminars and newsletters. In addition, they keep a list of craftsmen and preservation specialists that these houses' homeowners can turn to when they have to carry out restoration work on them.

[2] The great brownstone revival is continuing throughout Brooklyn, thanks in part to the enthusiastic proselytizing of "pioneer" brownstoners who began to reclaim blighted neighborhoods in the early nineteen sixties (Schuman 1973)
[3] Boerum Hill is another neighborhood in downtown Brooklyn with an abundance of brownstones.

2. CASE STUDY: BEDFORD-STUYVESANT

Bedford Stuyvesant's (Fig. 4) urban development started in the mid-19th century, during the American Civil War, when the Dutch farmers that had settled there during the 17th century sold their lands to speculative builders and real estate developers, who turned the existing rural community into an urban residential area of brownstones for upper and middle classes. In the 1860s and the 1870s an increasing number of merchants who worked in Manhattan, mainly of German and Dutch origin, established residence in Bedford (Echanove 2003, 3), as well as families coming from New England. Thus, Bedford became a very attractive and sought-after neighborhood, and proof of that is the refined architecture of the houses that mushroomed all around the empty lots, replacing most of the freestanding frame houses from the colonial era (Fried 1969; Lockwood 1972, 251). The most intense construction period was between 1895 and 1900. During this first stage, some wealthy African Americans also bought houses in the area. Over these years, it was a well-to-do neighborhood. After the First World War, and particularly after the Great Depression, the demographics started to change. The upper and middle class fled the area, moving to the suburbs, causing thus a drop in property value that was taken advantage of by the immigrant working class, comprised of a variety of ethnic groups (Jews, West Indians, Irish, Italians), who worked at the Brooklyn Navy Yard, near the Brooklyn Bridge. As Echanove mentions (2003, 3) when the subway line that connected the neighborhood with uptown Manhattan was built in 1936 along Fulton Street, many inhabitants from a crowded Harlem migrated to central Brooklyn, which offered more jobs and better housing. After World War II, the black population grew to dominate the neighborhood completely; by 1940, sixty-five thousand blacks lived here (Morrone 2001, 252). These demographic shifts, however, maintained intact the architectural character of the neighborhood (Fig. 5):

> while the brownstone houses of Bedford were solidly built and long lasting the community itself was to be temporary, transformed in a few short years by the ceaseless forces of urban change (Ment and Donovan 1980 cited in Echanove 2003, 3)

This was, however, only exteriorly, as in the 1930s and 40s many brownstones were subdivided into multiple dwelling and rooming houses (Morrone 2001, 251), as it has been seen on the previous section that happened in many other areas of Brownstone Brooklyn.

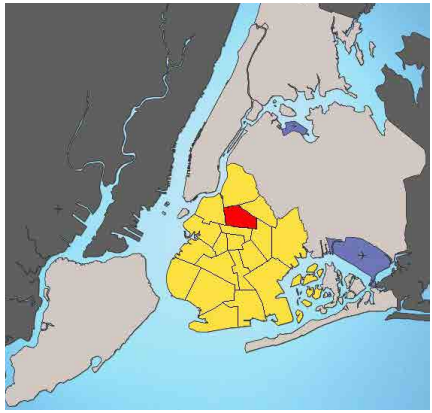

Figure 4. Location of the Bedford-Stuyvesant district within the borough of Brooklyn. Source: (Schorzman and JacobS 2009).

Figure 5. Halsey Street and Nostrand Avenue. Source: (Irma and Paul Milstein Division of United States History, Local History and Genealogy, The New York Public Library 1941)

The neighborhood fell into decline during the central decades of the 20th century, partly because of the tension caused by the racial riots and the crack epidemic that took place during these years at the New York areas inhabited mostly by black people, as well as redlining from the banking institutions. As Morrone (2001, 252) states "In the 1960s, Bedford-Stuyvesant became synonymous with the "urban crisis" in America"[4]. As property value kept dropping, black people came to Bedford-Stuyvesant because they were not able to be anywhere else.

In addition, during these years the construction of housing projects for low and moderate-income residents on the northern part of the neighborhood gave it a bad reputation. Another problem were abandoned residential properties. As housing deteriorated to slum conditions, the community turned gradually into "one of the nation's worst urban ghettos" (Rejnis 1974).

In 1967, Senator Robert F. Kennedy decided to tackle the problems that these neighborhoods faced, marked by poverty and left to themselves by the public authorities, and planted the seeds for what would become the Bedford-Stuyvesant Restoration Corporation, the first Community Development Corporation[4] in the country, after touring the dilapidated area.

This organization was born with the mission of creating job positions, renovating the existing housing and building new, affordable houses. During its first years it was moderately successful: after four years, the Corporation had improved the physical appearance of 55 blocks, renovated the exteriors of 2,230 brownstones, erected a 52-unit apartment house and rehabilitated 34 others (Emerson 1972). This work was done entirely by unemployed community residents who were given training by the Corporation. The President of the Corporation stated in 1972:

> The impact of young guys off the streets, learning a skill and seeing a job finished and homeowners seeing what they can do has an energizing effect. We are further along as a community now.

Senator Kennedy even invited the prominent architect I.M. Pei to consult on the physical planning needs of the area (Morrone 2001, 252). The result was the execution of an urban enhancement project on two blocks within the neighborhood, which, according to I.M. Pei's office, provided the variety of focal points that the area had been lacking (Fig. 6).

Figure 6. I.M. Pei's superblocks in Bedford-Stuyvesant. Source: (Pei, Cobb, Freed, and Partners 1969)

At the Brooklyn Historical Society there was a collection of magazines that this association published between the years 1975 and 1981, where they offered some interesting data and statistics about the neighborhood and the regeneration work of the Corporation in those difficult years. They stated that

[4] Community Development Corporation are not-for-profit organizations that provide programs, services and other activities that promote and support community development in struggling neighborhoods organizations are often associated with the development of affordable housing.

Bedford-Stuyvesant had traditionally been a stable community, with half of its residential buildings being owner-occupied. Finally, in 1981 there was news of restoration projects of old, abandoned buildings with public funding, which were destined to social housing.
But all these projects would not have been materialized without the people of Bedford-Stuyvesant. The owner of a house at one of the blocks object of I.M. Pei's project stated that

> now it's all nice again, and it's just because the people on the street wanted to make it that way (Borders 1969)

The "brownstoning" phenomenon also arrived in Bedford-Stuyvesant in the 1970s, with people who had grown in the neighborhood but had left for college. Instead of heading to the suburbs, they moved back and started renovating brownstones, joining block associations[5] and getting involved in other aspects of community life (Landmarks Preservation Commission 2015b, Rejnis 1974). The president of one of these associations claimed that "What Bedford-Stuyvesant needs is more of its people to care about it" (Fried 1969).
In 1978 "a small group of friends and neighbors who wanted to make a contribution to their great community" founded the "Brownstoners of Bedford-Stuyvesant", a non for profit organization dedicated to the preservation, revitalization and enhancement of the neighborhood. They tried to change the media's concept of the community, sparkling new pride in the neighbors who still lived there and encouraging many African Americans to come back to the properties that their parents and grandparents coming from the South and the Caribbean, had worked hard to acquire. It is still operating today, being one of its committees dedicated to promoting affordable housing and planning the annual house tours.
Recently a new wave of immigrants, from a variety of ethnic origins, has arrived in the neighborhood, having achieved its revitalization, by renovating and occupying properties which had been previously abandoned. The main reasons behind the growth and the charm of the neighborhood are its strong sense of community as well as its abundant and handsome houses, being the area of Brooklyn with the highest concentration of this typology. Signer (2012) speaks of these new arrivals as a second wave of brownstoners.
Echanove (2003, 3) suggests that the preservation works undertaken by community and governmental organizations, such as the Bedford-Stuyvesant Restoration Corporation, have been instrumental in uplifting the neighborhood. The Landmarks Preservation Commission (2013, 3) agrees: "this effort (…) has brought renewed stability the historic neighborhood".
However, the main disadvantage of the neighborhood's development, from the point of view of historic preservation, is the renovation of its housing stock by speculators, in the form of "luxury" developments, progressively removing the elegant row houses that made it famous (Vandam 2009). Here is where designations of historic districts come into play.

Figure 7. Row of brownstones within the Stuyvesant Heights historic district. Source: (Landmarks Preservation Commission 2013)

[5] Block Associations are groups of residents who decide to collaborate to strengthen a block or area, beautifying neighborhoods or advocating for better crime prevention. Their organization and governance comes in a variety of formulas. Nowadays, Bedford-Stuyvesant has the biggest concentration of block associations in the city (Schubach 2016). In 1969, it already had 100 block associations that "are striving, with varying degrees of effectiveness, to foster community improvement and spirit" (Fried 1969).

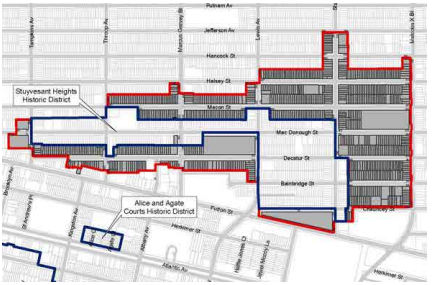

Figure 8. In red, boundaries of the expanded Stuyvesant Heights historic district. In blue, boundaries of preexisting historic districts. Source: (Landmarks Preservation Commission 2013)

In 1971 the Stuyvesant Heights historic district was designated, being expanded in 2013 (Fig. 7 and 8), after public hearings having taken place in 1993 and 2011. On the press release that followed the designation, Commission Chairman Robert B. Tierney made a statement highlighting the importance of community support (Landmarks Preservation Commission 2013, 2):

> We finally crossed the finish line today, thanks to a great deal of work by the residents, homeowners and leaders of this community. We look forward to our continued partnership with them to protect the extraordinary streetscapes of their neighborhood, one of the most renowned in New York City

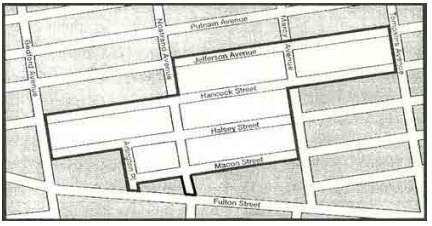

Figure 9. Boundaries of Bedford historic district before the official survey. Source: (Brownstoner 2010)

In 2010 started the process of protecting another historic district in the southwest section of Bedford-Stuyvesant, when the Bedford District Block Associations (BDBA) submitted a RFE to the Commission (Fig. 9) and started collecting signatures in support of the designation (Brownstoner 2010). They arranged meetings as well in order to inform the neighbors about what it would mean to have their house protected.

Figure 10. Rows of houses at the Bedford historic district proposal. Source: (Landmarks Preservation Commission 2013)

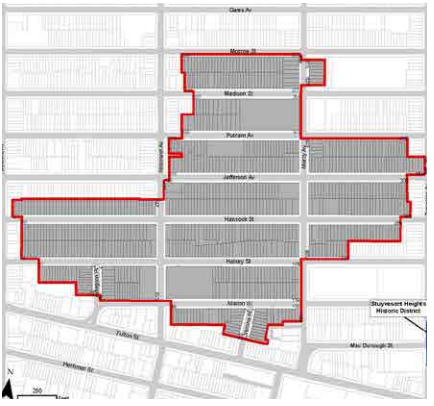

Figure 11. Final boundaries of the Bedford historic district. Source: (Landmarks Preservation Commission 2015)

Finally, the historic district was calendared on May 12, 2012, and the public hearing was scheduled on January 15, 2013. On the hearing, there was a presentation on the district, including photographs of relevant rows of houses (Fig. 10). The spokesperson for the New York Landmarks Conservancy also testified at the public hearing, stating that:

> The Conservancy is pleased to have that community as partners in preservation (…) This designation will only spur more applications and more improvements. We (…) look forward to speaking on the other Bed Stuy areas, including Stuyvesant East and Stuyvesant North, as well as several others

At the time, there were opposed positions (Budin 2013; Dunlap 2013; Landmarks Preservation Commission 2015a, 1; The New York Landmarks Conservancy 2013), and the Commission's vote was postponed[6]. It was not until December 8, 2015 that the Commission unanimously approved the designation of Bedford historic district (Fig.11).

As it has been already argued, the work of community associations is crucial when it comes to the Commission considering approval of a Historic District proposal[7]. In 2013 there were several associations that promoted the preservation of Bedford-Stuyvesant, whose work was decisive in order to get the positive vote from the Commission: the B*edford Stuyvesant Society for Historic Preservation, the Bedford Corners Historic District Joint Block Association and the Stuyvesant East Preservation Action League*.[8] The first one gathered information about the different historic districts that have been proposed in the area of Bedford-Stuyvesant and worked closely with the HDC to promote Bed-Stuy's historic district (Frishberg 2015). As for the second, it was basically a portal that answers the questions of the owners and residents in the Bedford area regarding its designation as a historic district and what this would entail, declaring itself in favor of its preservation, and offering the chance of signing a petition supporting the designation. There was also a section with news related to the historic district and its designation. The third one had more or less the same mission, but focused on the Stuyvesant East area.

3. THE SPANISH MODEL

In order to ascertain what the New York model of heritage management can offer to our system, we need to provide some information about how our model works. According to the Spanish Historic Heritage Law (Cortes Generales 1985, 10) and the Valencian Cultural Heritage Law (Cortes Valencianas 1998, 22), the designation of a landmark can be initiated by the administration or by citizens. The process includes a stage where the proposal is publicly exposed and a public hearing for the affected city councils is held. Then, article 5.4 of the Valencian Cultural Heritage Law (Cortes Valencianas 1998, 14) states:

> The Valencian Government will promote a collaborative framework with volunteering associations for the preservation and dissemination of the Valencian Cultural Heritage.

[6] According to the LPC (2015a), thirty people spoke in favor of designation, three people testified in opposition and three people questioned whether the designation process had provided enough community notification. The LPC received 356 form letters and emails in support of the historic district, and 220 letters stating that they wanted additional information about the process

[7] According to a 2011 news article "LPC didn't see enough community consensus to convince them that the Bed-Stuy residents wanted the designation (…) without community support, the LPC is not going to do this. If they don't see community support, they walk away (…) We've been on their agenda since 1993. They're just waiting to see the neighborhood support (Morris and Staff 2011)". Also, in 2011, Spellen stated after an informative meeting with the LPC that "Landmarks was very pleased by the turnout and positive interest of the majority of the crowd, an important part of their decision to landmark any area"

[8] The information about these three organizations was retrieved from their websites in 2013, but they are no longer operating, hence why they are not included on the reference list.

This is as far as Spanish law goes in relation to the role of non-governmental organizations and citizens on landmarks designation and preservation.

CONCLUSION

Having seen this, it can be asserted that the model of heritage management that prevails in New York presents very interesting contributions that could be adopted by the Spanish system, such as the necessity of community involvement when it comes to protecting their built heritage. The case of Bedford-Stuyvesant is an example of how people of the community can help regenerate and preserve a historic neighborhood, be it by renovating its façades or advocating the designation of the district. However, public awareness of the importance of safeguarding historic buildings and districts would not be what it is today in this city was not for the work of the brownstoners and other activists that set out to reclaim those houses and neighborhoods that no one valued at the time.

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PAPER #6.04

DEFROSTED ARCHITECTURE: DEBUSSY'S *CATHÉDRALE ENGLOUTIE* CASE STUDY

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ABSTRACT

Music is liquid architecture; architecture is frozen music said once Goethe quoting Novalis; *music is mobile architecture*, declared Xenakis, while according to Pallasmaa, *architecture is the art of petrified silence*. All these expressions deepen in a same idea, the material consistency of matter in front of the ethereal volatility of sound; but they also suggest another think: the interchangeability of their states of matter, solid from liquid, water from ice. Is it possible? To look into such a slippery business, we'll move closer to the programme music, that which, as opposed to absolute music, attempts to represent extra-musical contents (poems, images, descriptions…). In our case, we'd rather a piece based on an architectural program. Debussy composed the famous prelude for solo piano *La Cathédrale Engloutie* (The Sunken Cathedral) by 1910, inspired on an ancient legend: in the coats of Brittany, the mythical city of Ys had immersed into the sea and every clear morning the cathedral emerges from water and sinks back again.
This paper tries to discover the musical resources employed by Debussy to evoke specific architectural images, like Impressionist painters also did. For this purpose, we'll turn to the analytical study of the main musical components under the perspective of Architecture.

KEYWORDS

Music and architecture; impressionism in music; programme music; préludes for solo piano; city of Ys.

INTRODUCTION

It should be noted that the following text is not intended to give an absolute depiction of the extramusical content of Debussy's Prelude. Quite the opposite, only a possible interpretation is here presented.

1. CONTEXT

1.1. The Preludes for piano (1909-1910) by Claude Debussy (1862-1918)

The poetic sensitivity of Claude Debussy, the light and color that emerge from his music, have earned him the qualifier of "sound painter":

> Judging by his works and by their titles, he is a painter and this is what he wants to be; he calls his compositions pictures, sketches, engravings, arabesques, masks, black and white studies. There is no doubt that for him it is a pleasure to paint in music.[1]

The personality of Debbussy stands out for his bohemian and rebellious character, little given to follow the established. His music was influenced by the nationalist Russian composers (Mussorgsky, Rimsky-Korsakov...), the Impressionist painters (Monet...) and, above all, by the French symbolist poets (Mallarmé, Rimbaud, Verlaine...). In front of the grandiloquence of the Sublime, embodied by Richard Wagner, whose figure could not go unnoticed at the time, Debussy's musical choice was focused towards the delicacy of the Beautiful. Facing

[1] Quotation of René Peter, Debussy's close friend. Quoted in: Thompson (1967). *Debussy: Man and Artis*t. New York: Dover, p. 19.

the shape and structure of German music, he bets on color and texture.

It was from the 1890s when Debussy abandoned abstract music in favor of a more programmatic conception (Morgan 1994: 59). The composer chooses picturesque scenes that boost the recreation of suggestive atmospheres in search of the pleasure of listening, far away from the tears provoked by the expressionist music of Schoenberg and Webern.

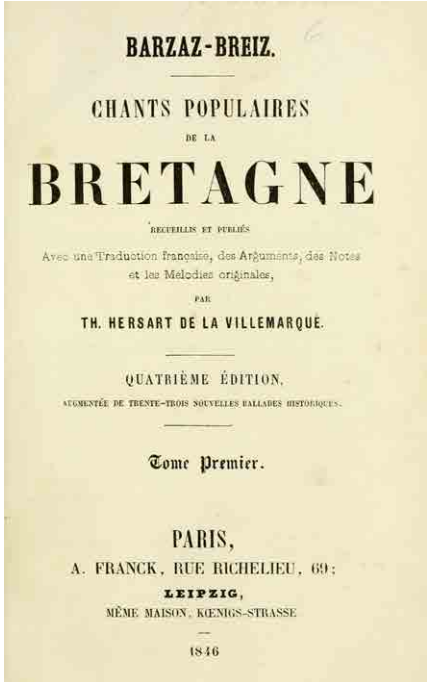
In his mature period, Debussy composed two volumes of preludes for solo piano, containing short pieces of varied subject matter. They are works of independent character, in the line marked by Frédéric Chopin in his Op. 28 (Llácer 1980: 127), that is, without subordination to other subsequent piece of greater extension. The total number of pieces is 24, the same as each of the volumes of Johann Sebastian Bach's *The Well-tempered clavier* and the aforementioned album by Chopin. However, unlike these, Debussy does not follow a predetermined pattern that justifies the number and order of the pieces, which is why concert performances are not always integral and do not always follow the original numbering correlation. The first volume of preludes[2] was composed between December 1909 and January 1910 and, that same year, they were edited and premiered.[3]

It is a music more evocative than descriptive. In fact, the title of each prelude does not appear at the beginning of each piece, but just at the end: it appears in brackets and after suspension points, as if wanting to leave the performer to transmit his own impressions, without conditioning him by those of the composer. However, the extra-musical reference of Prelude n. 10, *La Cathédrale engloutie*, is very specific. But let's know first where it is inspired from.

1.2. The city of Ys

The legend of city of Ys is based on historical facts about King Gradlon, in the area of Brittany, near Quimper, around the 6th century of the Christian era. From then on, the popular tradition has been fattening the myth of the submerged city. Ys was a town of Celtic origin, built below the sea level, so it was surrounded by dikes to contain the onslaughts at high tide. A single gate allowed ships to pass through during the low tide, the key to which was jealously guarded by Gradlon.

One night, while the king was asleep, Princess Dahut, his daughter, wanting to please his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1846

Figure 1. Front page of: Villemarqué, Th. de la, 1939. Barzas-Breiz. Chants populaires de la Bretagne. Paris.

[2] N. Opus / Catalogue: CD 125 (catalogue of François Lesure in 1977); L.117 (catalogue revised later). I-N. Catalogue: ICD 71. (Source: Petrucci Music Library).

[3] First edition in Paris, by Durand et Cie., April 1910. The first performance or Preludes n. 1, 2, 10 y 11 took place at the *Société musicale indépendante* in Paris, played by own Debussy. The first comprehensive audition of the 12 preludes was on 3 May 1911, at the Pleyel Hall in Paris, performed by pianist Jane Mortier.

lover's madness, stole the key and handed it to him. The lover ran to open the door and the city began to flood, disappearing soon after under the waters. The king managed to reach his horse on dry land riding on the waves, but during the scape the princess fell off the horse (Fig. 2), and then she sank and transformed into a mermaid.

The legend tells that in calm days one can hear the chime of bells and the singing of monks of the ancient cathedral from the depths. This and other popular Breton songs were rescued from oblivion by Théodore Hersart de la Villemarqué in 1839, in a book of great reception (Fig. 1), from which some texts would be adopted and adapted for several artistic manifestations, including Debussy's famous prelude.

2. *LA CATHÉDRALE ENGLOUTIE:* FORM AND STRUCTURE

Now entering to spell out the musical contents, we can first state that this prelude consists of a short (89 bars, about 6 minutes long), slow ("profondément calme"), soft (mostly between *p* and *pp*) and very tied piece. Although it is theoretically in C major and C# minor, the fact is that there is no clear tonal center because of the chromatism, the use of Gregorian modes, the sequence of parallel octaves and fifths, the pentatonic and whole tone scales, and the arrangement of triads with no harmonic function. The desire for freedom affects also the rhythm. The initial equivalence of two time signatures implies an ambiguity in the pulse, opting for duple compound meter in some segments (6/4, e.g. bars 16-21), and triple simple meter in others (3/2, e.g. bars 28-46).

It cannot be said that the musical fabric is woven by themes or melodies in the traditional sense, but rather by "short motivic cells that are variations of other interconnected to one another" (Morgan 1994: 60). Among the motivic units there is a very frequented cell, formed by notes D-E-B (bars 1, 3, 5, 14, 15, 84, 85), taken both ascending and descending. But just because the genesis of the work is not thematic it does not mean that there are no themes. We will quote two, formed in turn by motivic material: the melody of bars 7-13, which is later repeated in measures 47-51, and the theme formed by parallel chords in 28-38.

Figure 2. Évariste Vital Luminais: La Fuite de Gradlon (1884). Source: Musée des Beaux-Arts, Quimper.

2.1. Program

As we said, the extramusical reference of *La Cathédrale engloutie* is very specific. Some of the nuances of expression contained in the score refer directly to phenomena compatible with the mythical legend, such as the misty atmosphere that is ordered in measure 1 ("dans une brume doucement sonore") or in bar 16 ("peu à peu sortant de la brume").

In the course of the piece, the cathedral seems to emerge from the sun-bathed waters and then to return to depths, while ringing bells, religious chants and organ chords are heard. It is possible to imagine this tour from the very structure of the work.

2.2. Structure

From the get-go, the prelude comprises three sections divided by corresponding key signatures (Tab. 1), resulting in an A-B-A' scheme, where the last part includes fragment variations of the first. The initial section (bars 1-46) is in C major, the central (47-71) in C# minor, and the last one (72-89) in C major again. However, this organization is far from the rigid scheme typical of classicism, since the material is freely reworked.

In turn, each section contains several variable extension segments, which are underlined -although not always- by indications of *tempo*.

2.3. Section A (bars 1-46)

Within the first section, the longest of the three, subsection A1 (bars 1-15) represents the haze on the swell and the depths with the submerged cathedral; subsection A2 (16-27) evokes the gradual emersion of the temple; while segment 3 (28-46) already shows the majestic building clearly raised on the waters.

In turn, each of these passages could be broken down into smaller segments. And so, in the first part, the succession of ascending chords in pentatonic scale (D-E-G-A-B) over a pedal note in the first bars (1-6) is taken up again in ascending and descending movement at the end of this same subsection (14-15), allowing the clerics' singing be heard, still underwater, in the central bars (7-13) with the indication "doux et fluide", a theme that will reappear more clearly in section B.

The following subsection (16-27) comprises a first part in which the series of ascending and descending chords continue progressively increasing their intensity (16-21), in the presence of an ever-raising temple, to conclude with a transition passage composed of descending octaves in diatonic and pentatonic scales (22-27) that prepares the entry to the next subsection.

The beginning of the last excerpt goes along with the indication "sonore sans dureté". It starts with a very intense first part (28-38) that represents the sound of the organ rhythmically accompanied by bell taps (pedal note). It is the moment of greatest splendour, in front of the imposing volume of a cathedral outlined with grazing lighting. Tonality remains stable in C major, with homophonic texture based on parallel chords. After this passage, and before entering the next section, the musical discourse goes through two brief episodes: the first of transition (bars 39-41), and the second of returning to calm, where the soft chime of bell becomes diluted (42-46).

2.4. Section B (bars 47-71)

The second section begins with the same melody heard in 7-13, but two octaves lower (measures 47-51), and continues in a high-pitched position, intensifying the listening up to bar 61. The end of this passage is

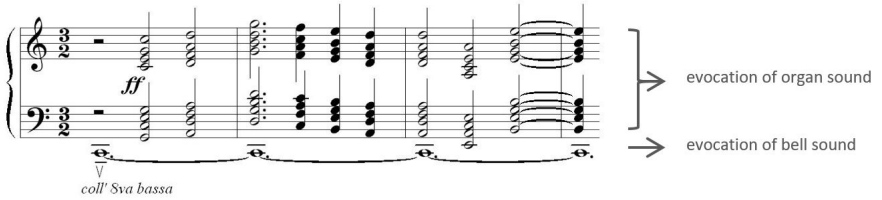

Figure 3. Claude Debussy: La Cathédrale engloutie, bars 28-31. Source: Petrucci Music Library.

reinforced by appoggiaturas in the left hand (59 and 61).
Suddenly, dynamics fades and evolves descending through a bridge of dominant seventh chords (bars 62-65: D#7-C#7-B7-A7-C#7-G#7), closing with a double cadence. The section ends with a new transitional episode (66-71).

2.5. Section A' (bars 72-89)

In the last section, the shortest one, the motivic development of measures 28-38 is repeated, but with significant differences: dynamics goes from *ff* to *pp*; the pedal note is transformed into an unfolded chord, whose *ostinato* oscillation recovers the soft swell and sun reflections; and, in addition, right hand chords descend an octave, all with the intention of generating "comme un écho de la phrase entendue précédemment" (72-83), evoking the progressive return to immersion and the reappearance of the misty atmosphere on the waves.
At the end of the piece, the ascending chords of the first bars are taken up again (84-85), with the indication "dans la sonorité du début". The cathedral has been completely submerged and now only the mist can be perceived. This passage is solved in the final cadence, where the sound is slowly extinguished with chords that extend to the entire keyboard range (measures 86-89).

section	bars
A	1-46
B	47-71
A'	72-89

Table 1. Structure of Debussy's Prelude n. 10. Source: own elaboration.

3. *LA CATHÉDRALE ENGLOUTIE:* EVOCATIONS

Once analysed the structure of the piece, we'll interpret what Debussy might evoke with his music and how he carried it out.

3.1. Remote times

At the time to move the imagined scene into the past, Debussy uses at least two resources.
On the one hand, he introduces the *organum*, or movement by chords with parallel octaves and fifths, which refers to the origins of polyphony in 11th and 12th centuries (*Ars Antiqua*). This movement was banned in Western music during the Renaissance precisely in order to distance itself from what was considered as outdated.
On the other hand, the composer resorts to different Gregorian modes, transcending the limitation to the major and minor scales of the tonal system. The use of Lydian (T-T-T-S-T-T-S)[4] and Æolian (T-S-T-T-S-T-T) modes will be discussed later. Doric mode (T-S-T-T-T-S-T) is present in bars 23 and 24 over D.

Figure 4. Gamelan orchestra in Java, late 19th century. Source: Tropenmuseum, Amsterdam.

[4] T: tone; S: semitone or half tone.

3.2. Exoticism

Although at first the pentatonic scale connects with the sound of Eastern music -in the case of Debussy, the connections would lead to Javanese gamelan, which he met at the Paris Universal Exhibition of 1889[5]- (Fig. 4), it is likely that the search for the exotic is mixed with references to the distant in time and the aura of suspense that surrounds the myth. Among other passages, there are pentatonic sequences in bars 16-18 (B C# D# F# G#) and following (19-21: E_b F G B_b C; 22-23: G A C D F) (Bruhn 1997: 42-44).

3.3. Religious content

The legend of Ys is imbued with ethical-religious connotations around the idea of sin, incarnated in Princess Dahut, as a result of which the destruction of the city would have been derived as divine punishment, as Sodom and Gomorrah were in their time. Also involved in the story was Saint Winwaloe, founder and abbot of the first monastery established in Armorica region, who had prophesied about what would eventually happen.

At a time when the Christian tradition is still present in French culture, Debussy resorts to sound references linked to the Christian liturgy to evoke this specific atmosphere: organ chords, monodic singing, and bell ringing.

The sound of **organ** appears in all its sumptuousness in bars 28-38 (Fig. 3), with a dense, sharp, homophonic, and rhythmic texture, without being polluted by the existence of other effects except for the bass touches of pedal. The movement by parallel fifths and octaves has already been mentioned.

As for **singing**, the arrangement of a simple melodic line with no doublings comes to evoke the monody of Gregorian chant, performed by male voices. This tune is half-heard fleetingly from the depths in measures 7 and 13, and then plainly with the cathedral emerged (47-51); the first in Lydian mode on E and, the second in Æolian or minor mode over G# (Bruhn 1997: 42-44).

Finally, the ringing of **bells**, understood among the Christian tradition as a sign to summon the faithful, is evoked through the iteration of long-lasting pedal notes in deep range.

3.4. Architecture

In bars 16 and 17, the symmetrical up-down movement (F#-G#-D#-G#-F#) of the right-hand chords represents almost literally the outline of some towers, still under water, but already visually noticed. The melodic drawing with a 5th jump in the middle suggests a pointed top, perhaps a steeple or a spire. At bar 18, symmetry becomes imperfect (F#-G#-D#-F#-G#), perhaps by glimpsing the connection of the towers to the central nave (Fig. 5).

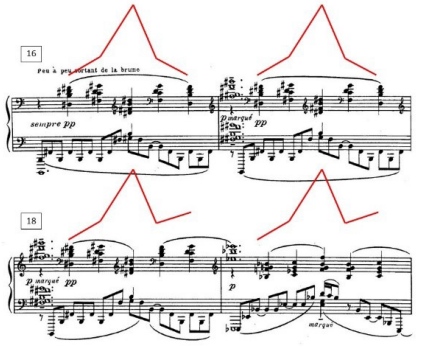

Figure 5. Claude Debussy: La Cathédrale engloutie, bars 16-19. In red the ascending and descending movement of the chords that suggests the vision of two towers. Source: Petrucci Music Library.

[5] The sonority of Thai gamelans has influenced many composers, such as Debussy, Satie, or John Cage and their *prepared piano*.

The magnificence of the building is shown in subsection A3 (bars 28-40), by means of resources such as the key of C major, very clear in 28-32; the homophonic texture formed by parallel diatonic triads with the counterpoint of a bell; the intense dynamics (*ff*); and the simple motivic development, both melodic and rhythmically. These tools may also insinuate the presence of consistent and imposing materials, such as a stone ashlar fabric.
Over this play of solemn representation, another capricious and delicate game is superimposed: the arabesque. In bars 19 to 21, Debussy introduces a recurring ornament consisting of groups of three or four descending fast notes (even reinforced by an *acciaccatura* in bar 20), which just appear in full ascent of the temple to the water surface. It could be interpreted in a vague way with the progressive visualization of the decorative apparatus that usually accompanies the architecture of great cathedrals (traceries, moldings, foliage…). The melodic material however does not seem to refer to a specific stylistic affiliation beyond providing a simple exotic touch.

3.5. Emersion - immersion

The dynamic intensification and the progression to higher-pitched tessituras suggest the rising ascension of the temple to surface (Bruhn 1997: 42-44). This phenomenon occurs from bar 18 (*p*), passing through 22-24 (*f*), 25 (*più f*) and 27 (*sff*), until measure 28 (*ff*). The opposite process implies consequently the descent and subsequent re-immersion of the cathedral into the sea. Observe the resolution of this episode, where dynamics passes from *ff* in 38 to *p* (42), *più p* (43), *pp* (44) and *più pp* (45-46).
The tower-top appearance on surface happens in measure 19 et seq, with some really marked notes on a rhythmic background based on triplets. In bar 23, it is the central nave that is emerging; the extended octave lines in Doric mode, first in right hand and then in left hand, followed by a pentatonic scale on the same D, allow us to calibrate their magnitude. Finally, the cathedral can be appreciated completely in bar 28.

Figure 6. High tide in Mont Saint-Michel, France (c. 1900). Source: (old post card)

3.6. Atmosphere: sea and mist

Seascape is one of the favorite pictorial topics of Debussy and, in general, of all Impressionist painters. The poetic strokes that sketch the sound image of the sea focus mainly on its most sensory aspects, such as the uninterrupted movement of waves and the incidence of light on the surface.
In the case of the swell, the incessant rolling of the waters is evoked by the succession of ascending and descending chords, perhaps accompanied by rising bubbles, as if something was happening underneath.
As far as light is concerned, two characteristic and simultaneous phenomena converge. Firstly, transparency, which allows a glimpse of what lies beneath, for whose musical expression the level of intensity and tessitura are played, depending on the proximity to the surface of the sunken objects. Secondly, reflections or light flashes, recalled by sporadic replication of motifs or melodic material fragments. In this sense, the presentation passage of the temple (bars

28-38) could be tinged by the rays of sunrise, thanks to a greater harmonic and melodic clarity after the disappearance of the mist.
To represent the appearance of the mist with its aura of mystery, Debussy associates the idea of blurring or loss of visibility with that of fogginess or lack of sound sharpness. And this is achieved through harmonic vagueness, the absence of a clear melodic line, or the incorporation of pedal notes, which eventually make turbid the sound.
The atmosphere hinted at by all these phenomena could well be identified with some of Claude Monet's paintings, among which *Impression, soleil levant* (1872), the series of the London Parliaments (1900-1904) (Fig. 7) and the one of Rouan Cathedral (1892-1894) deserved to be highlighted.

Figure 7. Claude Monet: Parlements de Londres (1904), oil on canvas. Source: (Kunsthaus, Zurich)

CONCLUSION

Music has effectively a great capacity to evoke extra-musical contents: arguments, images, atmospheres, movements... In *La cathédral engloutie* all this is combined: the tale of an emersion, the representation of a mythical city, the recreation of an inner life, the evocation of a mysterious atmosphere... Certainly, the evanescent character of all music seems to fit perfectly with the ephemeral and instantaneous perception the impressionists were interested in. And Debussy, with his synesthetic ability and clever sensitivity, gets easily to transport us into a world of vibrant images, drawn in the air with sound brushstrokes.
Among the gamut of dreamy figures, there are also architectural ones: spires, main nave, perhaps an impressive façade..., that are aroused by a wide display of tools: scales, harmonic games, motivic and melodic material, rhythms, dynamics and other nuances... Based on this election, it would be said that the evocation of *La cathédral engloutie* is oriented towards a High Medieval Period rather than a paleo-Christian construction (Early Middle Ages), which would be in greater accordance with the chronology of the legend. Debussy's frequent visits to the island of Mont Saint-Michel may be at the base of this association (Fig. 6).
It should be reminded, however, that the music of this prelude is not purely descriptive. Not even the author could see directly the image represented, but only imagine it. Hence, his intention was not to predispose towards an accurate interpretation of the story but only to suggest it, leaving performers and listeners to build their own world of impressions.

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PAPER #6.05

INTERVENTIONS IN SPANISH MONUMENTAL HERITAGE: A HOLISTIC VIEW OF BURGOS CATHEDRAL

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ABSTRACT

Theoretical protection -derived from conservation theories and international recommendations and conventions on the protection of historical cultural heritage- as well as the legal protection of monuments, are as necessary as they are vain if they are not accompanied by intervention, whether conservation or restoration.
Based on this concept, the present document proposes that there is no protection without a thorough knowledge of the good itself and the recognition of monumental values brought together in it. This fact is evident in monuments of high complexity. An example of this is the huge sequence of interventions in the Cathedral of Burgos, Spain. Motivated by the obvious historical and artistic values, more than half a hundred projects were carried out during the twentieth century.
This work provides an overview of the interventions made in the Cathedral of Burgos during the last century, and demonstrates that a global analysis allows us to understand this process as a constant search for balance and coherence, not only theoretical but also constructive, structural, and aesthetic.

KEYWORDS

Heritage; restauration; cathedral of Burgos.

INTRODUCTION[1]

In recent decades, there has been an explosion of interest for the state of conservation of cultural heritage in general, and spanish heritage in particular. Also, generic and specific studies, analyses, and research, have proliferated to provide further information on monumental heritage. This, in part, originates in intervention projects, whether conservation or restoration, and there are many researchers from multiple disciplines who analyze the past of goods, theories, and interventions.
During the last decades, a premise has been frequently repeated about heritage: it is not possible to protect what is unknown or what is known superfluously.
We can try, and just try, to find partial solutions through partial knowledge, but we cannot protect all values encompassed in a monumental good without the integral knowledge of it. Though it seems obvious, this has not always been accomplished. From our perspective, this fact demonstrates that, there is a need to determine a minimum knowledge that was required in each intervention of historic buildings. This minimum turned out to be the Director's Plans, which have served and still serve today to gather the vast information disseminated along the centennial history of the largest monuments in Spain. This seems like an immense task ... and, in view of the historical results, it has certainly been.
But, before intervention, even before the recognition of the need for intervention, there is a stage subject to legal norms

[1] This paper is part of the research carried out for the preparation of the Doctoral Thesis entitled "History of the protection of architectural heritage in Spain. 1933-1985", presented in 2016, under the direction of Mr. José Luis García Grinda and Mr. Jesús Prieto de Pedro, in the Department of Architectural Composition. Escuela Técnica Superior de Arquitectura (ETSAM). Universidad Politécnica de Madrid. Spain.

and criteria that protect the Monument conservation, or at least try to. The legislative set of protection rules has evolved since the nineteenth century with the sole intention to be increasingly efficient. After two centuries of evolution, we can appreciate that the doctrine must be applied, and that its application is the intervention itself. Far from inaction or indolence, the intervention MUST materialize everything that, as a rule, the Laws require.
Therefore, it is a succession of several documental, legal, and constructive efforts.

1. SEVERAL GENERATIONS UNDER CONSTRUCTION

In 1221, the new Cathedral of Santa María of Burgos was built on a Romanesque temple that would remain, like so many others, encysted inside or under it.
It shows reminiscences of French Gothic style and is therefore related to other similar cathedrals such as those of Burgundy or León (Gonzalez-Varas Ibáñez, 1999), sharing the stonemason master, Master Enrique in 1240.
Hans of Colonia, who also participated in its construction, built the perforated spiers in 1442 which would become one of the hallmarks of the Cathedral, as recognized by Vicente Lampérez y Romea in the installation project of the lightning rod in 1892 (Lampérez y Romea, 1892).

2. INTRODUCTION TO CENTRAL ADMINISTRATION RESTORATIONS

The Spanish administrative management during the first half of the twentieth century, through the General Commissions of the National Artistic Heritage for the conservation of Monuments, was concentrated in some architects for a long period of time. Therefore, in spite of the absence of a comprehensive document that implied an exhaustive documentary and historical investigation as well as the monitoring and control of all past interventions, knowledge of the monumental good was extensive and intense. This allowed that the works would follow a logical way, based on a planning that, far from being anarchic, has been progressive.
The same as for so many other monuments, the administrative organization, according to a geographical zoning, allowed some continuity of architects in charge of conservation and restoration works in the Cathedral.
Between 1942 and 1944 Francisco Iñíguez Almech, Director of Monuments of the National Treasury of Art, was in charge of interventions. From 1948 to 1963 he was replaced as architect of the monument by Anselmo Arenillas, who was followed by José Antonio Arenillas Asín (Assistant Architect of the 2nd zone). In 1978, Francisco Iñíguez Almech carried out two works, but the remaining ones, more than twenty restoration projects for the Cathedral, were performed by Marcos Rico Santamaría between 1976 and 1990.
The last restoration of the Cathedral of Burgos in the 19th century was carried out by Ricardo Velázquez Bosco in 1898. From then on, for almost twenty years, Vicente Lampérez y Romea intervened different areas of the monument. In 1929, J. Apraiz made the consolidation of the South needle.

2.1. Interventions on the roofs of Burgos Cathedral: the fundamental link for integral conservation

If the construction of a "building" lasts more than four centuries, it is apparent that the restorations alternate with the construction. In that case, we have to admit that some interventions have not recorded its imprint because they have been made interspersed and mimicked with the construction itself. According to the data provided by García Escudero and Hernández Gil in the 1995[4] intervention project, the first restorations was carried out in 1692 in the towers, followed by

the "Pellejería" (1516), the reconstruction of the dome (1539-1567) and the reform of the cruise of the cathedral (1642 and 1664).

They were followed by a multitude of cases with diverse objectives and incomparable magnitudes, from needles to reliefs, from facades to traceries and ornaments, which will be the subject of other studies.

But in 1948, although it had been proposed in some previous project and as an emergency plan, begin forty years of restoration works in all the roofs of the complex, alternating with works in other constructive and decorative elements.

By 1910, Vicente Lampérez y Romea had restored the covers of the Chapel of the Constable and the lower nave of the south side, with a budget of 18,732.89 pesetas, but unfortunately it has not been possible to access the documentation of the project, which prevents us specify the magnitude of such an intervention.[2]

Also, in 1929, Apraiz undertook the timely restoration of the cruise deck, as part of a general intervention.

But it is in 1942 when we began to recognize the interventions in the real problems of the roofs, starting with the project of Francisco Iñíguez Almech (Iñíguez Almech, 1942). In this project he faced the repair of the pavement of the low cloister and recognized that his roof had leaks and that it was necessary to restore it, although only the "review of the zinc cover" was indicated.

A few years later, in 1948, Anselmo Arenillas (Arenillas, 1948) insisted on this situation again, which let us infer that the tasks carried out proved insufficient.

As Iñíguez Almech explained in the project in 1963, almost twenty years later, the rains of the previous year had deteriorated the tissues of the whole, so he proposed the restoration of the roof of the Chapel of Santiago, such as the side skirt from the Chapel of Santa Tecla. This restoration involved the replacement of 40% pairs of the roofs, around 500m2 of planking, and with 50% use of the roof tiles.

Despite this, a year later José Antonio Arenillas Asín (Arenillas Asín, 1964) proposed the reconstruction of the cover of the Condestable Chapel due to the great deterioration detected (loss of section due to the presence of xylophagous insects), which compromised the structural stability of the cover, and put at risk the vaults and arches. The reconstruction proposed involved the construction of a metal structure with articulated anchors to avoid the transmission of effort when the material dilated.

It should be noted that this change in the construction system proposed by Arenillas Asín in his project, the replacement of a wooden structure by a metal structure, minimized the possibility of a fire like the one in Notre Dame Cathedral, in Paris, in 2019.

Obviously, the situation of the Condestable Chapel was no exception, and in 1966 Arenillas detected that this state of consummate ruin, not incipient, had repeated in the cover of the Chapel of Santiago (Arenillas Asín, 1966).

This situation would continue over time, and in 1976 architect Rico Santamaría presented three new roof repair projects of the lateral naves of the Chapel of "San Nicolás", the Chapel of "La Natividad" and the Chapel of "San Antonio" (Rico Santamaría, 1976a), "Santa Ana" and "Santa Tecla".

In addition to the structural replacement, the vaults were reinforced by a water-repellent concrete coating to minimize the possible leaks of the roof, and the stone material of the coronation of the walls was consolidated.

Due to the structural unit of the roof of the Chapels of Santa Ana (Rico Santamaría, 1976b) and Santa Tecla (Rico Santamaría, 1976c), the project for the roof replacement of the latter was prepared on the same year. On this occasion, and with the double objective of facilitating water evacuation and minimizing its effect on the left tower, and also visually freeing the flying buttress and the tower, the

[2] General Archive of the IPCE, Ministry of Education, Culture and Sports, Madrid, and General Archive of the Administration (AGA), Alcalá de Henares. Consultation period: January and February 2012.

project proposed the reconfiguration of the roof to four waters. The project contemplated the protection of the churrigueresque dome through an internal formwork with minimal impact on the surface.

The project also contemplated the restoration of the stones of the wall, as well as the provision of isolated zinc gangways to prevent the tiles from stepping on. The exterior stone walls would also be repaired, covering them with a coat of transparent and matt silicate paint as protection against future erosion.

From the general analysis carried out by Rico Santamaría, there is evidence that the roofs were in a state of poor conservation and that it was necessary to undertake successive restoration works that, could involve the dismantling and reconstruction of some zones.

In general, and due to the structural similarities of the roofs, the conservation problems were similar throughout the whole building. The leaks in the vaults and the consequent deformations, as well as the appearance of damp in adjacent walls would cause the wooden structures to be replaced by a metallic one. Besides this reconstruction, the stone material of the walls had to be also restored by means of stapling and grating at the coronation.

In the same way, the roofs of the central nave of the apse, both lateral naves, and the passage of the Chapel of the "Condestable" (Rico Santamaría, 1977b), respectively, were intervened.

Two years later, in 1979, two projects were drawn up with the objective of partially restoring the roofs of the Cloister, in the area near the Chapter House (Rico Santamaría, 1979a) and in the Sarmental (Rico Santamaría, 1979b) area, respectively. In both works, the wooden elements were replaced by metal belts laminated with a hollow ceramic vault board, with the corresponding compression layer and double metal mesh. These projects proposed to reduce the slope from 45% to 33% and replace the flat by the curved tiles. In the opposite sides, in the area near the chapel of Santiago and San Enrique, roofs of one water with a 10% slope and covered

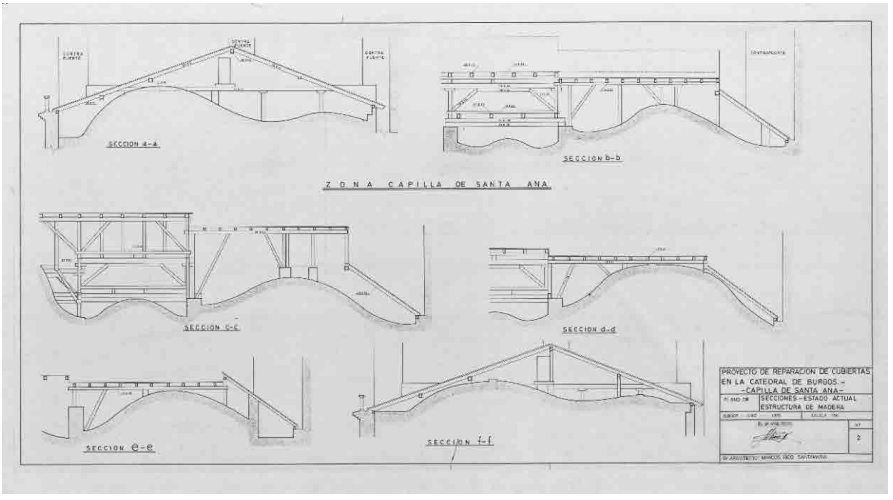

Figure 1. Detailed plan of the roof repair project in the Cathedral of Burgos. Chapel of Santa Ana. Current State. Architect: Rico Santamaría, M. Date: March 1976. Source: IPCE General Archive. IPCE Planoteca. Ministry of Culture and Sports. Spain.

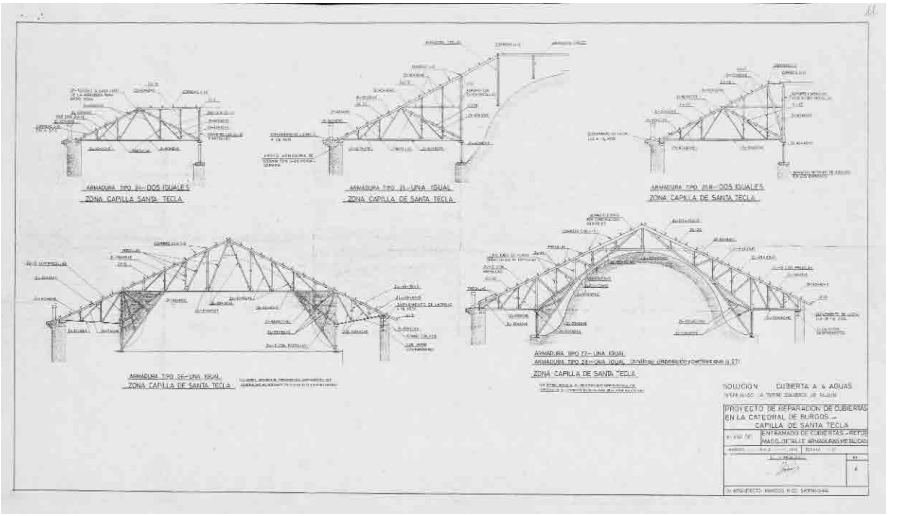

Figure 2. Detailed plan of the roof repair project in the Cathedral of Burgos. Chapel of Santa Ana. State reformed. Architect: Rico Santamaría, M. Date: March 1976. Source: IPCE Planoteca. Ministry of Culture and Sports. Spain.

by zinc sheet were renovated. In addition to the replacement of downspouts, valleys, and gutters, access doors to the galvanized sheet platform would be incorporated, plastering the skirts with water-repellent mortar.

That same year, at the end of 1979, Rico developed two complementary projects in which he proposed the partial repair of the roofs of the Anterior Central Nave, in Plaza de Santa María, the left front lateral nave (Rico Santamaría, 1979c) and the roofs of the towers, and the right lateral nave (Rico Santamaría, 1979d).

The following year, efforts were focused on areas that had not been previously intervened, covering 1,657 m2. Thus, the project for the partial repair of the roofs of the Burgos Cathedral (Rico Santamaría, 1980) was proposed, including several areas like the Chapel of the Remedies (or of the Holy Christ of Burgos), the Dressing Room of the Canons, and the Sacristy of the Chapel of the Presentation, the Chapels of the Presentation, of the Relics, of San Juan de Sahagún, and of Santa Isabel, the South arm of the transept, the Chapel of San Enrique, and the Vestibule of the Sacristy.

The intervention consisted in the application of the same technique of substitution of the wooden framework by a metallic structure of laminated profiles, the restoration of the accessory elements of the roof. Unlike other sectors, this area presented unevenness and access to the below deck, so access skylights would be incorporated. This solution makes it possible to bridge the gap between roofs and vaults without it being perceived from the outside.

In 1981, while the works in the nearby areas were being completed, the General Directorate of Fine Arts, Archives and Libraries of the Ministry of Culture commissioned Rico Santamaría a new project (Rico Santamaría, 1981) for the restoration of 2,014 m2 in order to conclude the repair of the Cathedral roofs. This new project included restorations in six priority areas which were located in the Sacristy of the Main Chapel, the roofs

of the transept lantern, the Chapel of the Condestables, the Chapel of Santiago, that of Santa Catalina and the Archive (on the Chapel of Corpus Christi), access to the archive (on the Chapter House), and the Engine Room and boilers.

As with all covers, the protocol was limited to the protection, replacement, and adaptation of covers according to their state of conservation, the degree of deterioration, and the material used.

For years, Rico Santamaría dedicated himself to restoring and rebuilding the roofs of the cathedral with the aim of stabilizing and updating the structures because, as he himself indicated in the project, "All the roofs of the Cathedral have been studied conscientiously to free them from their deplorable state, ..., having given an effective remedy to all of them." (Rico Santamaría, 1981. Pág. 2)

But this complex and methodical process would culminate in one of the most visible tasks, such as the intervention in the cruise ship's lantern. This element, rebuilt in the 16th century by Juan de Vallejo, had a plementery with openwork hidden by a framework. Such a sculptural filigree deserved special attention, literally, "... if there is one in which that scrupulous study has to be taken to the extreme, it is this one, the lantern in the transept." (Rico Santamaría, 1981. Pág. 2). This scrupulous study consisted of verifying the state of conservation of the roof elements, the decision to maintain the beams that supported the framework that was to be removed, "... as a relic of other times ...", the estimated calculation of the self-weight of the structure and the need to lighten it without intervening the openwork plementery.

Likewise, the placement of three skylights per triangle roof, a total of twenty-four Stadip skylights on the octagonal roof, was proposed with a double mission of lightening the roof and illuminating the delicate works of Juan Vallejo.

CONCLUSIONS

In the last decades, some studies have suggested that the works carried out in the Spanish monumental heritage during more than half of the 20th century had not followed any planning and that, on the contrary, they had been the result of impulses motivated by emergencies. It is true that, on many occasions, the appearance of pathologies of variable magnitude and importance has marked the sequence of works in many heritage assets. But, in contrast, some monuments have gone through a process of exhaustive analysis through which priorities were identified that guided the intervention process.

Gradually, interventions in the Cathedral of Burgos have been linked to a strategy of structural stabilization and roof consolidation, and this was demonstrated by the progression of the works carried out on the roofs by Marcos Rico Santamaría.

The Cathedral of Santa María de Burgos is one of the most intervened Spanish monuments over the last three centuries. Altogether, numerous works of all kinds, size, and budget have followed one another. All this with the sole and essential purpose of maintaining, preserving, safeguarding its integrity and that of the artistic, historical, architectural, and sculptural elements: to preserve their cultural values.

This monument, declared by Royal Decree of April 8, 1885, would take a century to be declared a World Heritage Site in 1985. During that century it became one of the hundreds of pampered goods, in the best sense, of Spain. And, for this reason, it was recognized by UNESCO in the best possible state thanks to, at least, sixty-four projects of various kinds.

It has been speculated that the tragedy occurred at Notre Dame of Paris could take place in one of the Spanish Cathedrals. It would be naive and reckless to deny emphatically that any disaster could occur

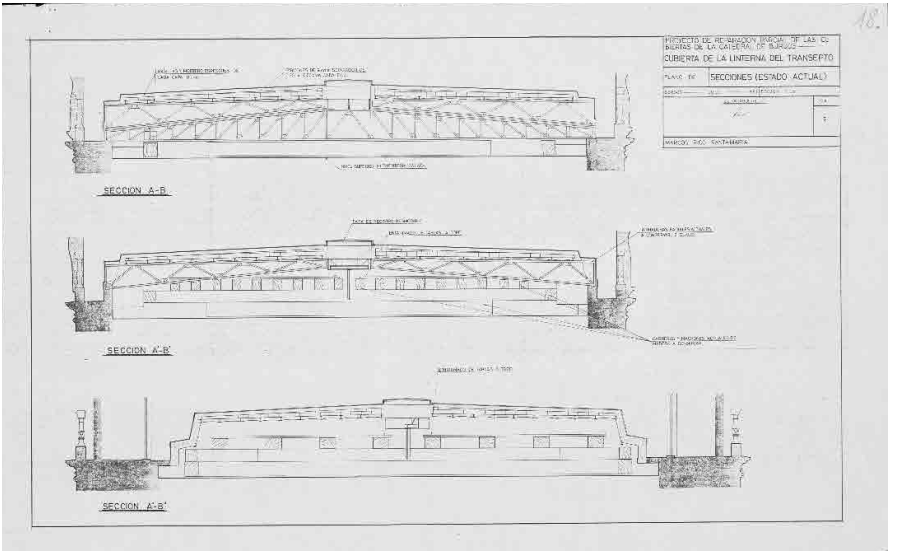

Figure 3. Burgos Cathedral: Cover of the Lantern of the Transept. Actual state. Author: Rico Santamaría, M. (1981). Instituto del Patrimonio Cultural de España. Planoteca. Signatura: PLM CAJA 7 127 / 1442

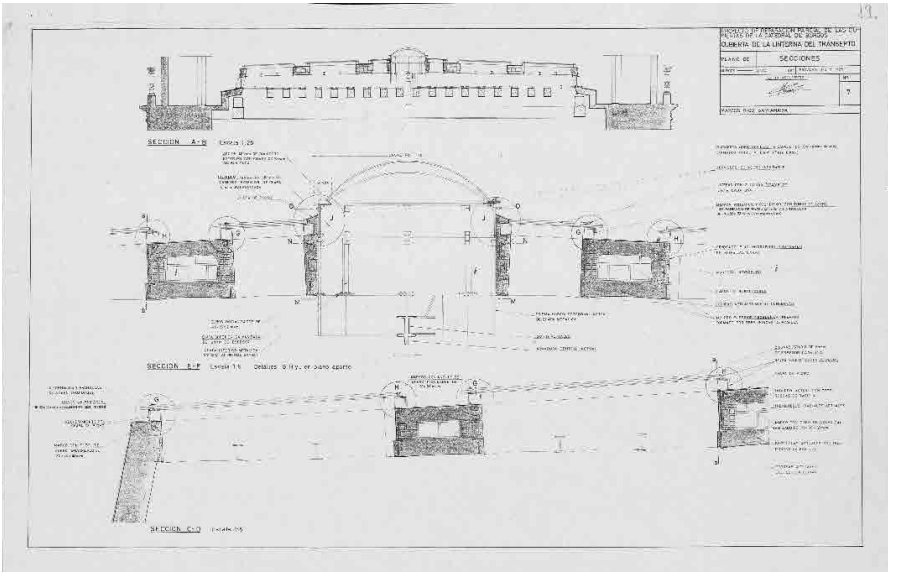

Figure 4. Burgos Cathedral: Transept's lantern cover. Reformed state. Author: Rico Santamaría, M. (1981). Instituto del Patrimonio Cultural de España. Planoteca. Signatura: PLM CAJA 7 127 / 1443

in the Spanish heritage, but in the light of data available, after centuries of meticulous and effective care, the possibilities seem drastically reduced and that image, less likely. Or at least we hope so.

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PAPER #6.06

THE ROLE OF KNOWLEDGE TRANSFER IN MASONRY BRIDGE CONSTRUCTION FROM SPAIN TO GUATEMALA

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ABSTRACT

By the 16th Century, transportation networks played a vital role in the urban growth of many settlements during the Spanish colonization in Guatemala. Consequently, the construction of masonry bridges ran parallel to the regional trading networks. Beyond its humble simplicity, expressed in the use of local materials, such as stone and bricks, these bridges resulted from technological advancements that fostered cultural, social and knowledge exchange between the Spanish colonists and the local Mayan Indigenous. Moreover, the construction of masonry bridges included a complex process of knowledge transfer among both cultures. Interestingly, little has been written about the still-standing Colonial bridges, which have not always been the primary focus of preservation efforts. The influence of both cultures on the masonry bridge's construction during the 16th Century in Latin America is one critical question in revealing its construction history yet to be answered.

This paper builds on an ongoing doctoral research that intent to investigate and document both the Las Donadas Bridge in Montoro, Spain, and the Los Esclavos Bridge in Santa Rosa, Guatemala. This study attempts to understand the non-verbal reflections of history through the physical characteristics, materials, and constructive methods of each bridge. Ultimately, the goal is to build a comparative analysis using three material and construction elements of a bridge, such as stone, arch, and abutment. A qualitative case study approach incorporates historical archives, field observation, survey, and photography. Each structure is expected to provide a greater knowledge of the cultural influences and the apportioning of both cultures' craftsmanship during the Los Esclavos Bridge construction.

KEYWORDS

Knowledge transfer; bridge construction; stone; arches; Colonial Period.

INTRODUCTION

In the 15th Century, during the Exploration period, Spain invested an extensive effort to expand its empire in America. Previous experiences in warfare strategies, including technological advantages such as weapons and horses, gave Europeans the superiority over Indigenous groups. Consequently, Spanish conquerors became experts in incorporating strategies of colonization throughout America. During this period, the encounters between local ideas and foreign ones created a hybrid exchange of knowledge between both Mayan Indigenous and Spanish cultures resulting in new cultural entities (Headrick 1988). This interweaved cultural integration was developed to fit local conditions through many areas of life. For example, the Spanish Colonization in Guatemala reveals a sum of new intangible manifestations expressed by language, faith, and folklore. In conjunction with tangible entities, such as architecture, cuisine, clothing, and building technology, all together became the cultural legacies between the Mayan and Spanish cultures.

In the 16th Century, the Colonization period started a new wave in building technology and infrastructure. It coincides with the development of a transportation system and the construction of masonry arched bridges. Few scholarly writings have been focused on the role of infrastructure related to colonization. One influential work is "The Tools of Empire" by Daniel Headrick. In his book, Headrick pointed out the impact of technological advances in transportation and infrastructure as elements of colonization in the new environments. Although the work focuses on the transfer of knowledge in technology, it is framed within the 19th-Century European context (Headrick 1988). Even less has been written about the role of the masonry bridges as elements of technological innovation in the context of the Colonial period. One crucial structure for this research is the Los Esclavos Bridge, found in a small village located in the Department of Santa Rosa on the southeastern Guatemalan territory. The masonry bridge's construction was primarily carried out by the Xinca Natives, one ethnic group within the Mayan civilization (Recinos 1984). To inquire into the role of knowledge transfer and the requirements to build the structure, first, it is necessary to know about the source of hand-labor and source of knowledge prior and during its construction. At the same time, it is essential to know the materials, methods used for its construction. Therefore, one section of this analysis provides a general background for each bridge undertaken. The other section offers a technical analysis of both structures to compare about their visual characteristics.

1. METHODOLOGY

The interdisciplinary nature of this research requires the need to analyze different fields, theories, and concepts, from a subjective perspective. Therefore, it is based on the comparative analysis of qualitative case studies. The focus of this approach is to develop an in-depth understanding of two units of analysis, represented by two historic bridges. This model will explore the phenomenon of transfer of knowledge through the architectural lens to demonstrate repetition, patterns, and commonalities between both cases (Merriam and Merriam 1998) The first bridge which will serve as a benchmark is the Las Donadas Bridge, located in Montoro, Spain, built approximately between 1498 and 1544. The second bridge that acts as an embedded (in-depth) entity is the Los Esclavos Bridge, located in Santa Rosa, Guatemala, built between 1592 and 1600. Los Esclavos case received a broader perspective of analysis with a more in-depth understanding of the factors that affected its construction (Scholz and Tietje 2002). The goal is to use the findings as a starting point to establish the patterns and interrelations between the Spanish and the local Indigenous, to argue the established assumption that the process of knowledge transfer ran only one way as imported and blueprinted from Spain. The research methodology included the following tasks: To establish the time-frame: built between 15th and 16th Century (based on Los Esclavos' date of construction in 1592) To select the geographic location: Guatemala and Spain (to display the sequence of events from Spain to Latin America) To generate a survey and analysis: based on bridge typology construction method, arch configuration; span range; length; function or utility; architectural features, such as construction materials: Masonry, stone, and brick To organize the acquired data. To draw the conclusions.

2. BACKGROUND

This analysis presents general information of the Indigenous and Spanish technological developments that influenced the construction of the Los Esclavos Bridge. As well, the historical background of the

locations where the bridges' construction took place. De-winding those factors together with the stone, arch, and abutment technical analysis will help create a holistic view.

2.1. The Mayan Indigenous' Influence

The region of Guatemala is the center of the ancient Mayan civilization. It is documented that during the time of the Spanish conquest, Mayan builders already knew the corbeled arch method, which they used to construct vaults. This particular spanning system is also known as the Mayan arch, designed to cover rectangular spaces and support the stone ceiling (e.g. Fig. 1). The Mayan arch system is based on the cantilever principle that relies on an offset horizontal stone projecting beyond the one underneath (Gilabert Sansalvador 2018). Simultaneously, the horizontal stone layers create an inverted "V" shape over a linear axis (depicted as stepping stone stairs in cross-section). Unlike the semicircular Roman arch, the Mayan arch's construction was less complex because it only worked under gravity loads or by axial forces; therefore, it was also known as a false arch (O'Kon 2012). Researchers believe that Mayan builders relied on two different methods to achieve this effect during construction. First, the synchronized construction of the exterior and interior masonry walls served as a mold or framework for the core fill-in material, usually ruble. Second, the internal thrust beams built with timber were designed to serve two purposes; as a scaffolding to reach heights fixed to remain-in place after completion and as an axial shear reinforcement of the arch (e.g. Fig. 1).

While the Mayan builders took advantage of their local resources efficiently, using mostly limestone, clay, and timber founded in the surroundings (Wernecke 2005), recent research demonstrated that the Mayan builders used a different method for building bridges across a major rivers. According to the archaeologist and engineer James A. O'Kon, the archeological remains found in a Mayan site called "Yaxchilan" demonstrated that they used a combination of a suspension rope-cable method aided by two a passing-through masonry towers and anchorages to each side. (O'Kon 1995). Because of the structural advantages of this system that allow longer lengths, the Mayan were able to build a bridge with three continuous spans for a total length of approximately 182 meters (approximately 600 ft.) over the Usumacinta River, which defines the border between Guatemala and Mexico.

2.2. The Europeans' Influence

Roman builders were considered as the fathers of the masonry arched bridge's construction that were built throughout Europe. When the Romans conquered Spain, they brought their knowledge of civil engineering to that region. Consequently, the history of bridges in Spain's western part was influenced by both the Roman and Moorish cultures that occurred the land.

Similarly, since the Spanish Empire colonized Guatemala, it was expected that the knowledge of bridge-building technology was an adaptation and incorporation of both cultures, the Spanish and the Mayan Indigenous.

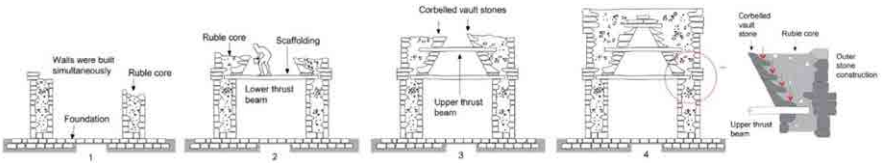

Figure 1. Construction process of the Mayan arch based on O'Kon sketches. Source: (Author 2020)

One crucial example of this technology is exemplified in the Los Esclavos Bridge, found in a small village located in the Department of Santa Rosa on the southeastern Guatemalan territory. It is undeniable that the Los Esclavos Bridge is a clear example of European colonists' intent to introduce their constructive methods in the new environment. For the first time, the Indigenous of Guatemala were introduced to the production and technology of fired brick and semicircular arched masonry structures. These skills and knowledge were passed down from Spanish builders and masons to the local artisans and then to their new generations (Fraser 1990). In Spain, similar structures were constructed in the Cordova and Extremadura regions, near the Portugal's border. One example is the Las Donadas Bridge, located in Montoro, Cordova (e.g. Fig. 2). Despite the two structures being built more than 150 years apart, and different continents with a distance of approx. 8,690 km from each other, the most visible characteristic of comparison are their physical configuration and surface qualities such as material and craftsmanship.

2.3. Las Donadas Bridge as a benchmark case study

The Las Donadas Bridge, located in Montoro Village, Province of Córdoba, Spain, carries the Cedrón road over the Guadalquivir River. The bridge's original name was Puente Mayor, which means "Major Bridge" in the English language. The exact dates of its construction have not been determinate. However, according to Jose Ortiz Garcia, a researcher from the University of Córdoba, it is estimated that the bridge construction lasted for nearly over 40 years between 1498 and 1544. There is the possibility that Enrique Egas, an architect from Brussels, was in charge of the design and the construction under the direction of a master of works named Pedro Fernandez (García 2006).

Portion of the funding for its construction came as a donation from the Montoro's inhabitants and neighbor communities under the justification of regional financial benefit (García 2006). For this reason, the bridge was called El Puente de Las Donadas or "the bridge of the donated" in the English language. According to Daniel Vela, historic bridges in Portugal and Spain that belonged to the Roman political system were regulated by pre-established rules that define their craftsmanship and materials and not by local conditions (Vale 2019). One of these rules dictated that a bridge must be wider than 5 meters (approx. 16.5 feet) to allow the Roman mounted troops to campaign and commercialize. Here, it is necessary to remember that back in the 15th Century, the typical transportation method in Spain and Europe was by horses and carriages, which justified the 5 meters bridge's width ruling. Despite the present technological advances in transportation, the Las Donadas

Figure 2. Left, Las Donadas Bridge, Montoro, Spain. Source (Garcia 2008). Right, Los Esclavos Bridge, Santa Rosa, Guatemala. Source (Author 2018). Two remarkable technological innovations from 15th and 16th Century.

Bridge still serves its original purpose. The 29 feet width clearance of its road is enough to accommodate a two-way vehicular traffic and the pedestrian circulation (Table 1). During special events, the bridge modifies its function and becomes part of the Montoro's community space for an open social events and celebrations (e.g. Fig. 3).

2.4. Los Esclavos Bridge as an embedded case study

As colonists began to establish new foundations, it became necessary to connect those settlements that were part of the Viceroyalty of the New Spain (now known as Mexico, Guatemala, and much of Central America). Before the year of 1592, colonists who traveled the southeastern mountainous area of Santa Rosa, Guatemala, encountered a raging river that caused a loss of time, human resources, and money. Those reasons were the primary motivation for constructing a masonry-arched bridge that would withstand the violent waters, especially during the rainy season, providing a fast and easy method to safely cross over the river for all the traffic operating during that time. The arched bridge's construction was executed by the Xinca Natives, who were enslaved to serve the colonists. Based on the chronicles of Bernal Diaz del Castillo, a traveler historian, the Xinca were the first slaves formally assigned to conquerors in that area (Tom. II, Tratado IV, Cap. XXII, from the MSS. of Fuentes). For this reason, the small village, including the river and bridge were named Los Esclavos, which means "the Slaves" in the Spanish language. Its construction began approximately on February 17, 1592, and was finished in the year 1600. Unfortunately, there is no known document describing the construction process or an inventory of the people who participated in its construction, which what makes this study important to reveal the construction story of that bridge.
During that time, the primary means of transportation were either riding a horse or a wagon pulled by oxen. Therefore, the three meters width of the Los Esclavos Bridge allowed just one-way traffic at a time (e.g. Fig. 3). The access ramps on each side of the roadway probably functioned as a waiting zone for travelers, cattle, and merchandise to cross over (Table 1). Similar to the Las Donadas Bridge, the construction of the Los Esclavos Bridge was partially funded by a taxation policy; in this case, a tax was applied to bottles of wine (Hemeroteca PL. 2017). Over time, the bridge's economic benefits became visible to the surrounding area, and the Viceroyalty of Santiago de los Caballeros in Guatemala located 40 miles away from the site (de Administración Tributaria 2009).

	Las Donadas Bridge	*Los Esclavos Bridge*
Location	Montoro Village, Cordoba, Spain	Los Esclavos Village, Santa Rosa, Guatemala
Length Approx.	180 Meters/590.5 Feet	89 Meters/293 Feet
Width Approx.	9 Meters/29.5 Feet	3 Meters/10 Feet
Height Approx.	19.5 Meters/62.3 Feet	11 Meters/29.5 Feet
Number of arches	Four (4)	Eleven (11)
Latitude and Longitude	38°01'37.4 N / 4°22'63 W	14°25'10 N / 90°27'42 W
Material(s)	Stone	Stone and Brick

Table 1. Technical information and table-comparison of both bridges, Source: (Author 2020)

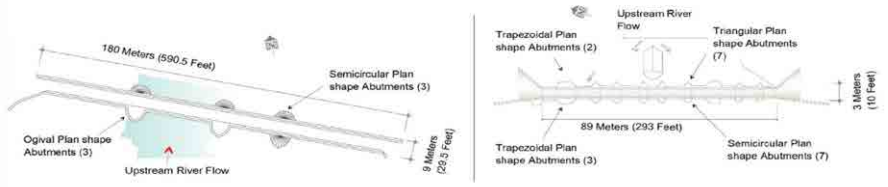

Figure 3. Left, plan of Las Donadas Bridge, Montoro Spain. Source (Author 2020) Right, Plan of Los Esclavos Bridge, Santa Rosa, Guatemala. Source (Author 2020)

3. TECHNICAL ANALISYS

3.1. Abutments

Both bridges appear to have similar abutments in their design and geometric configuration; perhaps their arrangement is one of the most common elements. While the structural analysis of the bridges is out of the scope of this research, it is necessary to provide a general explanation of the acting forces to justify the role of abutments on the bridges. Structurally, semicircular arches transfer loads in a vertical direction, and segmental aches transfer the loads in an inclined direction to the supporting piers and abutments (Huerta Fernández 2001). The Los Esclavos Bridge involves a combination of both type-arches, five semicircular, and six segmental arches that form the barreled vaults. The piers located on either side of the vault receive upper loads and bring them to the foundation. In conjunction with the piers, the abutments have three main functions; first, to absorb half the weight of each adjoin barreled vault; second, to resist the side forces created by the load on each vault; and third, to provide equilibrium and stabilization to the bridge in the horizontal direction (Apreutesei and Oliveira 2005). The presence of sharp edges on the upstream abutments serves as a hydraulic approach to redirect and lessen the upstream river flow's impact against the spandrel wall. Further, it deviates the floating debris by controlling the flow passing through the barreled vaults' openings and between piers. The upstream abutments in both bridges present the same principle. The abutments in the Las Donadas Bridge have only two plan configurations and fewer abutments; three are ogival and three semicircular. On the upstream façade, two of the ogival abutments are full height up against the road level, and a third is with half-height; some scholars suggest that it was never finished. One unique element of this bridge is that two full height ogival abutments became a balcony at the road level, modifying its function and providing pedestrian access for a lookout. This particular experience enhances the relationship between landscape, bridge, and the user. The semicircular abutments are built on the downstream façade. Each abutment is elevated until half the height of the bridge. After this point, the semicircle flat-based rises to a conical cap ending towards the spaniel wall, where it reaches the pinnacle (table1). Differing from the Las Donadas Bridge, the number of abutments in the Los Esclavos Bridge increased significantly to nineteen (19). All of them have a full-height; however, there is no pedestrian access. As expected, all the upstream façade abutments (east) have sharp edges, however, their plan configuration is distributed to seven triangular and two more in a trapezoidal shape. On the downstream façade, the plan configuration changes to seven semicircles and three trapezoidal shapes (table1).

Abutment	Las Donadas Bridge			Los Esclavos Bridge		
Location	Plan shape		Height	Plan shape		Height
Upstream façade	Three (3)	Ogival	Full (2)	Seven (7)	Triangular	Full
			Half (1)	Two (2)	Trapezoidal	
Downstream façade	Three (3)	Semicircular	Half	Seven (7)	Semicircular	Full
				Three (3)	Trapezoidal	
Total	Six (6)			Nineteen (19)		

Table 2. Distribution of abutment in both bridges, by plan shape, façade and number of units. Source: (Author 2020)

3.2. Arches

Contrary to the Mayan corbeled arch, the construction of a semicircular arch involves the use of a temporary framework in the form of mold to guide the construction as the arch gets shaped. The curvilinear shape of this deck not only provides stability, but also supports the dead weight of the materials, and maintains the semicircular shape of the upper unfinished vault-structure until it acquires the strength to support itself. In the Los Esclavos Bridge, five central barreled vaults have a series of small holes embedded on the walls along a horizontal axis as evidence of this procedure. By definition, those holes are known as "putlogs" it was a prevalent practice in masonry historical bridges (Curl 2006). Their consistent rectangular shape and their size indicated the possibility of perpendicular beams that penetrated the walls to support the curved platform's ends. However, there is no specific information about the material used for this purpose. It would be possible they used timber or bamboo as part of the framework and scaffolding since the grass grows in the area. Bamboo is a common material in Guatemala that is fast growing and can be up to 30 centimeters (12 inches). The Las Donadas Bridge is composed of four semicircle arches, all with different spans that support the 180 meters-long deck. This structure works on the basic principle of semicircular arches; the load and forces are transferred in a vertical direction to the piers, which was previously explained (e.g. Fig. 4). This was the technology that the Spanish Colonists brought to New Spain. The Los Esclavos Bridge has eleven arches to support the structure, distributed along a linear axis approximate 89 meters long (293 feet). Each arch became a barreled vault to carry the single-lane deck, defined by the three-meter width (approx. 10 feet) of the road above. The facades have five semicircle arches and six segmental arches

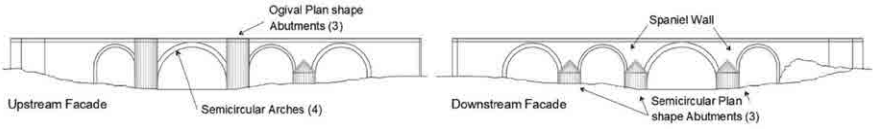

Figure 4. Left, Upstream Façade Las Donadas Bridge. Source (Author 2018) Right, Downstream Façade of Las Donadas Bridge. Source (Author 2020)

in elevation, each with different height and span to accommodate the uneven terrain. The role of the framework (or mold) in the construction of the Los Esclavos Bridge was essential for the learning of the local carpenters and builders who became acquainted with the new arch principles. This historical structure is sober in decorations, but it is evident they used an appropriate and well-constructed framework, which allowed a structural sound bridge when it comes to its efficiency. Despite torrential rains during wet seasons and the constant earth-shaking, this structure still stands to attest its exceptional craftsmanship, passed from the expert European master to the novice Mayan Indigenous builders (e.g. Fig. 5).

3.3. Stone of the Las Donadas Bridge

The village of Montoro, Spain, is well known for using a red colored stone in its buildings and ornamentation around the town. The Las Donadas Bridge was built with a local stone classified as lithotype known as "Molinaza Roja" (Molina et al. 2015). It is unquestioned that the Las Donadas Bridge's construction involved a considerable amount of labor not only in preparing the cut stone but also arranging the ashlar setting at the site. It was finely worked to produce a masonry system predominantly made of rectangular and square ashlar blocks. Although the structure was carefully built from start to finish, visually, it exposed two particular patterns. The upper section starts from the top of the handrail down to the road level. The lower section starts from the road level, down to the foundation (e.g. Fig. 5-b). Both upper and lower sections are separated by a continuous horizontal sill located approx. at the bridge's road level. This sill is projected from the spaniel wall and extends to the bridge's entire length in both facades. The upper section presents a modular system crafted into consistent stone blocks. Detailed stonework was applied to precisely lay the stone and neatly to address the handrail's edges. All three rows of the handrail wall are well proportioned and balanced for a uniform ashlar configuration, including the robust capstone that matches the wall pattern (e.g. Fig. 6-a, and 6-b). The size of the joints are consistent and relatedly thing that the mortar is almost invisible. The lower section presents a different modular arrangement (e.g. Fig. 6-c). Most of the blocks were laid horizontally and maintained the interlocking system between each row. However, each row has a different height related to the other (e.g. Fig. 6-c). In some cases, the stone units were laid in a random pattern, sometimes facing the headers and others facing the stretcher, but keeping the same height through the entire course. The changes in the ashlar configuration could be the product of an intermittent sequence of construction. The present findings suggest that the craftsmanship applied to the Las Donadas

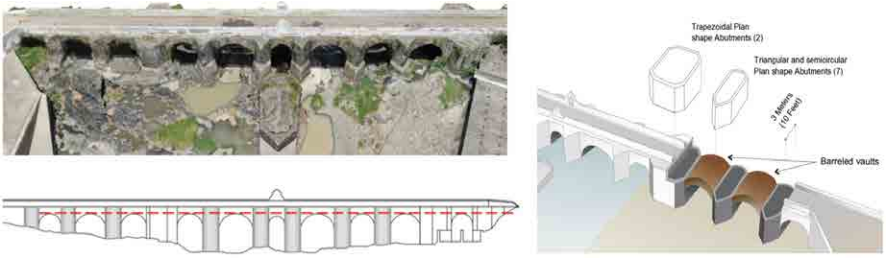

Figure 5. Left, Upstream Façade of Los Esclavos Bridge. Source (Author 2018) Right, 3Dimentional model of Los Esclavos Bridge. Source (Author 2020)

Bridge and its work's magnitude might significantly influence its 40 years of construction. Both sections' patterns balance the bridge; the lower part was designed for general serviceability. Based on the visual characteristics of the upper section, it suggests the use of sophisticated craftsmanship and material hierarchy compared to the lower section. Perhaps, the upper part was influenced by the relation between pedestrians and the bridge, to please and enhance the people's experience.

Stone of the Los Esclavos Bridge

The masonry stone system of the Los Esclavos Bridge is mainly composed of rubble stone except for the arches, barrel-vaults, and handrails that were made of brick. In some cases, the use of rough-cut stone was implemented to create specific elements of the bridge, such as the abutments, corners, and edges. The pattern configuration of the stone is varied and improvised. It is speculated that the Indigenous hand labor resolved the issues instinctively as it arose. The stones were laid with the intention of horizontal rows; however, not all the times it was achieved. The overall character of the bridge depicts a massive and permanent structure. However, visually at close range, the sober character of materials exposed an assemblage of emergency as if the constructors whisking to build the bridge as soon as possible. Further, the timeline coincided with the socio-political situation of the region at that time of its construction. Compared to the Las Donadas Bridge, the differences of the masonry stone system of the Los Esclavos Bride became evident at first sight. While the Las Donadas was built with red ashlar stone, in an almost perfect square-cut arrangement, the Los Esclavos Bridge was constructed with available local materials such as uncut rubble limestone in an irregular pattern configuration (e.g. Fig. 7).

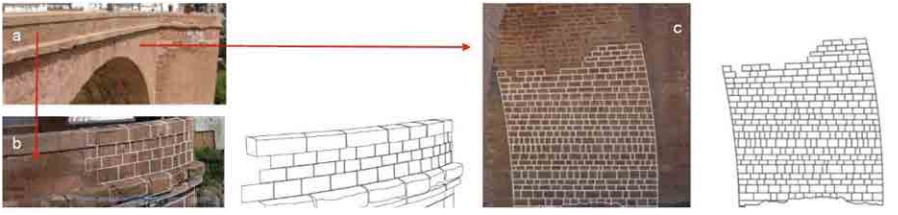

Figure 6. Upper and lower masonry stone system in Las Donadas Bridge, Montoro, Spain. Source (Garcia 2008) (Author 2020)

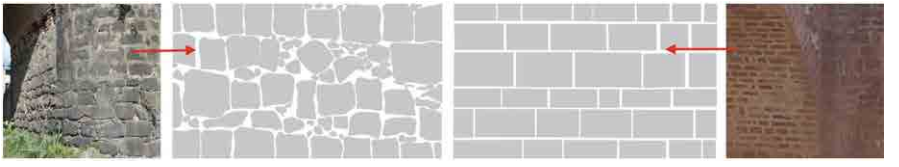

Figure 7. Left, masonry stone system of Los Esclavos Bridge. Source (Author 2018) Right, Masonry stone system of Las Donadas Bridge. Source (Garcia 2008)

CONCLUSIONS

The results of this analysis highlight several visual characteristics among the two bridges. These findings will lead to support or refute the hypothesis that the knowledge applied to the construction of the Los Esclavos Bridge is the adoption of European technologies. Similarities and differences in characters, and construction techniques might be summarized as follows:

Similarities:
Based on typology, both bridges showed a close relationship in their components, such as incorporated abutments, barreled vaults, massive handrails, and spandrel walls protected by colossal abutments. Although the abutment's plan configuration differs in each bridge, they are related by the same principle of sharp edges facing upstream river flow. The same situation happened on the downstream façade, where the principle of smooth semicircle abutments is evident. Also, each bridge presents a symmetrical number of abutments in both the upstream and downstream facades. While the number of arches and the type of building materials are different, the principle of an arched masonry structure is still the same. They shared the same structural principles, by transferring the weight loads in a vertical and inclined direction to the piers, then to the abutments, and lastly to the foundation.

Differences:
The most visual difference between both cases is based on craftsmanship and the pattern arrangement of the stone. The surfaces of the Las Donadas Bridge present more elaborated and smooth stone craftsmanship. Logically, Spanish builders had hundreds of years of practice in the making of masonry arched bridge technology. Spanish trained craftsmen had a superior advantage over the novice and informally trained Maya Natives. In terms of construction length, the Los Esclavos Bridge took less time to build (ten years), probably due to three important facts. First, the bridge's proportions are smaller; this involves fewer materials, less financial inversion, and less hand-labor compared to the Las Donadas Bridge. Second, the purpose of the bridge was to serve the necessity of crossing the river; its materials, ornamentation, and labor were applied accord to its function. Lastly, it is speculated that the amount of hand-labor provided by Mayan-Xinca Indigenous and African slaves was substantial at the time of the bridge's construction. Both bridges differ by the number of arches and abutments in their physical composition. Although the Los Esclavos Bridge is significantly smaller in its dimensions and proportions, it has a greater amount of elements such as eleven arches and nineteen abutments. The Los Esclavos Bridge presented a high degree of uneven stone configuration. There are many possible explanations of this craftsmanship issue, such as variations in builder's crew skills, hand-labor shortage, economic funding struggles, or quarry location changes. Further, the use of raw stone reflects its experimental status, challenges faced, and the Indigenous' problem-solution skills when issues arose. The level of sophistication of the Las Donadas Bridge's craftsmanship and technology correlates well with Montoro, Spain's socio-political context. Oppositely, the stone's size variations and the improvised pattern arrangement of the Los Esclavos Bridge reflect the historical circumstances when the bridge was created, characterized for economic manipulation, forced labor, and slavery against the Indigenous population. Two reasons might influence plaster usage as a final finishing on the surfaces in the Los Esclavos Bridge. First, to cover up the pattern irregularities and rough contour of the stone. Second, influenced by the local cultural customs coming from Mayan traditions with the use of plaster on the walls. Several fundamental questions remain partially or entirely unanswered due to the insufficient material and evidence to

thoroughly compare both structures, such as drawings or historical documentation. The construction of the Los Esclavos Bridge was a significant milestone of the vault method in the region of Guatemala. This bridge acted as a tool for learning, which provided the Mayan Indigenous and the Spanish masters the opportunity exchange the knowledge of masonry bridge technology and adapt it to local needs. It is anticipated that future analysis through photogrammetry will be reported on the bridge that can reveal more secrets about the history of its construction.

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PAPER #6.07

ARTS AS CATALYST: STRATEGY FOR URBAN REGENERATION - CASE OF BENESSE ART SITE: NAOSHIMA, INUJIMA & TESHIMA-

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ABSTRACT

"Benesse Art Site Naoshima" is the collective name for all art-related activities conducted by Benesse Holdings, Inc. and Fukutake-Foundation on the Naoshima Island and also extended to the Teshima Island in Kagawa Prefecture and the Inujima island in Okayama Prefecture. The Seto Inland Sea, known as "Japanese Mediterranean Sea" with hundreds of islands, are now became the tourist destination triggered by the combination with ART, Architecture and Nature.
In a heyday of these islands, industries brought permanent habitants, however, due to the decline of industry along with aging population, brought significant problems in there. Benesse's fundamental aim was to create engaged spaces by bringing contemporary art and architecture in resonance with the pristine nature of the Seto Inland Sea, a landscape with a rich cultural and historical fabric.
The world-renowned architect, Tadao ANDO was asked to be an advisor for establishing an "International Learning Camp", and 3 years later, commissioned the first project, Benesse House Museum, mixed-use development of hotel and museum (1992) after Benesse opened the International Camping field in 1989. As a great impact resulted from this bench mark project, Benesse accelerated its various interventions in Naoshima, as well as surrounding islands. Collaboration with Kagawa Prefecture government, they have launched the Art Triennale, since 2010, so far four Triennale has been held (1st: 2010, 2nd:2 013, 3rd: 2016, 4th:2019). In totalling with 105-108 days of this art festival, over 1million tourists have visited those islands during the event.
This paper will clarify a process of the Benesse's Strategy and its execution of interventions, impact to the neighbourhood, and summarizing a mechanism of urban regeneration chronologically, and will discuss and theorize this urban regeneration as an outcome of catalytic effect of series of Urban Interventions.

KEYWORDS

Urban Catalyst; art intervention; aging society; shrinking society; urban regeneration.

INTRODUCTION

Setouchi Art Triennale has initiated to pursue the reaeration and vitalization of the Setouchi Inland Sea and islands since 2010. Prior to this art Triennale, Benesse Holdings, Inc. and Fukutake-Foundation has been heavily involved with the regeneration of Naoshima Island particularly. "Benesse Art Site Naoshima", its fundamental aim is to create significant spaces by bringing contemporary art and architecture in resonance with the pristine nature of the Seto Inland Sea, a landscape with a rich cultural and historical fabric. Through contacts with art and nature, sceneries and inhabitants of the Seto Inland Sea region, they have been seeking to inspire visitors to reflect on the meaning of Benesse's motto - Well-Being.

The 1st Triennale was held in 2010, for a total of 105 continuous days in Takamatsu and Uno ports and on the 7 islands of Naoshima, Teshima, Megijima, Ogijima, Shodoshima, Oshima, Inujima, and from the 2nd time, 5 more islands of Shamijima, Honjima, Takamijima, Awashima and Ibukijima were added to the exhibition places (Table 1 and Figure 1). In addition to that, the Triennale periods are divided into 3 sessions; Spring, Summer, Autumn from the 2nd time, due to the high demand by the residents. The total number of participants (visitors) for the 1st Triennale resulted in over double numbers than originally anticipated. The nature of the art exhibition was to activate the declined island, where population decreases, ration of senior residents increases, decreased younger gradations, etc. Although the objectives to make a positive contribution to the local communities, administration and operation staff of the events depended on the local residents and volunteers on top of prefectural staff and Benesse Holdings, Inc. and Fukutake-Foundation. By the surprisingly large number of visitors to the islands exceeded the capacity of organization. Dividing into three sessions helped their operation and management of the visitors, and the Triennale was organized smoothly.

Year	**2010**	**2013**	**2016**	**2019**
Days	07.19 – 10.31	03.20 – 04.21	03.20 – 04.17	04.26 – 05.26
		07.20 – 09.01	07.18 – 09.04	07.19 – 08.25
		10.05 – 11.04	10.08 – 11.06	09.28 – 11.04
	105 Days	**108 Days**	**108 Days**	**107 Days**
Places	Naoshima	Naoshima	Naoshima	Naoshima
	Teshima	Teshima	Teshima	Teshima
	Megijima	Megijima	Megijima	Megijima
	Ogijima	Ogijima	Ogijima	Ogijima
	Shodoshima	Shodoshima	Shodoshima	Shodoshima
	Oshima	Oshima	Oshima	Oshima
	Inujima	Inujima	Inujima	Inujima
	Takamatsu Port	Shamijima	Shamijima	Shamijima (Sp)
	Uno Port	Honjima,	Honjima,	Honjima (Au)
		Takamijima	Takamijima	Takamijima (Au)
		Awashima	Awashima	Awashima (Au)
		Ibukijima	Ibukijima	Ibukijima (Au)
		Takamatsu Port	Takamatsu Port	Takamatsu Port
		Uno Port	Uno Port	Uno Port
	7 Islands & 2 Ports	**12 Islands & 2 Ports**	**12 Islands & 2 Ports**	**12 Islands & 2 Ports**
Artist	18 Countries	26 Countries	34 Countries	32 Countries
County/Numbers	75 Artists	200 Artists	226 Artists	230 Artists
Art Work/Event	76/16	207/40	206/37	214/35
Volunteers	8,500	7,000	7,000	7,165
Participants		263,000 (Sp)	254,284 (Sp)	386,909 (Sp)
		435,000 (Su)	401,004 (Su)	318,919 (Su)
		372,000 (Au)	384,762 (Au)	472,656 (Au)
	938,000	**1,070,000**	**1,040,050**	**1,178,484**

Table 1. Year, Days, Places, Artists, and Participants of Each Art Triennale

1. SETOUCHI TRIENNALE

1.1. Background

Over 1 million visitors from Japan and abroad came over the course of the three sessions. This demonstrated the popularity of the Triennale's unique approach, which allows visitors to experience the nature and culture of the Setouchi region and its islands through a wide array of site-specific works and projects. New art works and events were added with particular emphasis on each year's sub-themes, such as the region's connections with Asia and the world via the sea; the Setouchi Food Project; and sharing regional culture, such as lion dances and bonsai.

Not only the domestic and internal visitors, the number of foreign visitors rose dramatically as well. This was due in part to the establishment of additional international routes connecting Takamatsu Airport to other parts of the world and in part to the increase in overseas exposure with each Triennale. The number of repeaters also increased as did the length of time each visitor stayed in the area. In addition, a greater number of people visited sightseeing spots that were not part of the Triennale. The Triennale also generated many other benefits. The influx of visitors not only enlivened the islands during the Triennale but also sparked local initiatives directed at revitalization. In addition, media coverage by newspapers, television and magazines raised the reputation and increased the visibility of Kagawa prefecture as a whole.

Many local people were actively involved in making this Triennale a success by helping with the production of art works, manning the reception desks, offering food and hospitality that reflected local customs, and greeting and sending off visitors at the ports. Such efforts, which also contribute to revitalizing local communities, increased noticeably, indicating that they are becoming an established feature of the Triennale.

Figure 1. Islands for the Art Triennale Places. Source: (Kagawa Prefecture 2016)

1.2. Naoshima

Naoshima is an island town administratively part of Kagawa Prefecture, Japan located in the Seto Inland Sea. As of April 2017, the town has an estimated population of 3,117 and a density of 220 persons per km². The total area is 14.22 km². Naoshima Island is known for its many contemporary art museums. For example, the Chichu Art Museum (Figure 3: Top Left) houses a number of site-specific installations by James Turrell, Walter De Maria, and paintings by Claude Monet. Designed by world recognized architect, Tadao ANDO, it is located on one of the highest points of the island, and various exhibits and facets of the museum's buildings take advantage of its commanding view. Another contemporary museum (with hotel function, one of the early experiments in Japan) is Benesse House, also designed by ANDO. Table 2 shows the chronological interventions applied to Naoshima Island, Teshima Island and Inujima Island by Benesse Holdings, Inc. and Fukutake-Foundation in relation to the Setouchi Triennale.

The museums and beauty of the island draw many tourists, whose visits help support the local economy. However, it is Mitsubishi Materials, loosely affiliated with other Japanese companies of the Mitsubishi name, that dominates industry on the island, as Naoshima has been the site of massive refining by Mitsubishi since 1917. Benesse Art Site Naoshima, Benesse Corporation (one of the largest education companies in Japan and based in Okayama) has directed the creation and operation of the island's museums and other projects since the late 1980s. Basically, Naoshima is categorized in 3 regions, the North with Mitsubishi Materials, Central is with residential neighborhoods both traditional and modern time 2020, Universitat Politècnica de València
with two ports (Miyanoura and Honmura) for residents and visitors, and the South with National Park and Benesse's Art Site (Figure 2: Left).

Figure 2. Naoshima (Left), Teshima (Middle). And Inujima (Right). Source: (http://benesse-artsite.jp/)

Year	Naoshima	Teshima	Inujima
1989	Naoshima International Camp		
1992	Benesse House Museum		
1994	“Out of Bounds” Exhibition		
1995	Benesse House Oval		Shift toward Site Specific Works
1998	The Art House Project		
2004	Chichu Art Museum		
2006	Benesse House Park/Beach		
2008			Inujima Seirensho Art Museum
2009	Naoshima Bath I Love Yu		“Naoshima” Exhibition, Venice, Italy
			“Naoshima” Exhibition, Paris, France
2010		**Setouchi Triennale 2010**	
	Lee Ufan Museum	Les Archives du Coeur Teshima Art Museum	Inujima Art House Project
2012			“Insular Insight” Exhibition, Paris, France
2013		**Setouchi Triennale 2013**	
	ANDO MUSEUM	Teshima Yokoo Museum	
2015		“The Naoshima Symbiosis for the Future” Symposium. New York, USA	
2016		**Setouchi Triennale 2016**	
		Teshima 8 Million Lab Needle Factory Teshima Seawall House	Inujima Life Garden
2019		**Setouchi Triennale 2019**	

Table 2. Timeline of Projects in Naoshima, Teshima, Inujima. Source: (Benesse Art Site Naoshima)

1.3. Teshima

The main attraction on Teshima is the Teshima Art Museum (Figure 3: Top Middle), one of the most intriguing contemporary artworks in Japan. Standing amongst terraced rice fields, the simple concrete structure stimulates its visitors’ senses with the play of water drops on a concrete surface. Several more artworks are scattered around the island’s three fishing villages. Most are open almost every day, especially the larger museums and outdoor installations, however some of the smaller artworks are only open on weekends and holidays.

Teshima is the region’s second largest island after Shodoshima with population of 867. A forested mountain stands in its middle, and a circular road connects its three small fishing villages. Two of the villages have ferry ports, Karato and Ieura, the latter of which is the more important. A half to a full day is needed to explore the peaceful island with its slow-paced atmosphere and rural landscape. Dining, shopping and lodging choices are limited, but slowly increasing by the effect of Art interventions such as Teshima Art Museum and Teshima Yokoo Museum (Figure 3: Bottom Middle). Without previous knowledge, visitors will not notice that Teshima once made news due to a toxic waste scandal in the 1980s in which a company illegally dumped hundreds of thousands of tons of toxic waste on the western tip of the island. Cleanup efforts were finally completed in 2017 (Figure 2: Middle).

1.4. Inujima

Inujima (literally: "dog island") is a small island off Okayama in the Seto Inland Sea that is named after a large rock resembling a sitting dog. Like nearby Naoshima Island, Inujima has become known as a site for modern art in recent years and serves as a venue of the Setouchi Triennale. Due to its small size, the peaceful island can be explored entirely on foot (Figure 2: Right).

Before turning to modern art, Inujima was mostly an industrial site. During the feudal age it produced granite blocks for castle construction, and in the early 20th century a copper refinery was supposed to bring prosperity and people to the island. However, copper prices plummeted within ten years of the refinery's opening and led to its premature closure and a drop in the island's population. The refinery was not demolished after its closure, and despite being out of business for almost a century, its ruins still characterize Inujima's landscape. Designated as a "heritage of industrial modernization", the ruins with their exposed brick walls, overgrown power plant and crumbling smokestacks can now be explored by tourists.

In 2008, the refinery ruins were converted into the Inujima Seirensho Art Museum (Figure 3: Top Right) by tastefully incorporating an art gallery into the ruins. The gallery is located mostly underground and uses local materials such as granite and discarded bricks from the refinery. Among the small number of artworks on display are an intriguing tunnel of mirrors and a tribute to the late novelist Mishima Yukio, which consists of pieces of Mishima's former residence suspended in midair.

Figure 3. Architecture and Art interventions in Naoshima (Left), Teshima (Middle). and Inujima (Right). Source: (http://benesse-artsite.jp/)

2. IMPACT AND EFFECT

2.1. Effect of the Triennale

The results of input-output analysis and hearing surveys of transportation companies and other related parties indicate that Setouchi Triennale 2010, 2013, 2016, 2019 had the effects described below.

2.1.1. Economic Ripple Effects

Based on the Ministry of Internal Affairs and Communications' 2005, 2011 input-output table and the 2005, 2011 input-output table for Kagawa produced by the prefectural government, the Takamatsu branch of the Bank of Japan and the Setouchi Triennale Executive Committee concluded that the Triennale had the following economic ripple effects (Table 3, Table 4, Table 5 and Table 6).

2.2. Ripple Effects

Economic Ripple Effects (JPY) of Setouchi Triennale 2010			
	Direct Effect (JPY)	Primary Effect (JPY)	Secondary Effect (JPY)
11.1 billion	**6.4 billion**	**2.5 billion**	**2.2 billion**

Table 3. Ripple Effects of Setouchi Triennale 2010

Economic Ripple Effects (JPY) of Setouchi Triennale 2013			
	Direct Effect (JPY)	Primary Effect (JPY)	Secondary Effect (JPY)
13.2 billion Spring: 2.7 billion Summer: 5.9 billion Autumn: 4.6 billion	**7.7 billion** Spring: 1.6 billion Summer: 3.4 billion Autumn: 2.7 billion	**2.9 billion** Spring: 600 million Summer: 1.3 billion Autumn: 1.0 billion	**2.6 billion** Spring: 500 million Summer: 1.2 billion Autumn: 900 million

Table 4. Ripple Effects of Setouchi Triennale 2013

Economic Ripple Effects (JPY) of Setouchi Triennale 2016			
	Direct Effect (JPY)	Primary Effect (JPY)	Secondary Effect (JPY)
13.9 billion Spring: 2.8 billion Summer: 5.9 billion Autumn: 5.3 billion	**8.6 billion** Spring: 1.7 billion Summer: 3.6 billion Autumn: 3.3 billion	**2.9 billion** Spring: 600 million Summer: 1.2 billion Autumn: 1.1 billion	**2.4 billion** Spring: 500 million Summer: 1 billion Autumn: 900 million

Table 5. Ripple Effects of Setouchi Triennale 2016

Economic Ripple Effects (JPY) of Setouchi Triennale 2019			
	Direct Effect (JPY)	Primary Effect (JPY)	Secondary Effect (JPY)
18.0 billion Spring: 5.2 billion Summer: 5.0 billion Autumn: 7.7 billion	**11.2 billion** Spring: 3.2 billion Summer: 3.1 billion Autumn: 4.8 billion	**3.7 billion** Spring: 1.1 billion Summer: 1.0 billion Autumn: 1.6 billion	**3.1 billion** Spring: 900 million Summer: 900 million Autumn: 1.3 billion

Table 6. Ripple Effects of Setouchi Triennale 2019

Direct Effect: The amount spent that would flow out of the prefecture, such as goods and services that must be procured externally, etc., was deducted from the amount spent by Triennale visitors within the prefecture.

Primary Effect: The increase in output for each industry within the prefecture due to the Triennale's direct effect.

Secondary Effect: The increase in output for each industry within the prefecture due to the direct and primary effects that would result in additional consumption due to increased employee earnings.

The economic ripple effect within Kagawa prefecture in 2013 amounted to 13.2 billion yen, which represents an increase of 2,100 million yen, or a percent increase of 118.9%, compared to 2010.
The economic ripple effect within Kagawa prefecture in 2016 amounted to 13.9 billion yen, which represents an increase of 700 million yen, or a percent increase of 105.3%, compared to 2013.
The economic ripple effect within Kagawa prefecture in 2019 amounted to 18.0 billion yen, which represents an increase of 4,100 million yen, or a percent increase of 129.4%, compared to 2016.

Over all, the Triennale has been proved successful and even more the degree of economical impact getting bigger.
Operation budged including 2years of preparation for each Triennale was 723 million JPY (2010), 1 billion JPY (2013), 1.27 billion JPY (2016) and 1.25 billion JPY (2019). The budget has been increased, and the period of the triennale was almost identical. The number of visitors is increased as well. Comparison of the Economic Ripple Effect over the budget is 15.3 (2010), 13.2 (2013), 10.9 (2016) and 14.4 (2019). This proves the economic impact against the investigation is very successful.

2.3. Amount Spent by Visitors

Setouchi Triennale 2016	From Outside: Overnight Stay	From Outside: Daytrip	From Kagawa: Overnight Stay	From Kagawa: Daytrip
Ratio Amount Spent/Person (JPY)	47.0% 43,699	26.0% 15,927	1.0% 33,975	26.0% 15,514

Table 7. Amount Spent by Visitors of Setouchi Triennale 2010

Setouchi Triennale 2013	From Outside: Overnight Stay	From Outside: Daytrip	From Kagawa: Overnight Stay	From Kagawa: Daytrip
Ratio Amount Spent/Person (JPY)	43.0% 41,870	23.0% 14,529	1.0% 31,762	33.0% 14,899

Table 8. Amount Spent by Visitors of Setouchi Triennale 2013

Setouchi Triennale 2016	From Outside: Overnight Stay	From Outside: Daytrip	From Kagawa: Overnight Stay	From Kagawa: Daytrip
Ratio Amount Spent/Person (JPY)	47.5% 53,127	21.4% 19,150	0.9% 31,072	30.2% 14,646

Table 9. Amount Spent by Visitors of Setouchi Triennale 2016

Setouchi Triennale 2016	From Outside: Overnight Stay	From Outside: Daytrip	From Kagawa: Overnight Stay	From Kagawa: Daytrip
Ratio Amount Spent/Person (JPY)	52.6% 67,034	18.8% 13,913	1.0% 29,281	27.6% 13,041

Table 10. Amount Spent by Visitors of Setouchi Triennale 2019

The amount spent by overseas visitors was 61,733 yen per person, accounting for 13.3% of the total in the "From Outside: Overnight Stay" category.

The classification of visitors is divided into 4 categories: From Outside - Overnight Stay (50 %), From Outside – Daytrip (22 %), From Kagawa - Overnight Stay (1 %), and From Kagawa – Daytrip (27 %). Approximately of the breakdown was relatively similar. Significance of this table is the amount spend by the outside p overnight visitors increases.

Gender	No. of People 2010	%	No. of People 2013	%	No. of People 2016	%	No. of People 2019	%
Female	7,826	68.6%	11,637	67.5%	10,297	67.2%	4,419	67.2%
Male	3,581	31.4%	5,602	32.5%	5,019	32.8%	2,387	32.8%
Total	11,407	100.0%	17,239	100.0%	15,316	100.0%	6,806	100.0%

Table 11. Number of Participants for the Questionaries' Survey by Visitors in 2010, 2013, 2016 and 2019

Setouchi Triennale	2010	2013	2016	2019
Average Days (Stay)	1.96 days	2.48 days	2.72 days	3.05 days
Average Overnights (Stay)	1.94 nights	2.00 nights	2.36 nights	2.56 nights

Table 12. Average Days and Nights spent in Islands, Survey by Visitors in 2010, 2013, 2016 and 2019

Table 11 shows the proportion of Female and Male numbers who contributed to the Questionaries' Survey in 2010, 2013, 2016 and 2019. It shows the tendency of more female visitors than male visitors, roughly 2:1 throughout of the all Triennale.
And Table 12 shows the increase of average days and nights to stay in islands.

CONCLUSION

Many local people were directly involved in the production and implementation of Setouchi Triennale 2010, 2013, 2016 and 2019. This has become the culture and developing a sense of bonding among them. Such involvement contributes to the revitalization and restoration of local communities and is becoming a firmly established feature of the Triennale.
Not only making an economical advantages and impact, each Triennale helped building the benchmarks on the islands. Those permanent facilities will generate visitors even outside of the Triennale years. Chichu Art Museum in Naoshima, Inujima Seirensho Art Museum of Inujima, Teshima Art Museum, and Teshima Yokoo Museum are the great landmarks or anchor destinations to trigger more visitors.
There are tendencies for new restaurants and local inns to accommodate tourists by converting the vacant houses. Locations are mainly in the existing neighborhoods. The mechanism of spread of renewal is still unclear, therefore, it is significant to carry on this research by finding out when and where the new shops/inns appeared in 3 Islands (Naoshima, Teshima, and Inujima). Other small islands are still lacking permanent interventions yet.
The increase of permanent residents is clarified; however, the numbers are still limited. Most obvious reason is the visitors are limited still seasonal. Therefore, to make continuous income through the year is challenging if they rely on the tourism.
Conclusion is the Benesse Holdings, Inc. and Fukutake-Foundation, and Kagawa Prefecture`s effort has been very successful to revitalize the declined islands, moreover, it makes declined islands as a world-wide destination. 30 years ago, nobody knows those islands outside of Kagawa prefecture or Shikoku Island, now the international recognition is superb. It is important to continue observe, to collect data for this impact, and find out theory behind for application to other places.

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PAPER #6.08

SPACES AND PLACES OF CULTURE FOR THE RENEWAL OF CONTEMPORARY CITY

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ABSTRACT

Spaces for culture are necessary places for human and community life. Architecture gives form to this need and contributes, at the same time, to the construction and modification of the city.
In countries where architectural culture is more widespread and civic sense is linked to the qualifying experience of space, the construction of new spaces for culture (museums, libraries, etc.) - or the redevelopment of existing ones - has contributed to spreading the presence of services into the territory and has proved to be a valid opportunity (or pretext) to launch urban qualification programs (of the historicized city as well as that of recent formation). Moreover, it allowed to give quality to the public space through the modification induced in the context by the architectural project, through its ability to define formal relationships and functional correspondences, as well as significant exchanges with the existing place. In some cases, the new architectures, designed or become the strategic presence of urban transformations, have collaborated to outline (and communicate) the true identity of the city. In particular, public library, more than any other space, revealed itself to be a political-cultural communication tool: library projects have often determined initiatives and established important dynamics for the regeneration of the city (requalification of historic centres, provision of services of the suburbs, attribution of identity to the newly formed settlements). The library, a place of knowledge and encounter, of sociality and dialogue, exalts and develops transversal processes up to be a suggestive pretext for defining a program on the role of architecture and public space in the current urban scenarios.
In addition to outlining the theme in its transversal motivations and through some recent architectural solutions on the international scene, the contribution will present the results of an academic research project about the role of libraries (as representation of collective memory, invention and renewal occasion too) in the contemporary city.

KEYWORDS

Architecture; culture; city; library; project.

INTRODUCTION

The spaces and places for culture (especially libraries and museums, which are linked respectively and traditionally to the presence of books and of art) have been transformed spatially and typologically in recent decades; they have also modified specific settlement strategies, taking on precise roles in the organisation and construction of the contemporary city. Historically these architectures have been built (especially since the nineteenth century) in what we now consider the historic city, sometimes in buildings specially buit for, sometimes in pre-existing buildings of considerable historical and architectural value. The latter condition, if on the one hand it has defined the identity and prestige of many cultural institutions, on the other hand it has also determined a strong link between institution and city, even helping to clarify the image of the city itself. Many libraries, located in buildings sometimes created even

earlier to the formation and transmission of culture (convents, monasteries, seminaries, colleges) have guaranteed the permanence and continuity of the cultural institution in precise areas of the city and allowed the architecture to last, despite transformations and tampering. In this sense architecture has represented the vocation of the place and the recognition of the cultural institution. However, this condition is now sometimes assumed to be a weak and a critical point: the presence of libraries and museums inside the ancient city and in historical containers opens up some questions to be read and interpreted in the necessary relationship between the cultural structure, the architectural organism and the city, which appear to belong to internal order (since historical buildings have little inclination to change and assume the degrees of flexibility that modern cultural services require) and to external order (because of the difficult accessibility, the impossibility of expanding and acquiring new functions). At the same time, now that the city has expanded and become polycentric, architectural culture and political strategies favour the diffusion of services for culture in the vast urban area, the prediction (or implementation) of which has often proved to be an opportunity (or pretext) to launch qualification programmes both in the historicised city and in the recently formed one; it has also made it possible to confer quality on public space through the modification induced in the contexts by the architectural project and the ability of architecture to define formal relations. In some cases, the new architectures, conceived or become the strategic presence of the transformations, have collaborated to delineate (sometimes even projecting outside) the identity of the city itself with the iconicity attributed to the project.

1. LIBRARY ARCHITECTURE IN CONTEMPORARY CITY

Among spaces for culture, public library - more than any other space – has revealed itself to be a political-cultural communication tool: library projects, through presence of service for community and the role of space, have determined several urban initiatives and established dynamics for the regeneration of the city as requalification of historic centres, provision of services of the suburbs, attribution of identity to the newly formed settlements. The interest comes from the role of library, outlined in these years, which became a fundamental space of sociality and democracy that helps to overcome the individualist risk of contemporary societies tending to impoverish city of public spaces and cultural spaces. Library's role and functions transformation has been supported by several experiences made in those countries where architecture culture is consolidated and diffused while civic sense goes through public spaces as necessary qualifying agent for growth and learning. At the same time, in these contexts library represents for inhabitants a service for the community and a usually frequented place. It represents for the city an opportunity to organize public space and, sometimes, to give and identity to the existing one. Construction of new libraries and the spatial and organizational requalification of many existing structures, became an opportunity to create places for encounter and dialogue, to provide services to territories and, even, to enhance city marketing actions undertaken through *cultural operations.* Library went beyond a certain rhetoric which for century has consider it as a space – if not as a temple – for books but it can't be considered anymore exclusively connected to preservation and access to books: it is no longer a poetic "public granary" as described by Marguerite Yourcenar because the primary role of the book is now substituted by the primary role played by the user, therefore by the person that reads, or better, by all those

people that populate this space also for activities different from traditional reading; it is neither the "splendid courtyard" described by Joseph Fletcher where is possible to converse with old sages and old philosopher. To understand what a library of a contemporary city has become, it should be remembered that Temple University public library was open on 2018 in Philadelphia designed by Snøhetta to support 39,000 thousand students of the university but also to welcome (besides other traditional spaces for books storage, study and research) a variety of places for cooperative and social learning and to accommodate 5,000,000 visitors per year.

During these years, library became a perfect architecture to start and establish urban transformation dynamics: there are many contemporary experiences where the project of a library allowed to offer or to return to cities, meant as urbs (therefore as space and organisms) and as *civitas* (therefore as a community), spaces and places that historically and traditionally belongs to territory and population as right to access to cultural development and to access to cultural services. Library, though as infrastructure and as fundamental service for city and territory (as well as hospitals) it is an authentic place of urbs and civitas which accelerate urban regeneration and qualification in a physical and social sense, applying democratic principles; therefore, the public library is protagonist of city redevelopment projects, being a perfect example of participation and sharing, of freedom and creativity of each citizen.

Especially from recent architectural experiences, the role played by public libraries in contemporary cities arise as strategic presence in transformation's dynamics as important public space to freely access to information, as cultural service oriented to a polyvalent character. The library has lost its mono-functional place sacral character responsible for books preservation and to knowledge diffusion, in order to became a communication space (a centre of information and formation) and a place for community.

From the organizational and spatial point of view library transformed itself in a flexible container capable to contain multiple functions and roles, likewise necessity of user as changed following the rapid development of multimedia and digital technologies, with a destiny similar to museums: it is not a coincidence that, among cultural spaces, it goes to Piano & Rogers' Centre Pompidou in Paris the claim and implementation of a *free* space to facilitate interdisciplinary of communication tool, youth and pauperistic language which, anyway, can't stand without support of most sophisticate technology, almost like a revival Labrouste's libraries technological vocation. The Beaubourg, like a supermarket - which will be taken up again twenty years later in the Idea-stores (new concept libraries and permanent training centres designed by Adjaye Associates in the East End of London as a response to the decline of traditional library and training services) puts at the centre of the project the void for users (who see and touch everything), not necessarily attracted by the book but by the activities connected to it. As well as the *Sala Borsa* in Bologna (2001) uses the covered courtyard of an old building, in communication with the street, as the main space of a public multimedia library of general information that privileges the use of electronic resources and access to new information technologies, positioning itself as a centre of aggregation through services and the organisation of cultural events open to everyone, the city and the metropolitan area: it is the *square of culture* (Agnoli 2009) that opens the library to the city and is itself a fragment of the city. The library, in this way, becomes dynamic and "moves, driven by the interests and interventions of its users that are constantly developing and transforming" (Oechslin 2017, 29).

The library is then to be considered as a mirror reflecting the city and contemporary sociality,

at the same time a place of education and communication, "instrument of a social communication strategy [...] emerging point of a leisure management policy that involves the urban equipment and the planning of specific metropolitan areas. Around [libraries] the cultural districts are organised, through which the revitalisation of disused containers is proposed" (Irace 2001, 6-7), ancient buildings are recovered and reused, particularly in cities where the number of historical buildings and the density of the urban fabric are significant. In this vision, even libraries institutionally responsible for conservation and documentation (often located in ancient buildings) have directed their management towards overcoming the traditional model and have focused on promoting integrated cultural and social initiatives (Fig. 1). In these institutions, moreover, the enormous growth of the library heritage and of the number of users has in fact transformed the library into an urban component, a point of accumulation of the social and cultural life of the city; therefore, in any case, even historical libraries must perform more varied and complex functions than in the past and require reorganization with new architectural solutions.

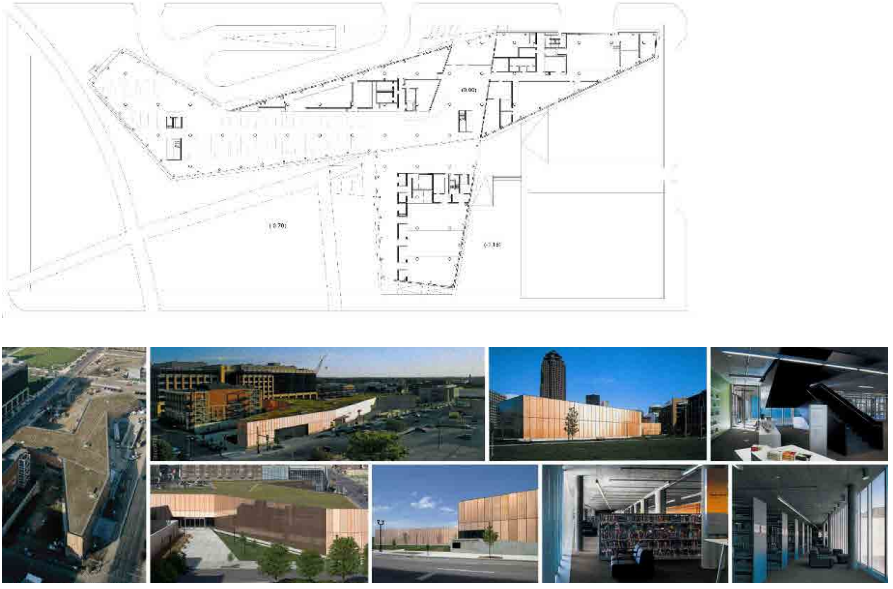

Figure 1. David Chipperfield, Des Moines Public Library, 2006. Source: (Biagio D'Ugo 2013, Paolo De Marco 2017)

2. THE PROJECT FOR NEW LIBRARIES FOR URBAN REGENERATION

Following the needs and transformations of the contemporary city, considering the role of the public library as an architecture that structures urban space, bearing in mind that the library still remains susceptible to definition and continues to offer itself for experimentation and research, the project of public libraries has often been used as a didactic theme for the students of the Course of Studies in *Building Engineering - Architecture* and in *Architecture* at the University of Palermo. The project of the public library, integrated in different urban contexts to propose services suited to the idea of the city, has for several years constituted the suggestive pretext for the definition of a programme about the role of architecture and public spaces in the contemporary city, with the ambitious intention of attributing to the projects the value of exemplariness, in the hope that the formal values of the building (and the transformations induced into the city) will generate further beauty in public and even private spaces. In any case, it proved to be an exercise in beauty and civil commitment. Within the framework of a general vision on the issues related to the library project in the contemporary city in different conditions and contexts in the didactic activity of the Courses, the project of new architectures has been privileged with the intent also to study new places of culture and meeting in the territory of modernity and in the contexts of marginality. The first experience - *A library for every city* - carried out in the academic year 2008-09 (*Course of Architecture and Architectural Composition 1* - prof. A. Margagliotta, tutor Giovanni Lumia and Ignazio Saitta) involved the whole of Sicily since small towns do not always have public places and spaces where to cultivate cultural interests and have opportunities for meeting and comparison. In small towns the library can represent an important centrality and assume the function of a multi-purpose cultural service. On this occasion almost fifty projects of small libraries are formalized for as many cities for which, in addition to spatial and figurative, functional and constructive research, the positioning and insertion in the urban landscape, the design of open spaces played a fundamental role, having taken as a starting point for the construction of the place relations between the existing system of signs, with the idea of identity and belonging (Fig. 2, Fig. 3).

In the academic year 2012-13 (*Architectural Design Laboratory 1* - prof. A. Margagliotta, tutor Sebastiano Provenzano, Ignazio Saitta and Giuseppe Scuderi) the theme was explored with the project of *new architecture*

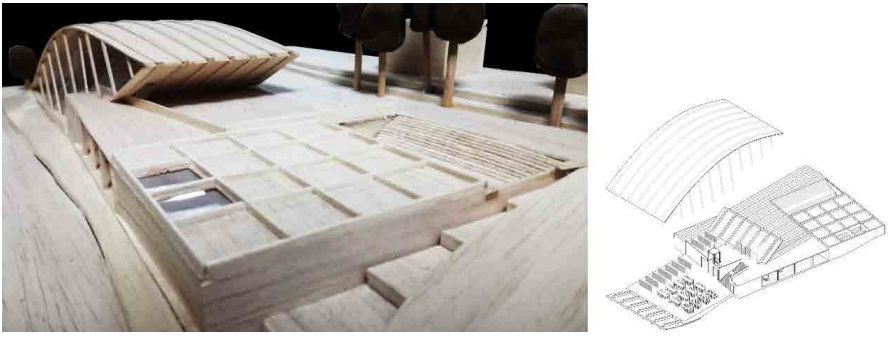

Figure 2. Project of Public Library in Buseto Palizzolo - Trapani. Source: (Paolo De Marco, Giuseppe Tranchida 2008)

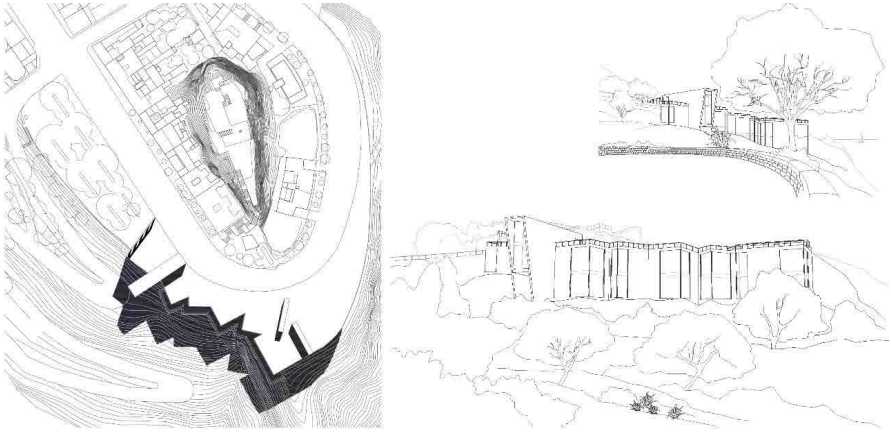

Figure 3. Project of Public Library in Termini Imerese - Palermo. Source: (Helena Carì, Melania Baldone 2008)

for the municipal library system in Palermo: small neighbourhood libraries to highlight the need for new *cultural infrastructures* for a city of great size (which, among other things, was preparing that year to become the Italian Capital of Culture 2019) with the intention of strengthening the municipal library system with a *widespread* presence to be established in emblematic areas, either in the organisational strategy of the neighbourhood, in the relation to the recognisability of the place, or in order to resolve critical spatial or environmental situations. Symbolically, eight areas were identified, corresponding to the municipal districts into which the city is divided, for which each library had to express its identity and explicit its identity. Thus the library of the old town centre (which is the district where all the ancient libraries are located and would be considered already abundantly served) is planned in a highly degraded but highly suggestive area for *the multimedia library*; in the district characterised by a small port (memory of a seaside village) the library requalifies the ancient landing place and builds the *library of the sea*; in a marginal district, marked by environmental degradation, inside a disused quarry the *environment library* is planned; in the residential area, in the area belonging to a school, the programme includes the *learning library* (Fig. 4). In this way, besides proposing a realistic functional programme, the project participates in the idea of *propagation* of architecture and services into the city, so each site has been chosen with its own specificity, which the project have to highlight in relation to the logic of the settlement, the character of the place and the communities for which it is intended. In this way the library becomes a new urban centrality with the function of a multi-purpose cultural service that acts as a centre of aggregation capable of encouraging more intense and active participation by citizens in the life of the community.

In the Degree Course in Architecture in Palermo (Agrigento's headquarters) during academic year 2016-17 the students of *Laboratory 3 of Architectural Design* (prof. A. Margagliotta

- tutor Giovanni Gueli and Sandro Lo Bello) designed new spaces to enhance the existing municipal library of Agrigento with new functions and attractiveness. Strategically, the area below the railway station forecourt has been identified, which today constitutes itself an urban centrality and is close to the municipal library and other cultural institutions. Also in this case the formulation of the functional program foresees functions necessary for a library that intends to relate and identify itself with the activities of a cultural production centre. The new place had to strengthen the existing service with new attractive spaces through the quality of the architecture that for didactic and narrative reasons is developed with a possible theme (the immaterial library, the library/archive, the children's and youth library, the multicultural library, the city library, the library of sounds, the popular library, the study-library, etc.) that synthesises the cultural and social needs of the city.

Figure 4. Project of Library of the see on the small port of Bandita - Palermo. Source: (Mattia Bruno 2013)

3. THE DESIGN EXPERIENCE ON HISTORICAL LIBRARIES

For several years, from 2008 to 2013, the final thesis Laboratory of *Building Engineering - Architecture Degree Course* (in charge prof. A. Margagliotta) developed a study and project strategy on places and spaces for culture in the contemporary city, identifying as a privileged area of research the city of Palermo for which (in addition to museums and places for music) project proposals have been developed for the reorganization, enhancement and expansion of historical libraries. The methodological approach followed as a path:

- the study, critical analysis and redefinition of the organisational structure in relation to modern techniques and recent library economics;
- the understanding and the attribution of meaning to the spatial structure, conducted through the history of the fabrics, the survey of the architectural complexes (of which the libraries often constitute only a small part) in order to overcome, through the project, the dyscrasies and fragmentations deriving from property constraints that over time have dismembered the architectures and caused the loss of spatial unity;
- the definition of the institution's relationship with the city in order to rediscover the sense of architecture in its relationship with the urban structure, also taking the opportunity to resolve open spatial issues through the project, wounds that have never been healed, to restore quality of abandoned or degraded spaces, to restore meaning to spacial situations waiting to be defined, to build the city.
- the elaboration of a design solution on the scale of the building and the city.

The projects, starting from the analysis of critical issues, aimed at reorganising spatiality in relation to the reasons of architecture, often aiming at configuring new extensions, sometimes redefining the proprietary framework because of architectural and urban coherence, sometimes with new projects describing new potentialities and new languages to be put in dialogue with what exists. Through the projects, an attempt was made to address a cultural policy for the city that aimed to adapt the library service to contemporary standards and, at the same time, to redefine the library's presence in the city (Fig. 5, Fig. 6).

All the project proposals, therefore, include both the redefinition of the existing spaces and the hypothesis of expansion through the search for a capacity of relationship that the new must establish with the historical architecture and cultural services existing in the urban surroundings; They also intend to express the sense of a research that contains the understanding of the urban phenomenon in relation to the artefact studied and the possibility of generating spatial relations, making the single intervention an opportunity for regeneration for a portion of the city (whose extension is connected to the capacity of interference of the single artefact with the morphology and the nature of the service offered). The project of the new, under this light, is not taken as an isolated phenomenon but is inserted into urban dynamics, generating relationships, connections, paths, unifying parts that have undergone processes of separation or detachment over time. Ultimately, through study, analysis and experimentation, the works as a whole have the ambition to offer a vision for the spatial and cultural redevelopment of the city.

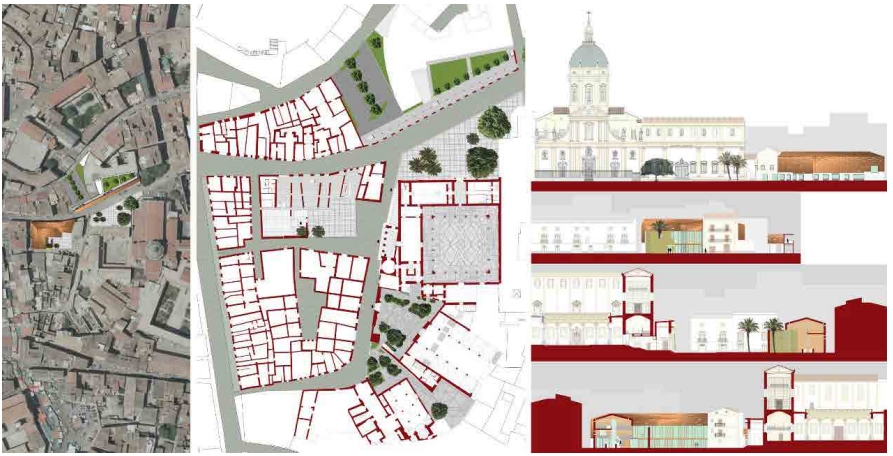

Figure 5. Reorganization of the Municipal Library of Palermo. Source: (Carmelo D'Anna, Antonio Giunta 2005)

4. CONCLUSION. EXERCISE THE COMMITMENT

Ultimately, the library requalifies the city in two ways and defines itself as a priority for the presence of users and is proposed as a place for the dissemination of knowledge, information and training, enhancing the possibility of developing cultural and social activities.

For the new libraries, which have become a symbol of urban public space, the project therefore becomes a way of rethinking urban spaces, of removing them from the increasingly rampant and pervasive commercialisation and making them places of encounter, exchange and collective action. In this vision, the public library becomes an *open territory*, a centre for reflection and knowledge sharing, the node of a network with other cultural institutions.

For the existing historical libraries, in particular, it is time to redefine the places in which they have settled, considering the condition that the contemporary city has assumed: in the face of the external turmoil, inside the library it is possible to find spaces for silence and listening (listen to others, to memory, to oneself). However, it becomes essential to adapt the spaces to the new ideological and library-related needs, offering more modern and attractive services, mitigating the austerity and rigidity of the buildings with the provision, where possible, of new expansions that coexist with the presence of the past but speak the contemporary language.

These aspects, with a view that simultaneously embraces a single building, a system of buildings and the city, are analysed through the ability of architecture to offer itself, for its relational value, to address (and try to solve) spatial and socio-cultural issues, in the ideal of an architecture that knows how to become an instrument of promotion and development. We have tried to grasp this attention and share it with young people in the didactic dimension, with the awareness that the project's didactics accord aesthetic issues to ethical ones.

However, the library cannot renounce beauty and the presence of books: the library can only be beautiful because it bears values for the

Figure 6. Reorganization of the Library of the Capuchin convent in Palermo. Source: (Giovanni Lupo 2015)

space itself and for the city itself, knowing that beauty educates and generates other beauty. This is the great responsibility of architecture. The library, then, must build on the friendly presence of the book as it is an ancient but lasting sign of culture and an expression of the dissemination and sharing of knowledge. Jaen-Claude Carriére compared the presence of books to a warm fur that warms and protects. In fact, in a library one is protected "against error, against uncertainty [...] Being surrounded by all the ideas of the world, by all feelings, all knowledge and all possible errors, offers a feeling of security and comfort. You will never be cold in your library. Here you are at least protected, at least from the dangers of ignorance" (Carrière, Eco 2009, 247).
For this reason, therefore, through the project of new libraries, as well as through the work of dissemination (exhibitions, seminars, conferences in Palermo and in the places of interest) following many of the initiatives described, we have tried to link the concept of urbs to the civitas, in order to try to influence the quality of the service, the city and, above all, the consciences of young students: urging them to pay attention to the spaces for culture, to the knowledge (and love) for libraries, to the exercise the commitment to the cities we live in. "If there is a subject that is pleasing an architect and that is capable of inflaming his commitment - Etienne-Louis Boullè seems to write about it - this is the project of a Public Library".

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PAPER #6.09

THE NEW CHALLENGES FOR CONSERVATION AND MANAGEMENT OF HUWI, AHMEDABAD, INDIA

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ABSTRACT

The overall aim of this paper is to investigate the new role of Historical Underground Water Infrastructures (HUWI) as *cultural heritage*, under the contemporary environmental and climate changes. The paper's first attempt is to understand the issues related to HUWI due to the gradual loss of its original function, and furthermore, to investigate the lack of proper protection and management and usual absent of effective and feasible future plan toward sustainability and the resilience of their contexts.
In this regard, the paper also critically reviews the *P Preventive and Planned Conservation* method -a long-run strategy of integrated management of built cultural heritage- as one of the most significant and recent integrative methods of dealing with complex conditions like in Ahmedabad, India. The main challenge which this paper presents, therefore, is the engagement of the conservation, protection and management processes as an innovative method of capacity building for sustainability and resilience for both the HUWI and their local context/communities.

KEYWORDS

Cultural heritage; historical underground water infrastructures; climate and environmental change; resilience; preventive and planned conservation.

INTRODUCTION

Scarcity of water resources has always been a critical issue for most settlements in the arid and semi-arid climates throughout Central Asia, North Africa, and especially Southwest Asia. Historically people of these regions invented or slowly adopted a variety of solutions to deal with their harsh environments. Historical Underground Water Infrastructures (HUWI), which can be found throughout those territories, are among the most fascinating architectural artefacts of local production, astonishing works of engineering and hydraulics with superb formal and structural aspects. The modernization, the introduction of new industries and heavy mechanization of agricultural systems that accompanied, by accelerated population growth, have generally sought different, more ecologically damaging system of water management through deep drilling, gradually ignoring the well-planned networks of the earlier systems, which had been so carefully integrated with cities/villages, their habitats, and the hinterlands. In India, the stepwells were unique national forms of subterranean water storage systems, especially in the western states where always exists a high level of scarcity of water resources. The main functional role of stepwells was water supply, both for habitats, households, and their personal means as well as for animal watering or agricultural purposes. As the water was a crucial factor in Indian's life, the underground water buildings –as a community center and religious place– were flourished with

the best responsive interplay. In fact, stepwells were designed and constructed as a combination between utilitarian and social manifestations, where the water resource became a meeting point for social and cultural interactions, and therefore a simple act of water drawing became a ritual. With the arrival of modernization to India and the lack of water resources for industrial agriculture, the dramatic shift from traditional hydraulic system to piped system occurred and hence, almost all of those stepwells lost their original function. Nowadays, they are either drastically ignored, severely damaged and abandoned, or on the contrary their cultural image used as the center of speculation for the real-estate market. Some of them can still be found in decent condition but totally or partially disconnected from the network they once supplied from. Only a few of them have been recognized as a monument, listed as cultural heritage nationally or internationally, while almost all of these structures and their networks could be qualified as cultural heritage. Even those that remained under continual maintenance usually do not have proper management and are lacking any future plan, which could provide sustainability or resilience of their contexts –both historical and emergent ones. Although those stepwells have the potential to contribute to the touristic offerings of their regions, their current lack of conservation and their poor management, make it difficult to consider them capable of fostering either local or international tourism, or contributing to the local economy. Hence, this paper aims to explore the current conservation management issues of Indian HUWI, and to critically investigate its protection/management quality, which often lacks an effective and feasible plan toward future sustainability and resilience of its contexts. The paper questions the contemporary landscape of conservation and management of cultural heritage in India, showcasing and comparing the current conditions of two cases of Gujarat stepwells. Furthermore, as the main challenge, this paper pursues the possible new role of HUWI, especially the Indian stepwells, as *cultural heritage,* under the contemporary environmental and climate changes. The paper finally advocates the *Preventive and Planned Conservation* strategy, as one of the most significant and recent integrative methods of dealing with the complex condition of cultural heritage such as HUWI, due to its effective and comprehensive multi-disciplinary process-based approach toward the conservation of cultural heritage and its strategic long term vision.

1. HISTORICAL UNDERGROUND WATER INFRASTRUCTURES

1.1. The Indian Stepwells: the genesis of problems

During the 18th century, with the decline of the Mughal Empire in India, the door to the remarkable career of commercial enterprises of the British East India Company was opened, and empowered by its political ascendency in India until the Indian independence. And, by gradually substitution of the Indian cotton textile manufacturing with the later imported mechanized manufactured products of British mills, a new era of commercial activities and trades was started which progressively, marginalized the role of Indian merchants, as well as gradually weakened the Indian handloom weaving and spinning wheels that were “the pivots of the structure of that society” (Marx 1853). Traditionally, in response to the arid and semi-arid climate, the artificial irrigation system by canals, and water storage buildings in India was providing the basis of agriculture, in which the “prime necessity

of an economical and common use of water" required "the interference of the centralizing power of Government" (Marx 1853). Although the economic function of providing the related public works, was led by Central Government, the internal economic and social structure of the villages/small cities –the so-called village system- allowed the domestic industries -agriculture and manufacturing- and local communities, to have "their independent organization and distinct life" (Marx 1853). Nevertheless, that particular form of the social and economic structure of Indian villages and cities was, gradually, broken by the English interference in trade, land and tax policies, and by neglecting agriculture and the maintenance of water storage buildings. During the mid-19th century, thus, the consequential issues related to the mismanagement of especially water resources in India, led to the debates, that originated the *foundation of an economic critique* by Karl Mark. In his thesis, he stated that "British steam and science uprooted, over the whole surface of Hindostan, the union between agriculture and manufacturing" (Marx 1853)[1]. In parallel events, the inauguration of the railway system in India by the British Government, "opened up the door of opportunity toward the industrialization of the textile system" (Heidari Afshari and Rajabi 2016, 936), which water was the fundamental resource for that type of industry. Once, those textile mills were successfully naturalized, due to the consequential fast growth of populations around them -especially the labor class– settlement patterns of the host Indian villages/cities, were drastically transformed, in particular in the western regions such as Gujarat in which the traditionally-planned networks of the water-buildings and agricultural lands integrated well with their original habitats' needs. Furthermore, the new hydraulic engineering system –piped system– was introduced also by the British, and thus the nucleus of the "social ecology" of those water-buildings was dramatically alternated. Although "caring for wells was once a critical community responsibility and created an invisible circle around a well", after the introduction of the piped system "they [people] stopped to cleaning it" (Livingston 2002, 139). The piped system became an overcoming substitute for the traditional water structures. Starting from the late 1960s –in the post Indian independence era- the so-called *Green Revolution* credited to the new type of agriculture, to the new related technologies such as deep bore wells system and thus, to the establishment of much heavier industries. And thus for decades, India witnessed the overloaded mass water drawing. As the underground water tables dried deeper until the contemporary time, several districts in western states such as Gujarat and Rajasthan became overexploited. One can consider the *Green Revolution* as the final blow to the traditional water infrastructure. Furthermore, the big scale ambitious construction projects –nationally valued- such as the dam of Sardar Sarovar on the Narmada River in south-eastern Gujarat are the good excuse of "the government [to] ignore small restoration projects when newsworthy dams were available to them" (Livingston 2002, pp. 164-6). Those devastating events, are not unique to India, similarly lots of developing countries in the arid and semi-arid climatic zone, have faced the consequences of their late modernizations, and over scaled industrialization. The condition which more than ever seems crucial, due to the contemporary impact of climate change on the sectors such as water. In fact, the "accelerated warming has been observed in India" between 1971 and 2007, "primarily caused by an intense warming trend observed in the recent decade (1998-2007)" (Revi et al. 2015, 12),

[1] Such critiques picked up by Marxists and Indian nationalists, are still alive in political debates in India.

in which urge us reasonably to rethink the contemporary role of Indian well-rooted and culturally feasible pre-industrial water infrastructures, ignored for the last decades.

1.2. Contemporary condition of Indian stepwells; case study of Ahmedabad

Gujarat state, on the west of India, is where one can find the most distinguished HUWI, stunning stepwells, water reservoirs, and Kankarias. Geographically speaking, Gujarat has a semi-arid climate with raining monsoon and almost half a year of the dry season. In the pre-modern India, stepwells were the strategic infrastructures and eminent architectures with the capacity to store monsoon's collected water in their wells and to have it accessible during the dry season. Their strategic locations based on the geographical features of the territory, as well as, their vicinity with the main roads and settlements, were well calculated and complimented by the nature of rural India. However, as mentioned before, their condition is changed. During the last 20 years, the whole Gujarat state transformed drastically, from typical rural/hinterlands and core cities to vast urbanized territory via an exploding, eclectic and uneven urbanization process. One can clearly observe the impact of rapid urbanization in the case of Ahmedabad city, which has been, recently, converted into a mega-region of several municipalities, most of which were previously rural in 2000. That was mainly the result of the so-called *smart development* vision, which is being accelerated by the first implemented program in India, *the Integrated Mobility Plan for Greater Ahmedabad Region, 2031*; the comprehensive plan which intended to adapt both *transportation plans* and *Development Plans* together in order to, shape the future vision of the Ahmedabad and Gandhinagar region. *The Greater Ahmedabad (GA) region* envisioned to cover the developments in the area, in a span of 20 years, arriving from 8.1 million habitants in 2011 to about 12.5 million in 2031 and, increasing employment by 70% in 2031. Looking into the condition of India after independence, without a doubt, the economic reforms of the 1980s and 1990s, consequently, the *liberalization of the Indian economy* and its transition to service sector, opened up the door of opportunities to large investments of private-sectors, as well as the emergence and development of small and medium industries, which were interspersed within, the historical villages and cities such as Ahmedabad. Accordingly, under the Urban Renewal Mission the program which was launched in 2005 by the Government for the development of hundred Indian cities, the Ahmedabad city envisioned *smart city, City Development Plan Ahmedabad, 2006-2012*, and *Comprehensive Development Plan of 2021*, were initiated. All comprehensive visions, as expected, accelerated the rapid urbanization and population growth in Ahmedabad city, having 5,633,927 populations as per the Census of 2011 and becoming the sixth largest city of India. Meanwhile, the Ahmedabad district, together with Gandhinagar, possesses some of the finest examples of stepwells, all of which lack a minimum of protection/conservation, not to say, a lack of a management plan. Out of around 60 recognized stepwells in Gujarat[2], only one -Rani-Ki-Vav (the Queen's stepwell) at Patan- has been nominated and inserted into UNESCO World Heritage Sites. Those recognized stepwells are protected, by the Central Government and Archaeological Survey of India (ASI), as the monuments of *national importance*, such as Dada Harir Stepwell at Ahmedabad city and Rudabai Stepwell at Adalaj village in Gandhinagar district, or the other 45 stepwells, by the Gujarat Archaeological department. Yet, there are a lot of lesser-known stepwells in the Gujarat state that, unfortunately, are

[2] Based on the published list by the Archaeological Survey of India.

not recognized, and thus, drastically ignored, severely damaged and abandoned. (Fig. 1) Dada Harir stepwell -dated around 1499 A.D- was built with Hindu and Islamic styles. It is located in the eastern part of Ahmedabad city -near the core historic city, which by 2017 inscribed in the UNESCO World Heritage List- in the post-industrial context with several abandoned textile mills' sites, several small/medium-scale industries, and their low-income society settlements. Nowadays, the stepwell and its mosque are, to some extent, isolated and separated from their context, original programs, and social and economic structures of their contexts. Although, Dada Harir stepwell, is declared as the monument of *national importance*, in the development plan of the city, it is not provisioned as a cultural heritage site. The stepwell suffers from ignorance, not only by the state government and decision-makers but also by local people -where Hinduism entails the majority religion in the city. And thus, during the last decades, the preservation plans for the stepwell mostly were limited to the monument itself. (Fig. 2) On the other side, another declared *national importance*; Rudabai Stepwell -dated around 1499A.D, located at the historic village of Adalaj and constructed with Hindu style- currently, is one of the most famous touristic destinations on the periphery of Ahmedabad city. While, the stepwell's complex is well protected, during the last decades, the edges of its protected boundary and the surrounding areas of the historical nearby village, have been dramatically transformed. Such immediate transformations were the consequences of separate development plans based on the promotions of tourism in India initiated in 2002, followed by the states' tourism policies in 2015, and accompanied by the regional *smart development plan*. For instance, the new highway and touristic facilities nearby the stepwell, built under the assumption of beautification for the mass tourism, has been transformed the social, economic and spatial structure of the village. By consequence, the villagers are being, more than ever, separated from the stepwell, incoming tourists and any possible future programs of the under-used touristic facilities. (Fig. 3)

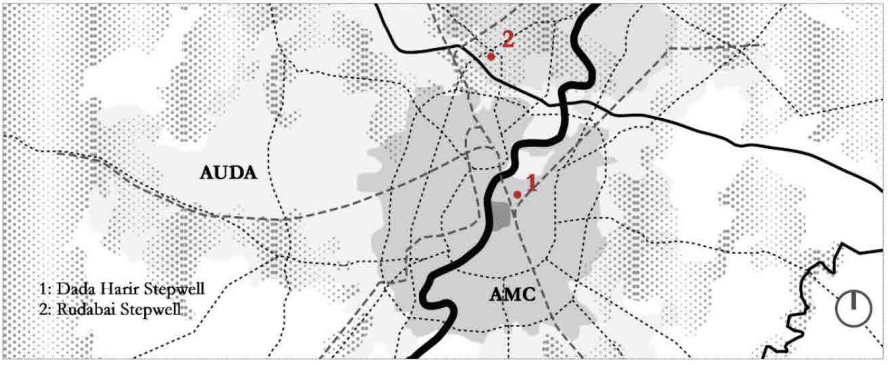

Figure 1. The location of Dada Harir and Rudabai Stepwells in relation to Ahmedabad Municipal Corporation – AMC, and Ahmedabad Urban Development Authority - AUDA. Source: (Authors 2020)

Figures 2 and 3. Up: Dada Harir stepwell and its surrounding; Left: 2001, Right: 2020. Down: Rudabai Stepwell and its surrounding; Left: 2001, Right: 2020. Source: (Google Earth 2020)

2. CONSERVATION, MANAGEMENT, PROTECTION IN INDIA

The Archaeological Survey of India (ASI), under the Ministry of Culture, is the prime governmental organization that is responsible for excavations, protection, conservation, and preservation of monuments and sites, already recognized as the monuments of *national importance*. While the Archaeological department inside the states conducts the preservation activities, as well as, the protection actions on the *protected monuments of the state*, the Indian National Trust for Art and Cultural Heritage (INTACH) -the only non-governmental body of professionals in India- has been involved, with identification, documentation, protection, and conservation of India's cultural, natural and intangible heritage, which are not under the jurisdiction of the ASI as well as protected heritages of the state; INTACH's Charter of 2004 -*charter for the Conservation of Unprotected Architectural Heritage and Sites in India*- has been the main document, to refer to, for the conservation of *unprotected architectural heritage and sites of India* within an institutional framework. Nonetheless, without a doubt the conservation manual of Sir John Marshall, in which the principles of the conservation was comprehensively laid down, for the first time, is still one of the primary conservation references in India; where the values of cultural heritage used not to be considered, in governmental decision makings and policies, nor inclined to be inserted in legislation and norms and similarly used to follow the old colonial-period heritage laws, constituted by focusing on the fabric of the monuments, or else, on the material-based approaches (Sharma 2019). In recent years yet, the ASI has adopted several international charters and guidelines to, better, define conservation approaches for the protected monuments (NPC – AMASR 2014). Likewise, *The National Policy for the Conservation of the Ancient Monuments,*

Archaeological Sites and Remains (NPC – AMASR) of 2014 is the first conservation policy in India for safeguarding, protecting, managing and conservation of the monuments and sites of *national importance*. The National Policy primarily dealt with the internationally recent issues such as *capacity building* and *building of partnerships with multi-disciplinary organizations and institutions, Community Participation in Conservation, Public-Private Partnership in Heritage Conservation and Management, Tourism and Visitor Management,* and *Disaster Management*. The National Policy was envisioned, in concurrence with the provisions of the *Ancient Monuments and Archaeological Sites and Remains* (amended and revalidated) Act of 2010, which, in specific, obligated the 100 meters around protected boundary of the monument as *Prohibited Area or Buffer Zone*, and further beyond the prohibition area, up to 200m in all direction, as the *Regulated Area*[3]. However, those protections designated for monuments, such as stepwells of Ahmedabad, have not been successfully implemented or, if the profit necessitates, the more powerful bodies prefer not to deliberate those further protections around heritage. On the contrary for instance, in the case of Rani-Ki-Vav, it was evident that besides all Indian heritage regulations, the international organizations had effective influence on the stepwell's protection from the disengaged development plan of the city of Patan, which was prepared and sanctioned, before inserting the stepwell at Tentative List of UNESCO, in 1998, and its inscription at UNESCO World Heritage List, in 2014. In recent years, several policies, charters, and strategies are passively deliberated by Government, ASI, and INTACH, in order to adopt more *values-based* and *people-based* approaches to conservation, management, and protection of built heritage in India, yet, practically, they have not been even-handed; as in two cases of Dada Harir and Rudabai stepwells, the missing roles of local and low-income communities in the so-called *smart development* plans were evident, and the process of economic speculation of residential extensions and *tourism development* exceeded over the conservation programs of the two monuments. At least, in the monuments of *national importance* under the protection of the Governmental bodies and the legislations which are *purpose-oriented*, one can, clearly observe that those decision makings are still based on the *top-down* attitudes and the new tendencies on the *bottom-up* approaches are not yet considered effectively. And, thus, by contemporary measures, those monuments, are not validated truthfully as *cultural heritage*; their factual authenticity and significant values, are not fully recognized by decision-makers, politicians, and developers as well as, by their local people. The actual condition on Indian conservation, critically requires a shift in attitudes, towards a *global strategy* which "needs to be carefully designed as a set of different tools (regulations, incentives, education, and dissemination of best practices...)", and "actions have to be taken at different levels, and many regulations have to be harmonized" (Della Torre 2010, 169). In India, the missing link in the regulations and the strategic plans is that they are not strategically oriented toward conservation, management, and protection of cultural heritage. That does not mean that the plans and strategies should include conservation of monuments inside their programs, but rather put the conservation of resources especially cultural heritage and its human resources, in the center of all key decisions. Involving citizens, local professionals, experts, and NGOs, should be the main orientation for the policy making for those contexts. As a result, in order to identify the contemporary role of that cultural heritage

[3] The *Prohibited Area*, where no construction is allowed, the *Regulated Area*, where any new construction will be granted permission only with the approval of the National Monument Authority and ASI.

such as stepwells, in their historical and emergent contexts, it is necessary to understand their true authenticity and to recognize them as *cultural heritage* with its most comprehensive and contemporary meaning which includes integration among different disciplines, and at various scales.

3. GLOBAL CHALLENGE FOR CONSERVATION; CLIMATE CHANGE AND CULTURAL HERITAGE POINTS OF VIEW

Taking to account that although climate change has critically affected our cultural and natural heritage sites, generally speaking, the current national and international rules and policies on climate change have not been placed in any respective plans for heritages; "Only Italy and France have included Cultural Heritage in their respective National Adaptation Plan to Climate Change" (Lefèvre 2018, 15). Moreover, cultural heritage still does not have any central role in any international Policies in relation to climate change. In rare cases like Italy, the *Italian National Strategy for Adaptation to Climate Change* referred to cultural heritage sector -by the three technical-scientific documents produced in 2014 and connected with Cultural Heritage protection will be discussed (Bonazza 2018). The ground-breaking initiative of ICOMOS Symposium on *Climate Change* in Pretoria in 2007, was one of the first to underline the significant impact of *Global Climate Change* on cultural heritage "that is often about loss and destruction as much as preservation" (ICOMOS 2008, 4). The initiative underscored "the serious local social impact from such loss" and the involvement of local communities "in establishing related priorities" (ICOMOS 2017, 18) policies and decision makings. But, the turning point was in Quebec ICOMOS Symposium in the same year, which promoted efforts to actively involve climate change concerns in cultural heritage practices. Meanwhile, by 2007, the UNESCO's efforts, on identifying the world heritage properties at risk from climate change, achieved the significant results, in a compulsory *Policy Document on the Impacts of Climate Change on World Heritage Properties,* and in a pioneering report on *Predicting and Managing the Effects of Climate Change on World Heritage* as well as a "strategy to assist States Parties… to implement appropriate management responses", in order to "protect the outstanding universal values, integrity and authenticity of the World Heritage properties from the adverse impacts of climate change" (UNESCO 2007). And thus, "Between 2007 and 2017, 154 reports on 38 World Heritage properties located in 33 States Parties were examined … in relation to climate change related impacts on Outstanding Universal Value" (WHC/18/42. COM/7, 2018). Currently, the World Heritage properties play a significant role in gathering and disseminating the impacts of Climate change, raising public awareness, and capacity building in relation to their contexts. And in similar events, freshly revised UNESCO *Strategy for Action on Climate Change* (2018-2021), -recalls the same strategy of 2008, was adopted by the UNESCO's General Conference in 2017, so as to underline the 2015 United Nation's *Paris Agreement on Climate Change*, and *the 2030 Agenda for Sustainable Development*; "an innovative and ambitious agenda that places the issue of the environment and sustainability at the center of all social and economic activities" (UNESCO 2019, 6). The strategy considers four thematic focus area for action: *Climate change education and public awareness programs and policies, Interdisciplinary Climate knowledge and scientific cooperation, Cultural diversity and cultural heritage safeguarding,* and *Inclusive social development, intercultural dialogue and ethical and gender quality principles*, for climate change mitigation and adaptation.

Developing countries such as India are also slowly picking this issue up. For instance, in 2017, the *Declaration on Heritage and Democracy* issued by ICOMOS in New Delhi identified the *Heritage* and *Democracy* as key ingredients in a *people-based approach* to *sustainable development*, as well as setting it as a relying vision for the cultural heritage societies toward climate actions. One can argue that it is natural for those countries to have consequential delay in recognizing and adopting those kinds of brand new international agreements, yet the concerning issue is that, despite all considerable international efforts during the last two decades, not only the bodies involved in cultural heritage conservation in those countries, have been inefficiently engaged in this mainstream, but also there is no significant and organized rise of cultural heritage concerns in regard to climate change alarming issues.

And that is mostly due to the absence of sensitive cultural heritage driven management system and the lack of consensus among public and governmental bodies regarding the climate change preventive and planned actions.

4. PREVENTIVE AND PLANNED CONSERVATION

The analysis of the current situation of stepwells in India detected a dramatic alternative between abandon and improper management of some cases, which should be protected, but rather suffer exploitation and commodification. This happens because the recognition as *cultural heritage* does not entail a management system focused on the multiple roles heritage can play for local development, but just on the function to foster tourism. Therefore, decision making refers more to tourism destination management models rather than to best practices in the heritage field. Actually, some practices in the heritage sector can be inspiring in dealing with HUWI problems. Some decades ago the problem has been set no longer just in terms of outstanding values, but in the frame of a wide vision of the implications of growth at the planetary scale. This was the contribution given by Giovanni Urbani (1925-1994), who actually started a research stream on conservation as the management of risks, overcoming the theoretic and radical discussions on the preventive conservation, enhancing it from the scale of the objects in the museums to the monuments and sites at territorial scale. Underscoring a shift in the whole matter, that "Cultural heritage must not be dealt with, separately from the natural environment", he prepared, accordingly, a pilot plan for the planned conservation of the cultural heritage in Umbria in 1975[4], which considered the environmental concerns in the conservation of cultural heritage that was radically different from the traditional restoration. One can observe a distinctive common background between Urbani's *Conservazione Programmata* and the parallel concept of *integrated conservation* stated by the *European Charter of the Architectural Heritage* of the Council of Europe and the Declaration of Amsterdam in 1975. By the verge of 21st century, Urbani's planned conservation was re-launched in Italy, encompassing the idea of *preventive conservation*, in concordance with the Italian development of planned conservation from 2000, especially by enforcing the *Cultural Heritage Framework Law* in 2004 which quantified the *strategy*, as a "coherent, coordinated and planned activity of study, prevention, maintenance, restoration". The statement obviously presented the paradigm shift from traditional restoration as event,

[4] Only part of the foreseen activities were implemented, thanks to the enduring commitment of the Umbria Regional Government. Urbani's initiatives were perhaps unsuccessful, because of the political issues of that time, but they had a great influence on the long run.

to conservation as process, which didn't refer anymore to single actions, but "include many more phases, tasks, and activities, like restoring, maintaining, monitoring and also, planning" (Della Torre 2010/a, 169; Della Torre 2010/b, 145) inside the process as a *whole*. And evidently, in the new method, all the phases introduced to be implemented within a long term vision, in order to achieve the maximum coherence. Urbani's claims also bridged the gap between Italian and International practices, introducing a broader understanding of the relationships of cultural objects with environment and society. Those researches in Italy eventually ended up in a vision and a management model, the *preventive and planned conservation*. One can argue, that the focus on prevention has been undoubtedly inspired by the best practices in Netherlands and Belgium, or by the problem solving approaches practiced in the UK. Indeed, the successful experiments in practice by the preventive conservation in Belgium underscored the cost-effectiveness of the approach and highlighted the well-known message of *prevention is better than cure*, and it is worthy to underscore that also these researches came to broaden their approach towards issues like community involvement and economic impact (Van Balen, Vandesande 2015; Van Balen, Vandesande 2016). The *preventive and planned conservation* has been theorized as a long-term strategy of careful planning of uses and quality, information management, regular maintenance and control of environmental factors (Della Torre 2013 and 2015). In this comprehensive vision, all actions and strategies on cultural heritage are deliberated, to be programmed, in the systematic view that they are coordinated, by the management process. As, the strategy encompasses the *planning of large scale features*, from the policies and decision makings for the optimal performance of local people, it emphasizes on being "implemented in the design of regional development projects which encompass investments on cultural heritage properties and sites" (Della Torre 2013, 123). As a matter of fact, strategically, as a new management approach dealing with built cultural heritage (Vandesande et al. 2018), in a long-term vision, endeavors to put together a top-down approach (prevention of territorial risks, such as floods, quakes, abandon…) and a bottom-up approach, i.e. every day behaviors of stakeholders, like architects, conservators and users (Della Torre 2010 and 2013). And thus, in case of successful implementation, this kind of strategy is more effective and feasible in the coherent sustainability and resilience frameworks. In the *preventive and planned conservation* method, the main targets are oriented to, involve different actors and supply chains and to give the opportunities for educational activities and training on the field, as the tactical tool for innovation and capacity building. It provides thus, the necessary condition, to the intellectual capital enhancement in the target territory. In this regard, conservation as planned process, by recalling the *culture as a unifying factor*, could have effective incentives on the improvement of local/ regional development processes, in order to empower local resources and economy. This vision is focused on the recognition of the potentialities of cultural heritage for society, economy and development, and spans from the value of precious details to the global trends related to major challenges and threats. That's why this model is promising, in order to deal with the problems detected in stepwells, which are no longer useful for everyday life in a becoming world. In overall, the capacity to provide an effective and comprehensive multi-disciplinary process-based approach toward the conservation of cultural heritage, inclusiveness of the process, and its strategic long term vision, is making the *Preventive and Planned Conservation*, one of the most appreciated methods in regard to the contemporary challenges like climate change as well as enhancing the intellectual capital of

a territory; the issue which former methods and approaches of managements and policy making in the camp of conservation, failed to address feasibly and effectively, especially in the global south and countries such as India.

CONCLUSION

The *cultural heritage* which, in the 21st century discourses, has been proved not to be anymore, "a cost to society" (*Getting cultural heritage to work for Europe* 2015, 6), but rather, a unique constructive *identity*, should always be measured as an important source of *creativity and innovation* that could encourage *education and lifetime learning*, enhance local development, and empower the local and regional economy. It is obvious that it is almost impossible to achieve these objectives, unless, the governmental bodies consider and apply the integrative type of methods for the conservation and management of cultural heritage, to guarantee their historical and contemporary social, cultural, economic and environmental values and, last but not least, to revive their true authenticity. The main challenge in this regard and, in complex contexts such as Ahmedabad -within its fast-forward development and growth- is, exactly in the systematic management of cultural heritage which, introduces and follows the rational and feasible paradigm of resilience. To put it simply, the management of cultural heritage is much different from the management of the cultural and natural destinations of tourists that insists on the cultural image or, the *Outstanding Universal Value* of cultural heritage, in order to produce the center of speculation of the real-estate market and the source of attraction for the tourists which, is far away from the contemporary definitions of sustainability. Regarding the resilient attitude toward cultural heritage, more than ever before, the need to think and act differently seems necessary; in those contexts, the overall condition of conservation debates requires to change the attitude in both public and engaging bodies. And thus, the strategic plans have to provide stability by refusing to fell in a trap of short term political positivism. The innovation has to be found, in the provision of constancy and anticipation of uncertainties rather than achieving the so-called *smart growth* objectives. The *preventive and planned conservation* as an innovative long-term management approach to cultural heritage, with the definition which was mentioned before, would be an appreciated alternative, especially regarding the contemporary challenges of climate change for cultural heritage. While in 2018, the Intergovernmental Panel on Climate Change (IPCC) projected that by 2030, global warming could reach +1.5°C, and thus, urged all to "immediately and collectively achieve a paradigm shift" (IPCC 2018), the 2019 UNESCO's report of *Changing minds not the climate* underscored that "the climate crisis is an ethical challenge". The management plans should actively pick upon "the cultural dimensions of climate action" (ICOMOS 2019, ii). And, in the contexts such as Ahmedabad, with a long history of water preservation and traditional resilience toward arid climate, the stepwells, are not just water infrastructures out of commission, or historical sites, their value as cultural heritage, are far more climatically ethnical, and culturally proactive. And thus, at least, the stepwells can act in the *preventive and planned conservation* as the strategic *identity* for the contemporary dimension of cultural resilience.

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PAPER #6.10

AN INCESSANT RESEARCH EXERCISE ON THE HISTORICAL CONTEXT OF FIORENZUOLA D'ARDA CITY

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ABSTRACT

Designing means looking at and listening to what surrounds us, it means respect for the dense layers of signs sedimented by the time that, in their continuous change, become elements that enrich the existing heritage.
Knowing the stratigraphy of a building or a context, not only in a physical sense, allows us to think about new uses, new needs and to set them up in a manner consistent with the pre-existence.
It is a matter of unveiling potential unexpressed identities to materialize them in reality and bring them out of their latent state.
When the project faces a historical built environment, the role assumption of the knowledge direction becomes particularly significant and necessary in the transforming process of a space in another way than the original one. The project interprets the role of unifying catalyst of the different disciplines necessary for the design of a new space.
Following this track, the case study of Fiorenzuola d'Arda city will be taken as a concrete laboratory in which the knowledge of history has become a guiding tool for the project.
The enhancement of the architectural context characterized by the presence of historic buildings with their internal spatiality and the open space with which they relate, also requires the inclusion of new architectural elements, both through internal interventions, and through new addictions, opening a dialogue aware between what the building was, is now, and what is becoming. A process that is not closed in itself, but that tries to investigate and value the continuous and changing relationship between the city, a part of it, and the single architectural episode with its system of relationships.
It is a profitable process that defines levels of complex relationships, enriches, presents, adds, removes, mediates, tells, briefly, plans the change, searching the appropriate form.

KEYWORDS

Architectural heritage; permanence and transformation; unveiling identity.

INTRODUCTION

The demonstrative occasion of the project methodology application to investigate and design in a systemic way, which primarily chooses to work on the existing heritage by promoting a line of sustainable development for the current city, was the collaboration program between a group of researchers from the Polytechnic of Milan and the Municipal Administration of Fiorenzuola d'Arda city.
The ambition to offer a concrete project theme and direct debate with institutional bodies and citizenship over the years has allowed us to verify new functions and activities to be included, test different structures of public spaces, highlight the possibility of connection urban alternatives, framing the focus of the investigation each time within the historical stratigraphy and re-reading the complex weave of signs and relationships that constitutes the urban fabric.

1. KNOWLEDGE AS A PREMISE TO RESPECT COMPLEXITY AND TO REKINDLE A TERRITORY TOWARDS THE PROJECT

1.1. The complexity of the territory: space and time

The territory can no longer be considered as the physical place where fragmentary monumental episodes are located, but as a complex system of architectural assets and open spaces that interact to form its structure. The widespread historical architecture is perhaps the essential component of the landscape resources that contributes to determining the historical substance of any territorial system. Recently, in addition to the interest in architectural monuments, all those tracks that constitute a concrete testimony to the material, social, political and religious life of a place and the community that inhabits it have become important: the effort result, both in terms of knowledge and design, is to consider them as part of a more complex and articulated system.

Within this ever-changing panorama, the architect interprets, builds and tells. Apparently in opposition, construction - linked to space, which uses stone to show itself - and storytelling - linked to time and word - are instead closely related to each other: in fact not all about the space is regarding to the form, and not all about time is related to the stopwatch.

Both are linked to the concept of human life (Riva 2008): that's why we can define the existing reality, be it an urban or landscape fragment, a place of living, with all the meanings and depth that derive from it. When the architect is called to know and to intervene on architectural heritage, in its several aspects, the effort has to be to interpret places not only from the physical point of view, in any case very rich of meanings and character, but also from an *anthropological* point of view: the built carries on itself the tracks of the ways of living.

Questioning ourselves also on this aspect is necessary to prefigure possible transformation scenarios able, on the one hand, of preserving the character of tradition and, at the same time, of welcoming new needs and new requests and trying to give an answer through an appropriate spatial configuration.

1.2. The knowledge between representation and vision

First of all, what do we mean by a *knowledge project?* A representation that is the language we use to describe a piece of the world. What is represented is not the reality itself, but a reconstruction chosen by the observer who, by returning it, interprets it. However, it cannot be limited to a description of the obviousness, linked to the perceptual approach, but has to become an explanation of the phenomenon investigated.

Through an inquiring gaze of complexity (material, architectural, spatial, relational...), capable of a *deep vision*, it aims to reveal the mechanisms and reasons that explain, as well as give meaning, to the evidence. It is not an almost obsessive accumulation of data and notions, although scientific, the use of these, in a conscious and transversal way, to be able to highlight the *underlying form* (Tagliagambe 1998, 20), or the system of relationships (physical but also temporal and social) between the parties.

Therefore bibliographic, documentary, and archival research become an opportunity to read and interpret the transformation processes, over time and in the matter.

Survey activity is no longer a mechanical action - taking measurements and returning them graphically - but it means investigating, researching, knowing, and understanding, to acquire awareness of the complex and articulated nature of architecture, over time and history.

Specialized investigations, which in recent decades have used increasingly advanced

equipment, are invaluable when they help to give specific answers, to validate some insights or not. The analytical data itself, the result of a specialist investigation, has a relative and limited value if not related to the complexity of the complete cognitive activity.
The constructed reality remains unchanged; knowledge can be compared, therefore, to the set of linguistic tools that we use to explain the existing, capable of giving us back the most different aspects, which are located at levels of greater or lesser depth.
The knowledge of the built city is therefore an opening in a multiplicity of interpretations that have to be respected in their plurality and become the premise for the project. Different points of view and methods of investigation from ours help us to read and understand the forms of contemporary life: they are the result of an articulated framework of complicity and differences, of contradictory and complementary elements of continuous processes of direct and induced transformation.

1.3. The project between permanence and mutation

The territory cannot be described, analyzed, and even less designed, and therefore transformed, through simplifications and reductions, but requires an approach

> that respects its inextricable complexity and the simultaneous presence of heterogeneous events and aspects, which they constitute a network of relationships that is gradually expanding to always include horizons larger and to compose a dust of possibilities that aggregate and disintegrate starting from portions the existing one (Tagliagambe 2005).

How can these design experiences, so specific in terms of context, architectural, material, spatial and temporal characteristics, become opportunities for research?

The question is once again related to the ability to "ask the right questions, choose the right tests and find the right conclusions" (Tagliagambe 1998, 18). The challenge consists in the ability to investigate a specific *object* (an urban or landscape fragment) through its peculiarities and, at the same time, be able to abstract its aspects capable of interpreting some more general questions. Following this, we can test, through the project, a response to conservation and transformation requests.
A project thought not as the only possible but as, "the possible alternatives seen from reality" (Tagliagambe 1998, 34): it's an active and dynamic balance between the rights of the *sense of reality* and the reasons for the *sense of possibility*. We can speak of *ontological planning* (Winograd, Flores 1987), which looks back on the tradition that has formed us, but also towards the transformations that have not yet taken place; it's can only grow on the existing, and starting from it to imagine possible scenarios.
So what is the challenge that increasingly becomes a necessity? Being able, through the project, to define a balance between the ability to innovate and build new meanings and, at the same time, the capability to subordinate these changes to the preservation of a specific identity, which we can define dynamic (Tagliagambe 1998, 5-6).
The essential condition of any authentic and effective design activity is therefore the *ability to feel* and see reality not as something complete and defined forever, but as a process in continuous evolution.

2. THE CATALYST AND UNIFYING ROLE OF THE ARCHITECTURE PROJECT

The assumption of direction role of knowledge and disciplines required in designing a space in a many and different ways from the original one, becomes particularly significant. The architectural project has the catalytic and

unifying role of this articulated process of knowledge.

> Modification, belonging, context, identity, specificity, are a group of words that seem to presuppose a pre-existing reality to be preserved by transforming it, passing on its memory with the traces in turn founded on the basis of the previous traces, a reality that appears in the physical form of a geography whose cognitive cult and interpretation of which provide the backbone of the project (Gregotti 1991).

The project therefore, as a meaningful synthesis of knowledge and interpretation of the existing heritage, has the responsibility to convey the contributions of all the disciplines that, today more than ever, contribute to better define a space. Without this cultural direction in the project the technicalities, the norms, the laws, the functionality prevail and the space, with the load of meaning expectations, is lost.

2.1. A recent experience of territorial government policy in Emilia Romagna region

Promoting a culture that recognizes the complexity of the urban fabric in which it is called to operate, underlines the relational values between the parties and recognizes and confirms the importance of regeneration actions, discouraging new land use, therefore becomes the foundation of each territorial policy that wants to propose itself as sustainable. The city today should push appropriate development policies "to enhance the productive, cultural and relational potential within the growing levels of systemic interconnection" (Losasso 2015).
Based on the in-depth knowledge of the historical building at various scales, the territorial, the urban and the architectural one and defining a systemic framework of all potential that the existing carries with it, has certainly represented a constant with which to measure oneself by those who work in the area, but also an essential challenge of not always easy promotion.
In this sense, the policies of the Emilia Romagna region, one of the most advanced regions of Italy together with Lombardy, are interesting to understand how administrative and political support is a necessary condition for extensive and shared action.
Since the early 1990s, the Urban Redevelopment Programs introduced by the Regional Law have been promoted and funded n. 19/98 "Rules on Urban Redevelopment". These planning actions have anticipated for a large part the contents contained in the "Urban Regeneration" call issued subsequently by the Emilia Romagna Region, without however putting into place a real systemic planning. On the other hand, they contributed to increasing the sensitivity and institutional development of a more structured and complex programming. It is in fact in 2018 that the aforementioned regional call for funding is being promoted which it intends to represent:

> a policy in support of the reuse and adaptation of public and private heritage with targeted, long-lasting and sustainable planning, of obtaining a widespread urban, territorial, socio-economic and environmental quality that is a response to phenomena of spatial and environmental degradation combined with functional decline and poor social cohesion, divestments of activities and improper spatial uses, congestion and settlement disorder, as well as the safety and efficiency of the diffuse heritage, the requalification of marginal spaces with precise attention to the reduction of the consumption of soil. [1]

It is clear the desire to attribute to the planning action the possibility and the ability to transform not only physically and functionally parts of cities. The goal is to finance a strategy for urban quality with a view to a "revitalization

[1] From the regional call Urban Rigeneration, Regione Emilia Romagna, 2018.

of the cities of Emilia-Romagna", as it is written in the call.
The *widespread* term with which the demand for regeneration is characterized by identifying the relationship between urban spaces, buildings and structures to be redeveloped, business plans and management programs as the foundation. In summary, it is an invitation to a systemic reading of the space, be it public or private, whether open or inside a building envelope in close relationship with the life of its inhabitants. In search of what De Carli called "primary space", that complex of relationships that "above all and par excellence in architecture" constitutes "an act of qualification and an authentic attribution or donation of meaning" (De Carli 1982, 362).
Widespread also demonstrates the need to emphasize a cross-scale feature, from the municipal or supra-municipal dimension to the size of the neighborhood, square, building, with the specific request to reason by systems, never in a reducing manner. The single intervention takes on value if inserted in a broad regeneration program that involves a complexity of factors and has positive and lasting effects over the years. [2]

2.2. Fiorenzuola d'Arda

Fiorenzuola d'Arda is a small town of just over 15,000 inhabitants, located along the historical roman Via Emilia, on one of the main motorway axes that connect Milan to Bologna, in the province of Piacenza.
The historic urban fabric of Fiorenzuola is characterized by an older nucleus enclosed within a contiguous quadrilateral of the Via Emilia in which Piazza Fratelli Molinari takes a place as the core of the city with the Collegiata, San Fiorenzo Church and the peculiar bell tower detached from the church.

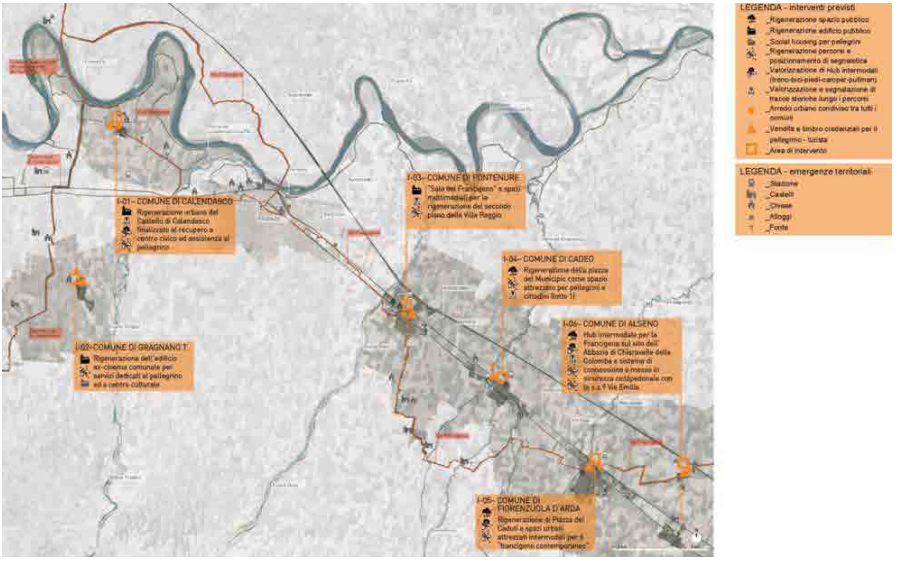


Figure 1. The Via Francigena as a territorial systemic project: the six municipalities involved whose single projects are included in a broad vision regeneration strategy are highlighted. Source: (Vito Redaelli 2018)

[2] The text of the call refers to the absence of a state-level strategy and explicitly adopts some of the principles introduced by the European Union through the Leipzig Charter of 2007 and the Toledo Declaration of 2010 (assuming the integration of policies and sustainability environment as fundamental factors for the attractiveness and competitiveness of cities) and the objectives of the European Agenda for sustainable development.

This original nucleus is in turn inserted in a first historical rectangular shape expansion that extends itself longitudinally following via Emilia, enclosed within the Roman walls on whose route the ring road of the city has been set. Blocked by the railway track, in the second post-war period, urban growth occurred mostly in the south, strongly unbalancing the city towards the hill.
An articulated road network, set on a matrix of roads parallel and perpendicular to the Via Emilia, design the historic area of Fiorenzuola; except for some streets, all road axes are quite narrow.
Instead, there are numerous spaces with a square vocation, urban value and green spaces with relational value. It is not interesting here to go into the specifics of each design solution but to illustrate the principles that generated the project experiences which are described below.

2.3. The Via Francigena as an opportunity for a linear cross-scale connection

The case study of the city of Fiorenzuola d'Arda represents an example of good practice for having participated in the aforementioned regional tender and for taking part in a grouping of six municipalities that proposed the enhancement of a territorial system and historical connection such as the via Francigena (Fig. 1). Also called via Romea, it is the set of historical routes that in the Middle Ages brought pilgrims from Canterbury to the Holy Land passing through Rome, it has united and historically and physically unites the urban agglomerations intercepted by it and, in the specific case, it is assumed the significant connector role of all the projects that each municipality has identified.
Starting from the planning policies developed after the publication of the 2000 European Landscape Convention, the landscape is

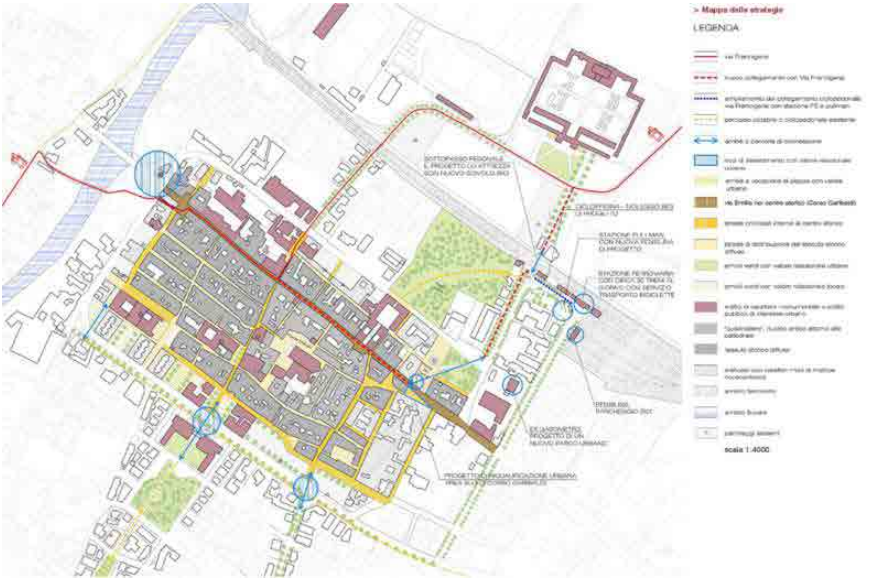


Figure 2. Map of strategies relating to Fiorenzuola d'Arda: all urban regeneration interventions are identified along the urban stretch of via Francigena. Source: (Ugolini, Varvaro 2018)

assumed among the programmatic aspects of the government of the territory.

> The Via Francigena must be structured as one of the axes of the European slow mobility network, in the idea that the corridors are not only fast mobility, but also slow mobility green ways. (...) We agree with the fact that the landscape must, in turn, be considered as one of the values of sustainability (Bettini, Marotta, Tosi 2011).

The landscape of the Via Francigena near Fiorenzuola d'Arda is particularly interesting because it touches an alternation of spaces still open in the countryside and heavily urbanized and infrastructured spaces. There are numerous architectural beauties, among which we can find the Cistercian Abbey of Chiaravalle della Colomba, near the town of Fiorenzuola, which animate the horizontal landscape of the low Emilian plain.
A strategic map is thus outlined which aims to highlight the great potential in the areas directly or indirectly linked to the Via Francigena. Specifically, in relation to Fiorenzuola d'Arda, the railway underpass is redefined as the access point of the Francigena in Fiorenzuola and the bus station, the public space in front of the railway station are redeveloped, providing them with a cycle workshop, the boulevard connecting the station and the Via Emilia is also improved. The intervention aims to enhance intermodality, as an indispensable sustainable choice identified in the broader project of strengthening and upgrading the Francigena route.
Specific occasions have been identified graphically in a dot, usually the expression of a need on the hand of the public administration, by means of a crosshatch it has been identified the area actually involved in the project actions.
It is then proposed, as it emerges from the strategic map (Fig. 2), the definition of a new urban park on the reclaimed area of the former gasometer and the redevelopment of a sequence of open spaces now disqualified and episodic, disconnected from each other, among which piazza dei Caduti takes a place. The project of the square is part of an urban design which, from via Emilia, involves the whole space in front of and behind the war memorial and leads, crossing the public garden, along the large tree-lined pedestrian and cycle path of Fratelli Cairoli boulervard, towards the railway station, the most important of the six municipalities participating in the call.
The nineteenth-century Lucca Park is also involved in this strategy, now in total abandonment, providing for its restoration and proposing it as an alternative connection between the station and the historic center.
The whole project presents via Francigena as a complex territorial system which, knots other systems at the scale of the single municipality which, in turn, strategically insert potential and critical issues to be solved. The necessary knowledge of history and its signs

Figure 3. Behind the actual town hall

Figure 4. Don Bosco school

Figure 5. Former town hall.

passes, therefore, through a dimension of cross-scale project, which, as can be seen from the actions put in place at Fiorenzuola, makes individual projects meaningful and collects the regional political invitation to structure long period topics.

2.4. Redefining the boundary between the historic center and the new expansion in Fiorenzuola d'Arda

Through the project, there have been some occasions to rethink the areas between the new urban expansion and the historic center. The request to qualify the open space behind the current town hall created the opportunity to identify and reconfigure the system of spaces overlooking the ring road that follows the Roman city walls (Fig. 3); the request for new public services within the Don Bosco school complex suggested the need to restore the city thistle to the south and to study the urban connection and the relationship between the built outside and inside the walls, pushing the sequence of spaces and urban park beyond the building (Fig. 4); the request to first place a library, then a health home inside the former town hall overlooking the axis of via Emilia has allowed us to redefine an entire urban quadrant, giving shape to the incongruous and residual open spaces, the result of planning sectorial and approximate past (Fig. 5).
The knowledge of the urban historical evolution (Fig. 6, 7, 8) together with a desire to record the complexity of the issues put in place by any changes in the status quo, has allowed us to identify spheres of influence extended to the single occasion of intervention and therefore to work on parts of the city, where open spaces take on a strategic relational role.
The interpretative maps, not only historical but also investigating the architectural and urban form, the dimensions and the altimetry of the built and the ground, the green spaces, the ways of use, the critical points and, the strengths, are developed together to the design suggestions in a relationship of mutual feed.
We try to record the opportunity not to respond to the specific need with an optimal design response, but with a response that makes a reflection and obliges us to a scale and multidisciplinary discussion.

CONCLUSION

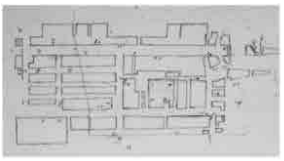
The awareness that *the urban project is structured as a dialogue with the existing, its modification and the constitution of an existing future* (Gregotti, 1993), brings with it the need to articulate that process of context historical knowledge and critical analysis that becomes a project. The analytical approach, already in the identification of the themes, structures the guidelines for a contextual reading from which the project originates. This is the teaching that comes from the work of Giancarlo De Carlo.

> Considering the environment, the city, the neighborhoods, the house not only and solely as artifacts, but rather to consider them as phenomena that make up the human experience. (De Carlo, Sichirollo, 1992)

opposing functionalism with a reading of the use of space as *experience in all its meanings: practical, contemplative, symbolic (...)* and, proposing participation as an operational tool for drawing up plans for the city of Urbino.

> Beginning to 'know' one realizes almost at first sight, how the landscape of Urbino is rich in events, variations, subtleties, which intersect and stratify to generate a multiplicity of situations that are already memorable or can become one (...) (De Carlo, 1994)

We welcome the invitation not to give up on the interpretation of the complex nature of the urban fabric and to take it as a value, to arrive at diversification of the project capable

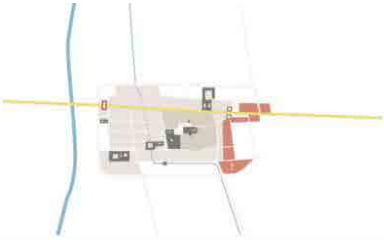


Gli isolati si spingono al di là dei confini degli assi di costruzione principali, tra cui la storica via Emilia. La città si espande a nord dell'asse storico e viene completata l'edificazione dei lotti gotici, disposti parallelamente e perpendicolarmente al castrum romano. Sono ancora ben visibili i caselli, posti alle estremità della via Emilia.

1790

Figure 6. 1790, interpretative map: the city expands beyond the historical axis of the via Emilia (yellow line) and the construction of the Gothic lots is completed, the ancient toll booths at the ends of the via Emilia remain clearly visible. Source: (Ugolini, Gabaglio, Master degree studio Politecnico di Milano 2012-13)

Verso la fine del 1800 l'espansione della città si estende oltre il casello ad est della via Emilia, andando a tangere e ad oltrepassare le mura del castrum romano. Compare il cimitero all'interno delle mura e viene interrato un tratto del canale che attraversa la città parallelo al fiume Arda.



1850

Figure 7. 1850, interpretative map: the expansion of the city extends beyond the walls of the Roman castrum, the cemetery appears within the walls and a section of the canal that crossed the city is buried, parallel to the Arda river. Source: (Ugolini, Gabaglio, Master degree studio Politecnico di Milano 2012-13)

A metà del 1900 si registra una forte espansione a macchia d'olio della città, che rimane però al di sotto del tracciato ferroviario, costruito intorno al 1870, che rappresenta tutt'ora un elemento di forte disconnessione urbana. L'espansione della zona industriale si concentra nella fascia compresa tra l'asse della via Emilia e l'asse ferroviario. Scompaiono le porte della città e l'antico sedime delle mura romane lascia spazio alla nuova circonvallazione esterna della città.

1968

Figure 8. 1968, interpretative map: in the mid-1900s there was a strong expansion which remains in the south of the railway track built in 1870, which still represents an element of strong urban disconnection. The expansion of the industrial area is concentrated in the area between the via Emilia and the railway. The city gates disappear and the ancient site of the Roman walls leaves the floor for the city's new external traffic road. Source: (Ugolini, Gabaglio, Master degree studio Politecnico di Milano 2012-13)

of grasping the richness of the stratification of history understood as vital human experience. The design experiments that have been briefly described concerning the city of Fiorenzuola d'Arda tell of the importance of facing a project never in a closed way. Whether it is a building or whether it is an open space, a street or, a square, a project is needed that, in its functions and material form, chooses the open path of relationship, dialogue, and systemic thinking never partial. In this sense and even more so in historical construction, working on the ground assumes a strategic role because it can be entrusted to it the task of establishing significant relationships between the parties.

In recent past, that of the eighties, where the non-consumption of land was already widely promoted, at least in the cultural debate, and parts of the city recovery and regeneration ware encouraged, Secchi invited to this reflection:

> (...) shift our attention: from the building to the ground, to the surface between the buildings and which cannot be denied or reduced to pure technical space. The opportunity to deal with it, the moment in which to deal with it is certainly this when the pressure for the construction of a huge amount of houses in addition to the existing ones has become perhaps lesser and, instead the pressure for the modification of the existing is strong. I maintain that it is not a matter of thinking only of modifying the use of what already exists or of replacing it with new architectures, of filling the parts of unfinished cities, but today it is also the time, if not above all, of planning the soil in a way not trivial, reductive, technical and inarticulate (Secchi 1986).

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PAPER #6.11

URBAN DESIGN STRATEGIES FOR A PROBLEMATIC, SOUTHERN MID-SIZE AMERICAN CITY

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ABSTRACT

Lafayette, Louisiana, is a mid-size southern city with a population of 240,000. This city thrived during the latter part of the 20th century from its oil driven economy and the university, thus making it a regional, economic center. Typical of most American cities of this size which experienced staggering and unchecked growth during this time period, Lafayette now possesses a fragmented core and blighted, traditional neighborhoods. For the past decade, the city has struggled to regenerate its urban core and traditional neighborhoods, but redevelopment efforts have been stymied by political, economic and poor policy planning decisions. The city suffers an assortment of reconstruction issues including; multiple commercial centers, inadequate zoning policies, dysfunctional planning, private property rights, favored suburban development and an anemic public transportation system.

The Community Design Workshop (CDW), a graduate studio within the School of Architecture and Design at the University of Louisiana at Lafayette, has worked with the city for the past 23 years on developing urban design strategies and economic tactics for the city's renewal. Two case studies proposed policy changes and urban design planning strategies to redevelop the city's urban core. The end goal for both projects was to renovate the single-story neighborhoods into a thriving multi- level, mixed-use redevelopment.

The recent economic downturn combined with a low tax base and a shifting political climate created an environment that has impeded the city's urban core reconstruction efforts. Possessing a clear understanding of these factors while being linked to viable urban tactics for combating these issues at a policy level along with formal and economic strategies, is the foundation of the two projects and the CDW.

INTRODUCTION

Lafayette, Louisiana is a regional hub servicing the southwestern area of the state. The Community Design Workshop (CDW), a graduate studio in the School of Architecture and Design at the University of Louisiana at Lafayette, has been working with the City of Lafayette to provide both urban strategies and economic tactics for redevelopment of the city's urban core. Two projects emerged from the graduate studios that helped identify some of the barriers and possibilities for redevelopment. The first project, Freetown, a neighborhood whose name is derived from the area where free African Americans lived and worked, is currently occupied by students and faculty, and includes a mix of commercial and industry. The CDW produced urban proposals on how to redevelop this neighborhood into a multi-story development. The second neighborhood, the Oil Center, sits adjacent to the University of Louisiana at Lafayette. This area was developed for the newly emerging oil industry in the late 50s and 60s. It housed geologists, engineers, land men and wildcatters, as well as some commercial properties and a hospital. The development of this area again was a single story, single program. The CDW made proposals and wrote an urban code to redevelop the Oil Center district into mixed-use office and housing. The City of Lafayette

recently completed its comprehensive plan which lays out strategies for large buy in collaboration from neighborhoods, businesses, and public officials. The challenge for this city and the comprehensive plan is to overcome the multitude of barriers that exist within a mid-size American city.

Figure 1. Image showing French long lots. Source: (CDW – Original to Author)

1. ORIGINS OF URBAN FORM

Lafayette, Louisiana's morphology is impacted by the French long lot. A French long lot is a special land structure that exists within Southwest Louisiana along the Mississippi River Valley (Figure 1). This agrarian structure allowed French colonists access to the river for the transport and movement of goods. Partitioning the land in this manner provided main routes to the interior and created a long, thin land organization. The long-lot system divides large land acreages into long narrow strips. Each long lot had a narrow frontage on the river only 5 to 8 arpents wide but extended as much as 40 to 60 arpents deep. Cities along the Vermilion River and the Bayou Teche are organized according to this morphological structure which impacts the urban form. This urban form facilitates travel perpendicular to the bayou but becomes problematic when traveling parallel to the river. Contemporary road systems are required to cross these individual land boundaries. Jean Mouton laid out the French long lots in 1821, and the city's original 20 block position is far inland and aligned on the North-South Axis or the national grid. (Figure 2). Lafayette's early development and expansion was forced within the existing organization to the French long lots. "In the beginning, most businesses were located near the church or the courthouse or between the two. Lee Avenue later cut diagonally across the southeastern part of the map, and the cross streets and lot lines were reoriented to that axis…After the railroad tracks were laid northeast of town, streets in new additions were laid out to run parallel or perpendicular

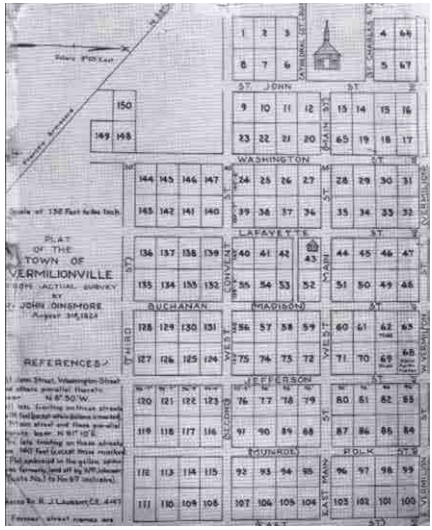

Figure 2. map showing Lafayette original 20 block position. Source: (Keisel, 2007)

to the tracks" (Kiesel 2007, 12). Lafayette's success also contributed to Mouton securing the parish church and then establishing Lafayette as the parish seat of Lafayette Parish. In 1887, the urban form was impacted by the southern intercontinental railroads which came through the City of Lafayette. The railroad forced an economic-driven shift to the city grid (Figure 3). The city's grid shift toward the railroad is an effect of landowners developing around the infrastructure. The railroad provided a corridor to connect industry to bring resources beyond the Mississippi River. Another bearing on the urban development happened in the late 19th century when the University of Louisiana at Lafayette was sought by several cities of the area, but the City of Lafayette instituted a tax to buy the land and then donated it to the state for the establishment of the University. Since the first graduating class in 1904, the University has continued to operate as an economic engine for this area. "Higher education came to Lafayette in 1900 when the Board of Trustees decided to locate Southwestern Louisiana Industrial Institute there. The Girard family gave 25 acres of land, local citizens pledged $8000 in cash, and the parish passed a two-mill property tax to support the school. Local banks offered loans totaling $10,000 against the proceeds of the tax, so the school could begin work immediately" (Kiesel 2007, 39).

Figure 3. 1912 Map of Lafayette, LA. Source: (Dismukes, 1972)

2. SUBURBANIZATION OF A CITY

Many issues contribute to the suburbanization of Lafayette. Beginning in the 1950s through the 1970s, the United States experienced a post-war population boom. Government supported the country's infrastructure with roads, water, sewer, and electricity, thus helping to expand the American city's periphery. Lafayette was no exception. Office parks, suburbs and the American strip became common place to suburban development.

Another restriction to Lafayette's urban growth was the facilitation of the automobile. The Federal- Aid Highway Act of 1956 passed by Congress and initiated by Eisenhower, created a network of interconnected roads across the country. These main arteries led to negative consequences that penetrated the urban core of cities. The interstate emerged in Lafayette in the late sixties and I-10 was completed across the Atchafalaya Basin during the mid-1970s. The interstate shifted the economic activities to the suburban fringe. The interstate and highways became economic engines that expanded the development of cities away from the urban core. This displacement affected Louisiana cities and began the organization and emergence of suburban neighborhoods. Single-family homes encase the surrounding areas of Lafayette's urban core. "Within the overall scope of the ranch house type, an evolutionary pattern of development is evident. Primarily, both the size and complexity of the floor plan layouts increase. In fact, the house type evolves through three rather distinct phases from modest basic ranch type, on its way to the

sprawling, highly articulated ranch rambler" (Rowe 1991, 73). These subdivisions create entire communities where family incomes and demographics are almost completely similar. Suburban neighborhoods separate residential and commercial development, thus depriving the walking access for daily needs. These subdivisions mostly consist of single-family homes placed within a field of green landscape, garages that replace porches, and roads conforming to a hierarchy. Dead-end roads feed into residential streets that lead into the large collector roads to current shopping malls and strip malls hidden behind large parking lots.

Johnston Street is a major artery running through the heart of Lafayette (Figure 4). It began as a modest country highway then grew to become today's five-lane state highway. It links a series of important landmarks in Lafayette: the University of Louisiana at Lafayette campus, the Cajundome, and commercial districts along the street, including the Acadiana Mall. It is also the spine for thoroughfares that branch out to many other places throughout the city. This major artery exhibits the characteristics of most American commercial strips. With a series of object-oriented architecture placed in a field of parking lots, landscape is either miniaturized or pushed to the margins of the development while the architecture becomes a flat generic response to the automobile. Big box stores, malls, gas stations, car salons, and fast food restaurants, with a collage of signage, produced a typical suburban development that occurs throughout the United States. Acting as a connector to many important buildings and activities, Johnston Street has created extreme congestion which is one of the major problems with the existing condition. In addition, this major thoroughfare lacks a presence as a connector for a community that has a unique history and a rich and vibrant culture.

Figure 4. Johnston Street Lafayette, LA.

3. BARRIERS

The barriers to redevelopment in a mid-size American city are numerous but can be categorized into physical, bureaucratic, policy, economic, and political. The physical barriers to redevelopment can be seen in the city's urban form. This urban form was generated by the land division of the French long lots. This land pattern is useful in an agrarian economy with transportation on the river, but with established neighborhoods and developed road networks, this land pattern is problematic. The vision for this early town was somewhat limited with the original design of 1821 with just 20 blocks and limited space for right of way for roads and streets. Additionally, the lot sizes were average 40 feet by 80 feet making it difficult for contemporary redevelopment. These modest lot sizes can be seen in the 1912 plan for the City of Lafayette (Figure 3). From a bureaucratic point of view, until recently, the city was being regulated by an outdated zoning code based on suburban principles. Pyramidal zoning separates land use, institutes setbacks from the street and produces oversized parking requirements that eat up valuable land and hinder a more compact building model. The Lafayette Consolidated Government Zoning Ordinance states setbacks for the general business zoning district are, "Front- 20 feet; Side- for detached dwellings, 5 feet per side; Rear- for dwellings, 10 feet; Where lots are created

adjacent to or abutting a substandard public right-of-way, a building setback line shall be placed at a distance from the public right-of-way equal to the sum of one half of the right-of-way deficit and the zoning setback for the applicable zoning district." (Lafayette Consolidated Government 2012, 69) The setback policy which is suburban in nature excludes any mixed-use or urban buildings fronting on the public right-of-way such as sidewalks or public spaces. Administratively, the city's planning department organized its code enforcement based on the suburbanmodel. The traffic department deals with road planning and its development. The two departments rarely converse with each other and traditionally defend their turf.

With its newly completed comprehensive plan, Lafayette instituted a Unified Development Code. (Figure 5). This code replaced the old zoning ordinances and has been in place for the last fifty years. Progress has been made, particularly in the downtown, where the code is following a form-based three-dimensional model. Two new construction projects have adhered to this new code. Unfortunately, the newly elected Mayor-President has formed a task force to reopen the UDC and remove critical urban development codes in order to expedite development. "There's a regulatory aspect to this and an implementation from the administration that we need to learn how we can better serve developers, how to better serve business… Guillory said". (Welty 2020)

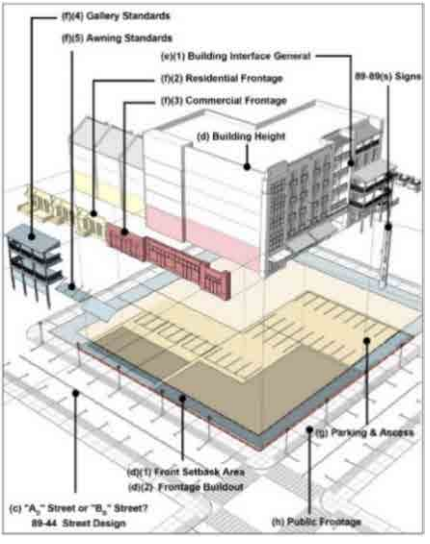

Figure 5. Unified Development Code. Source: (Lafayette Consolidated Government, 2019)

The city's most recent outgoing elected officials implemented Taxing Incremental Financing Districts (TIF). A TIF is a taxing district that has the ability to levy taxes in a designated area with approval from the State Legislature. These districts are monitored by an independent board. The tax monies can be implemented for infrastructure improvements such as electrical, roadways, sidewalks and even streetscape improvements The new Mayor-President is opposed to the economic development districts. "I want our city and parish to be known as business friendly, low tax jurisdictions that are more inviting to visitors who want to stay here and shop here," he wrote. "These taxing districts do the opposite." (Taylor 2019). This administration could stop this badly needed policy to help redevelop Lafayette's urban core.

At a state level, Louisiana has no mechanism to assemble a series of properties for urban redevelopment. Governor Kathleen Blanco's administration passed legislation that favored strong property rights over redevelopment. Political pressure applied to the city council comes from developers that do not have the skill set to build multifamily housing in an urban context and continue to only build three-bedroom family housing. The barriers for the redevelopment of Lafayette's urban core are numerous and wide ranging from physical to political. Unless some of these barriers can be overcome, urban redevelopment will be delayed and will follow the anemic pace of the last 20 years.

4. POSSIBILITIES

The City of Lafayette and the surrounding region has always enjoyed a history of creative and energetic involvement for Lafayette's redevelopment. The Chamber of Commerce and other civic groups have been hyperactive in the city's interests. These groups have been instrumental in procuring and supporting the comprehensive design. This civic process that the community has been engaged in has brought a new optimism to the city. The process is encouraging more development in the urban core and establishing an urban code. It also has been publicly discussed to reorganize the departments of planning and code revision into one streamlined department. The hope is that the plan will set some priorities for the redevelopment of the city's urban core. The University also has completed its own Master Plan for redevelopment of its campus. What is optimistic is that the University's Master Plan and the city's Comprehensive Plan are proceeding forward with an unprecedented, cooperative dialogue between the two, whereas before they acted as an independent agency making plans in isolation. The best example of this is the recent sale of the horse farm and land swap that benefited both parties for the development of a new passive park in the middle of the city. Opportunities exist to operate a hybrid condition of suburban-urban landscape in this American mid-size city. This American urban landscape is, at best, a difficult entity to read and comprehend that may be attributed to the collision of two very different city types that make up the urban condition. This condition is composed of the traditional city, and its post-industrial counterpart, the suburban city. Each has its own reading, its own properties and elements. The traditional city, with its layers of history, contains highly distinctive urban elements perceptible in its containable spaces, grids or fields, block structure, and commercial core, even if they have been fragmented by 20th century development. These elements produce a clear datum whereby one is capable of reading the city's fabric. It is within this backdrop of hybrid urban form, political and bureaucratic barriers and current economic and policy opportunities that the Community Design Workshop (CDW) has operated in Lafayette and the region in the last twenty-three years.

5. THE COMMUNITY DESIGN WORKSHOP

The School of Architecture and Design provides expertise in urban design, planning, landscape design, architecture, housing, and preservation. The Community Design Workshop (CDW), located in the School of Architecture and Design at the University of Louisiana at Lafayette has been involved with small town projects that promoted the revival of their downtown areas and neighborhoods along with large infrastructure designs for interstate highways and major arterials for Municipalities and the State of Louisiana Department of Transportation and Development. The CDW was engaged in restoration projects for small towns following Hurricanes Katrina and Rita devastation. Additionally, the CDW has completed multiple

Figure 6. Aerial of the Oil Center. Source: (CDW – Original to Author)

projects for the University of Louisiana at Lafayette. In all CDW projects, the team, which is comprised of students and faculty, propose the design, develop the construction documents and become involved with supervising the building construction The purpose of the CDW is to function as an outreach Institute to the community for urban design and provide architecture students an opportunity to gain practical experience with real world design problems.

6. TWO PROJECTS

Two projects that illustrate redevelopment possibilities are the Freetown neighborhood and Oil Center district. Freetown is an original Lafayette subdivision formerly called the Mouton Addition. Prior to the Civil War, many freed slaves settled in this subdivision, along with a heterogeneous mixture of lower- and middle-class Caucasians. Over the years Freetown, as it became known, served as a melting pot of various cultures including African, Cajun, Lebanese and Middle Eastern, Greek, Spanish and Irish. Freetown residents came together and developed their neighborhood into a strong community. Traditionally, this area has been home to university professors and their families. The other study area, referred to as the Oil Center, was developed by Maurice Heymann beginning in the 1950s through the 1970s and provided valuable office space for southwest Louisiana's emerging oil industry. (Figure 6). Originally established as a Lafayette office park, today the Oil Center is a suburban city model surrounded by housing. "The importance of the Oil Center extends beyond the oil business. The Oil Center has become a city-within-a-city, containing professional offices, retail shops, a shopping center, banks, brokerage firms, a medical clinic, florist shop, gift shops, drug stores, art galleries, and post office" (Guaranty Bank and Trust Company 1980, 78). This condition has restrained the Oil Center's horizontal expansion and has forced a more urban vertical redevelopment. The CDW hosted a series of charrettes with stakeholders for both projects where precedents of successful urban districts and neighborhoods with diverse programming were introduced. The fabric of these example urban districts called for mixed-use building typologies which allowed these districts to be more vibrant and compact. The CDW analyzed these precedents and synthesized them with the stakeholder concerns and the context of the existing districts' conditions. The CDW made impressive strides in building consensus and generating momentum amongst stakeholders and the general public regarding the redevelopment for both of these districts.

7. FREETOWN

7.1. Urban Design

Freetown's physical position between the university and the downtown has created a great need for redevelopment. Programs that would bring life to this district are a denser mixed-use fabric of housing and commercial supported by additional infrastructure of parking, pedestrian walkways, and landscape. The overall proposed plan was divided into three phases. Phase One proposed the development of four blocks at the intersection of Jefferson and McKinley Streets. Within these four blocks, a grocery store would be placed to occupy an existing building with a parking garage to extend over the roof. On the smaller block adjacent to the park, the existing industrial buildings remain but include new construction, mainly housing, and would reflect surrounding typologies. The final block proposed new construction to reflect the typologies of old warehouses and include housing, commercial, offices, and restaurants. The parking for this block would be consolidated to the block's core

thus keeping the urban edge while creating a dense street presence. Phases Two and Three continue down Jefferson Street to the downtown area and McKinley Street to the university. The redevelopment included two to three story buildings with housing, commercial, and parking. Two green spaces are strategically placed within the neighborhood offering different amenities.

Other CDW proposals presented an opportunity to connect both the University and downtown Lafayette and with the redevelopment of McKinley Street, that connection could be formed. The intersection of McKinley Jefferson Streets would become the primary node with the establishment of McKinley Park. and commercial shops on the opposite side of Jefferson Street along McKinley Street. In order to accommodate parking, three parking structures were proposed. These structures were internalized on their respective blocks and surrounded by mixed-use buildings in order to keep an active urban street front thus providing sufficient public parking for the majority of the development. The park consists of commercial and mixed-use developments surrounding a large, public green space. The northeast end of the park is home to a culturally rich development, programmed with an open farmer's market, restaurant, classrooms for culinary arts, music venue, theater, and art galleries. The other mixed-use developments incorporate cafes and retail shops that act as an extension of the park through outdoor seating. (Figure 7).

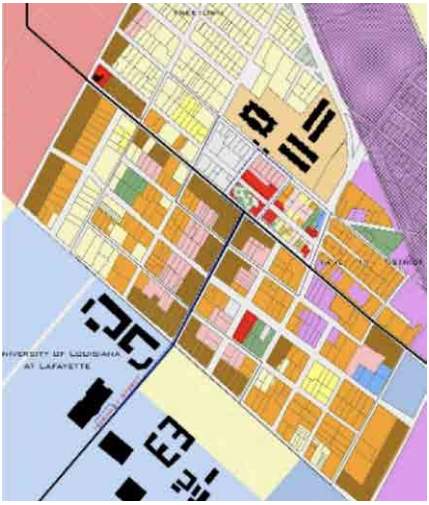

Figure 7. Mixed use growth down McKinley Street
Source: (CDW – Original to Author)

7.2. Architecture

Many of the proposals for the Freetown neighborhood took on a more urban quality along the prominent Jefferson and McKinley Streets. The architecture was kept small scale allowing it to relate to the existing neighborhood (Figure 8). The site strategy pushes itself to the sidewalk edge with parking in the back of the building. This maintains the urban edge and keeps the sidewalk activated. Along the ground floor and adjacent to the sidewalk, the building footprint carves out space for interaction with the street. These mixed-use buildings animate the street with public space for outdoor dining. Apartments are designed for the upper floors with terraces for the restaurants and the apartments. Parking was organized to the back of the buildings or tucked underneath while still being screened from the street.

Figure 8. Corner of Gen Mouton and McKinley Street.
Source: (CDW – Original to Author)

7.3. Streetscape

In order to redevelop McKinley Street and the surrounding neighborhood, a plan was generated to connect the University of Louisiana at Lafayette and downtown Lafayette through the McKinley Street Corridor. An option to create a pedestrian promenade along McKinley Street was available. Multiple schemes produced a variety of options within the promenade's plan. In urban environments perception of the street is important. In the pedestrian promenade, traffic would be diverted to peripheral streets, creating a bike path in the center bordered by landscape. Sidewalks were widened to allow for outdoor seating while balconies create an arcade for shade. The corner of McKinley and Jefferson Streets would be home to a children's playground. The overall design was a joint effort between neighboring property owners, the Lafayette Consolidated Government, and the University of Louisiana at Lafayette.

7.4. Urban Design

The urban design strategy for the Oil Center Office Park was not only to transform the overwhelming majority of its single-story/ single-use structures into mixed-use low to mid-rise buildings, but to also reverse the primacy of the automobile over the pedestrian by creating a greener and walkable community. The urban plan was forced to take into consideration that a significant public transportation system will not come into existence in the City of Lafayette and therefore, automobile access and parking would maintain its influence in all aspects of programming. The challenge of maintaining automobile access and parking, while giving primacy to the pedestrian, was further compounded by the relatively small city block sizes and the area's high groundwater table. The main parking strategy that would allow the density of the Oil Center to expand from single story to low and mid-rise buildings would focus on the creation of parking decks

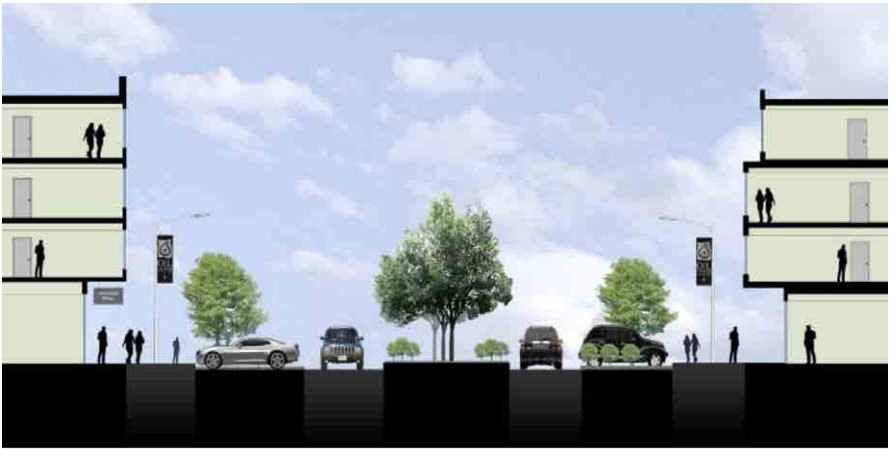

Figure 9. Coolidge Blvd Proposed Section
Source: (CDW – Original to Author)

embedded into the center of the urban blocks where each development or building would screen parking from the street and pedestrians. Additionally, a shared parking strategy for mixed-use buildings was integrated into the overall master plan. In order to capitalize on the proven value of diversified programming in the use of urban districts, the master plan offered urban buildings with commercial and/or retail space on the street level, office space on the floors above, and to be capped with residential space on the top floors.

The pedestrian urban space between the building skin and curb edge is energized by generous sidewalks and positioning the urban buildings' edge close to allow for increased commercial development on the lower floors (Figure 9). To incorporate more green space into the redevelopment, four types of green spaces were included in the master plan: urban parks, streetscapes, linear parks and a river walk. The existing boulevard landscape was redeveloped into tree-lined boulevards and streets, and the secondary streets include landscaping at the corners of the blocks. The planned extension of the existing thoroughfare to the river incorporates a linear park along the street edge, and urban parks are incorporated into the block structure in the districts. This system of parks included additional landscaping, urban furniture, lighting and benches throughout.

7.5. Urban Code

The second task facing the CDW studio was to create an urban code for the Oil Center. For mixed-use urbanism development to exist there must be a mechanism to change a suburban environment into a more vertical and compact urban environment. The CDW was able to introduce preliminary code requirements which were then tested and expanded with the CDW projects. (Figure 10). Best practices and test cases were identified and discussed at the charrettes and public meetings. Strategies for developing an urban-suburban hybrid code were chosen for the city's extreme suburban development and its dependency on the automobile. Many model codes were documented, analyzed, studied and compared including the urban code for City Place in Dallas, Texas, Transit Oriented Development Code in Austin, Texas, Buckhead Village District in Atlanta, Georgia, and the Louisiana Overlay District. Best practices and code analysis reviewed height restrictions, setbacks, floor-area ratios, parking, programming efficiencies, and proximity slopes. The projects revealed the strengths and weaknesses of the developing code. The hybrid codes strengthened and defined public space such as streets and squares. Requirements for parking placement and reduction in automobile spaces linked to programmatic and transportation needs were varied. Analysis for best practices and core elements were synthesized and reorganized to the new Overlay District. The code provided bonuses for pedestrian environments such as landscaping, bike racks, paving, public spaces, LEED certification and parking garages. These bonuses would permit a higher floor-area ratio than was otherwise allowed.

Figure 9. Coolidge Blvd Proposed Section. Source: (CDW – Original to Author)

7.6. Implementation Strategies

Public meetings and charrettes explored the issues of implementation strategies. All strategies involved developing an urban code utilizing urban design, architectural standards and economic development. Historically, the CDW has studied implementation techniques in the form of TIFs, Business Incentive Developments and Overlay Districts. A TIF District is a planning tool that supplies economic incentives to the developer and builder in redeveloping urban districts. TIF District monies can be used for a variety of infrastructure needs: roads, streetscapes, parking garages and even construction costs for new buildings.

A financial framework makes the development of a hybrid suburban-urban condition possible. Taking cues from cities such as Dallas and Lafayette itself, the Oil Center's code threads residential architecture into the existing fabric and procures success through economic stimulation. The concept of a multi-use environment dense with purpose and activity can be realized through the merger of commercial, residential, medical and other types of usage. This reinvestment in streetscape, utilities, land acquisition, parking garages and new buildings will directly enhance this area's living environment.

CONCLUSION

Lafayette, Louisiana is indeed facing challenges and barriers to the redevelopment of its urban core. The city is at a pinnacle point within their history. There is optimism that many of these barriers will be mitigated by the adopted comprehensive plan. Discussions have addressed the reorganization of the planning and transportation departments to become more streamlined and updated with a contemporary code. The other great strength for the city of Lafayette is that the creative class has been instrumental in a public discussion of a true urban form and traditional neighborhoods. Of course, support from

the University and the Community Design Workshop facilitates a public discussion on architecture that identifies opportunities within the city and advances urban design principles. The CDW goals have always been to engage the public in its design process, how student learning benefits both the student and the public, and the development of the design.

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PAPER #6.12

GREEN BOOK IN ARIZONA: INTERSECTING URBAN HISTORY, HERITAGE, AND PLANNING

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ABSTRACT

The Negro Motorist Green Book published between 1936 and 1964 steered middle-class African American travelers toward businesses that would serve them during racial segregation. Although few of the businesses listed in the *Green Book* are extant in Arizona, the neighborhoods that once hosted businesses evidenced alternate experiences of travel in a state well-known for its tourism. Many of these historical conditions remain un-researched by urban historians and architects. This paper integrates methods in architectural history, planning, and preservation practice to describe and analyze the material and social characteristics of the neighborhoods in Arizona's two largest cities, Tucson and Phoenix. The paper uses archival material, fire insurance maps, aerial photography, and census data to examine Black tourism and argues that multi-faceted and intersecting material, economic, and social conditions combined to create segregated ethnic environments that have largely been erased physically or through processes of displacement and gentrification. The study reveals that the neighborhoods home to Green Book businesses were materially poor at mid-century, built inexpensively of wood or unfired adobe, yet they also contained vibrant social and economic institutions, such as Chinese grocery stores, Mexican churches, schools, and clubs. Thus, as motels, tourist homes, and restaurants opened doors to Africa American travelers, these travelers synthesized contrasting experiences: the stereotypical images of mid-century automobile tourism and cowboy culture; modern interstate highways; and the diverse material and social realities of the urban environments in which Black travelers were most welcome. Remaining portions of the neighborhoods are now gentrified, housing affluent residents or mainstream economic and civic institutions and activities. This study of Arizona's urban Green Book neighborhoods thus illuminates the past ethnic and racial mixture of neighborhoods; the understudied outcomes of urban renewal and gentrification; and issues pertinent to the preservation of neighborhoods that have undergone significant social and economic transformation.

KEYWORDS

Urban renewal; historic preservation; African American travel.

INTRODUCTION

The Negro Motorist Green Book, created by the New York City postal worker Victor Green, was a travel guide for African Americans in the United States. Although published for nearly three decades under different names with special editions about air and international travel, the purpose and format of the book remained unchanged: businesses listed by state and city helped Black Americans travel with greater ease during the final decades of legalized racial segregation and discrimination. What appeared in *The Green Book* came recommended by travelers, select companies, and US institutions and with careful editorial oversight (*The Negro*

Motorist Green Book 1940, 4). Thus, by printing only a few paid advertisements and listing Black-friendly businesses by state and city, *The Green Book* not only steered African American travelers toward welcoming hotels, restaurants, and services, but also represented first-hand knowledge of local places. With information garnered by travelers navigating less familiar social and material environments, *The Green Book* provided a service as it evidenced the racial conditions of cities during the mid-twentieth century.

Scholarship concerning *The Green Book* examines the travel guide itself alongside Black migration and tourism in the United States (Taylor 2020; Kennedy 2013; Hall 2015). These studies consider North America as a whole, or emphasize the South, where racial segregation was most visible. Other studies analyze urban renewal's impact on cities, giving attention to the ethnic, poor, and segregated neighborhoods of metropolitan areas after World War II. Although numerous, few of these studies focus on the Southwestern states (Fairbanks 2014; Otero 2010). This paper builds upon extant scholarship by zooming into a single state and two of its cities to analyze the location of *Green Book* businesses; ethnic and racial neighborhoods; transportation routes; and the issues pertinent to urban renewal, gentrification, and the preservation of neighborhoods that have undergone significant social and economic transformation.

Arizona and the cities of Phoenix and Tucson present unique historical circumstances relevant to contemporary preservation practices and planning. Once part of New Spain and Mexico, the history of the territory and state includes Native American settlements, Spanish colonization, and modern economic expansion through ranching, mining, railroad, and road. Moreover, the state's landscape of mountains, canyons, forests, deserts, and seasonal rivers, and the harsh climate framed the experience of Arizona's diverse population, which according to the 1940 tour book, *Arizona: A State Guide*, hovered at 50% Hispanic in Tucson and 10% in Phoenix, with whites, Blacks and other races comprising the rest.[1] The vast, rugged landscape, climate, population growth, and diversity of the state amounted to a unique set attributes that differed from many other US areas. Thus as motels, tourist homes (similar to bed and breakfasts), and restaurants appeared in *The Green Book*, African American travelers in Arizona would have synthesized contrasting experiences: modern national highways; cowboy culture; Mexican food; Native American and Spanish Colonial architecture; racial discrimination; and the diverse material and social realities of Arizona's towns and cities. In other words, the complexity of Arizona's racial, ethnic and political past, and experiences of racial discrimination in the US, challenge straightforward examination of tourism, ethnic neighborhoods, and urban renewal.

1. METHODS OF RESEARCH AND ANALYSIS

This paper integrates methods in architectural and urban history with contemporary planning and preservation practices to describe and analyze the material and social characteristics of the neighborhoods with *Green Book* listings in Arizona's largest cities Tucson and Phoenix. First, the research used various archival sources, including all Arizona businesses listed in every edition of *The Negro Motorist Green Book,* Sanborn fire insurance maps of Phoenix and Tucson released in 1948 and 1949, historic aerial photography, state highways and railroad lines extant in 1940,

[1] Writers' Program of the Work Projects Administration in the State of Arizona. *Arizona, a State Guide.* American Guide Series. New York: Hastings House, 1940, pp218, 254 describes the racial and ethnic makeup of Arizona by city. Elsewhere this source states one third of the state's population was Native American and Mexican (p6).

Home Owners Loan Corporation (HOLC) home security maps (i.e., redline maps) and urban renewal districts from the mid-twentieth century. Additionally, census data from 1960 through the present contributed to the context of each city. Then, archival material was combined in GIS to spatialize Black tourism in Phoenix and Tucson. Next, neighborhoods with numerous businesses in Phoenix and Tucson were documented and described using photographs of historic properties, Sanborn fire insurance maps, and windshield surveys of extant buildings. Finally, these documents were analyzed spatially and materially for social, racial, and economic conditions.

2. GREEN BOOK NEIGHBORHOODS

Touring the United States and Arizona in the 1940s required knowledge and planning, especially if you were Black (Monahan 2016). *The Green Book* was first published just a decade after the Federal Aid Highway Act, signed into law by Calvin Coolidge, required a system or numbered highways. These paved US Routes crisscrossed Arizona and connected small and large cities, including Yuma, Phoenix, Flagstaff, the Grand Canyon, Prescott, Tucson, Bisbee and Douglas. These routes also served as important transportation links for what is now referred to as the "second great migration," which saw an exodus of 1.5 million African Americans from the South to industrial centers in the Midwest and Northeast as well as to western cities including Phoenix, Los Angeles, San Diego, San Francisco, and Oakland (Price-Spratlen, 2008; Tiagi, 2015). Other established transportation routes included rail and bus routes as well air travel in Phoenix, Tucson, and Douglas. With great distances between cities and settlements, standard tour books of Arizona recommended travelers carry water, gasoline, and layers of clothing to prepare for the long stretches of highway without services and for the daily temperature swings.[2] The open road, however, was not egalitarian (Seiler, 2006). Knowledge of local Green Book businesses helped Black travelers avoid discrimination and violence (Bottone, 2020).

Multiple highways linked numerous cities with *Green Book* businesses, but the most listings appeared in Tucson and Phoenix and situated on or near US Route 80. This route connected Arizona to southern California and New Mexico, and led travelers through the various landscapes of Southern Arizona. The neighborhoods with *Green Book* businesses were spaces of social, architectural, and urban encounters. According to Sanborn maps, the urban neighborhoods were materially poor, built inexpensively of wood or unfired adobe, yet they also contained vibrant social and economic institutions, such as Chinese grocery stores, Mexican churches, schools, and clubs. These various social and economic conditions contributed to the separation of ethnic neighborhoods in each city, but more important here were the characteristics of the neighborhoods and the physical and social environments traveling African Americans faced, which differed somewhat between Phoenix and Tucson.

2.1. Phoenix

Of the forty-eight businesses listed between 1939 and 1964, *Green Book* businesses in Phoenix resided in one of three areas. Most were located east of downtown on either Jefferson or Washington Streets in the city's historic African American neighborhood south of US Route 80 and north of the rail yard. The first listings in this neighborhood included two restaurants, two service stations, one tourist home, four motels, and a beauty parlor. After World War II, eighteen new businesses

[2] For travel guides, see the Writers' Program of the Work Projects Administration in the State of Arizona. *Arizona, a State Guide.* American Guide Series. New York: Hastings House, 1940, ppXIX-XXI. Locke, Harry. *Arizona Good Roads Association Illustrated Road Maps and Tour Book [1913].* Los Angeles, California: Printed by Frank E. Garbutt Company, 1913. Browne, J. Ross. *A Tour through Arizona*. 1864-1864.

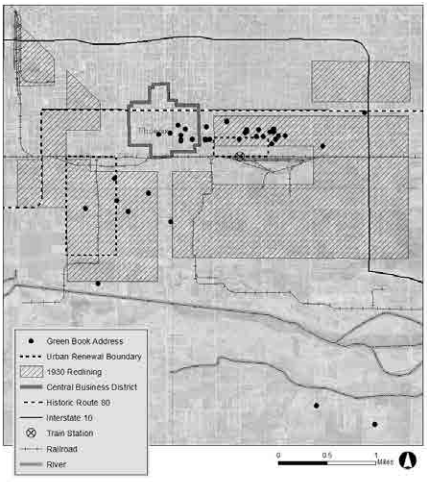

Figure 1. Phoenix Green Book businesses mapped with aerial imagery, historic Route 80, Interstate 10, railroad lines and train station. (Source: data compiled in GIS by Author 1+2 and RA1)

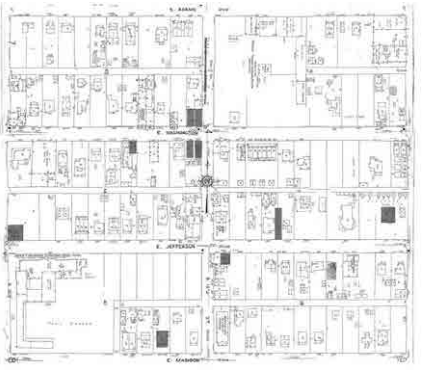

Figure 2. Select Green Book businesses in Phoenix on Jefferson and Washington Streets visualized on Sanborn maps. (Source: Sanborn, Author1, RA1)

appeared in *The Green Book*, increasing the number of restaurants and tourist homes. Although some businesses moved and disappeared from the travel book, the spatial patterns of Green Book businesses in Phoenix remained clustered together to form a clear pattern of African American tourism in Phoenix (Figure 1).

Arizona's 1940 state guide describes areas of the historic Black (and Mexican) neighborhood as the "shack town" of Phoenix, but Sanborn maps evidence a diverse working-class neighborhood (*Arizona: a State Guide* 1940, 218). Within four blocks, travelers could find a service station, a motel, numerous restaurants, and a beauty parlor as well as a Mexican Church, a Black Church, the Urban League, and the Booker T. Washington Elementary school (Figure 2). The institutions and commercial enterprises illustrated established architecture for social and economic activities and a mixture of African American and Mexican residents. Travelers to these areas would have found patterns of urban development set on a grid, with storefronts generally facing the street and built to the street's edge and dwellings set back from the street and sidewalk. Moreover, tourist homes and motels typically had an older dwelling near the street and a row of small dwellings near the alley. These street-scale urban patterns and the neighborhoods hosting businesses friendly toward African Americans suggest a breadth and diversity of economic activities in central Phoenix that would change by the late 1960s, in part through processes of urban renewal.

2.2. Tucson

In Tucson, *Green Book* businesses resided in one of three neighborhoods. The first businesses to appear, however, were located in either the historic African American neighborhood now called Dunbar Springs, which was north of downtown and the railroad line, or El Barrio Libre, a neighborhood immediately south of downtown now called The Barrio. Later listings for motels were located further south on the Benson Highway, also known as US Route 80. At a glance, the Tucson businesses presented to Green Book

travelers between 1939 and 1964 amounted to only two restaurants, three tourist homes, one service station, and three motels. In any given year, only a few businesses appeared in the book, meaning that the businesses either came and went or opened later. Although few in number, the businesses evidenced a pattern of African American tourism in Tucson in three distinct neighborhoods over time (Figure 3).

Platted at the beginning of the twentieth century, Dunbar Springs presented travelers an established neighborhood that by 1948 was peppered with African-American churches, Chinese grocery stores, service stations, and schools. Two tourist homes, for example, operated within walking distance of six established churches and several corner stores. Nearby stood a gas station and many automobile repair services. The diversity of uses amounted to a diversity of architectural style, building materials, and urban conditions. Set on a grid, bungalows made wood of wood and built on stone foundations, stood back from the street. Other dwellings made of adobe stood at the edges of streets or alleys to suggest well-defined public right-of-ways. Corner stores met the sidewalk and defined intersections. Taken together, the neighborhood presented a tight-knit urban neighborhood with local businesses, churches, and accommodations to both locals and visitors.

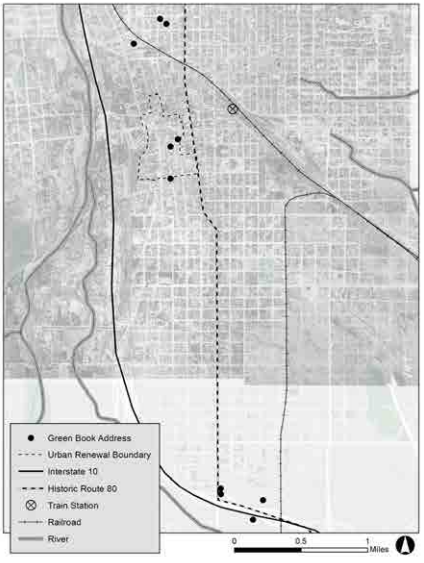

Figure 3. Tucson's Green Book businesses mapped with aerial imagery, historic Route 80, Interstate 10, railroad lines, train station and mid-twentieth century urban renewal boundaries. (Source: data compiled in GIS by Author1+2, RA2 and RA!)

An area just south of downtown Tucson, referred to locally as the Bario or La Calle, was the center of Mexican Tucson (Otero, 2010). But during the mid-twentieth century it also housed many Chinese and Black residents. Tour books suggested the Church of San Augustin, and the Temple of Music and Art, the Carnegie Library, and Amory Park as nearby tourist attractions (*Arizona: a State Guide 1940,* 259). Travelers utilizing *The Green Book* would find the Criterion Rooms one half block from Meyer Street, the main business corridor of the neighborhood where two *Green Book* restaurants and numerous other stores stood. Unlike Dunbar Springs, structures in the neighborhood were almost exclusively made of adobe and followed the urban patterns of Mexico and New Spain, with some likely dating to Tucson's pre-Gadsen Purchase history as a Mexican settlement. The thick exterior walls of buildings defined property lines, hid private courtyards, and formed a well-defined public right-of-way (Otero, 2010). With the neighborhood's urban density, dirt streets, and adobe architecture, mid-century Anglo residents of Tucson viewed the area as a poor ethnic enclave, which similar to many such areas in other cities in the US, soon fell victim to the forces of urban renewal during the 1960s and 1970s (Gomez-Novy 2003; Otero 2010).

Unlike these older parts of Tucson, the third area of Tucson that housed a number of motels listed in the Green Book represented the era of modern automobile travel. Sited adjacent to the highway, accommodations offered parking spaces, air-conditioned rooms with direct access to the outside, and a common garden or pool area. These *Green Book* motels mirrored the mid-century motor court, which by the mid-twentieth century was a national typology (Jakle and Sculle, 2011). All three of Tucson's *Green Book* motels stood on route 80 south of town near the postwar suburbs populated by a significant number of Tucson's African Americans residents (US Census, 1960). Despite their standard, modern convenience, the Green Book motels south of Tucson contrasted with the dozens of motels clustered along the celebrated and better preserved Miracle Mile (Clinco, 2017). None of the accommodations found along the Miracle Mile were ever listed in the Green Book.

Important to Tucson's history was how the pattern of African American *Green Book* businesses changed over time. The earliest *Green Book* editions listed a single tourist home and a gas station in Dunbar Springs, as well as two restaurants and the Criterion Rooms in the Barrio. In later editions, the businesses listed in the Barrio disappeared to be replaced by another tourist home in Dunbar Springs and three motels south of town. The shift evidenced urban, economic, and social factors, and the tastes of Black travelers reporting back to Victor Green. The Criterion Rooms, for example, stood near "Gay Alley," a street known for prostitution. The more reputable Veterans of Foreign Wars building was nearby, but Black travelers may have found the conditions of the Criterion Rooms distasteful, particularly if veterans were familiar with the Mountain View Black Officers Club at Fort Huachuca. Moreover, the motels south of town presented travelers options for modern, standard, and convenient automobile tourism.

3. URBAN RENEWAL AND GENTRIFICATION

Green Book locations in Tucson and Phoenix were in neighborhoods that have largely been erased through processes of segregation, racialized disinvestment, and, beginning in the 1950s and 1960s, physical displacement and gentrification. Notably, Phoenix and Tucson *Green Book* locations existed almost exclusively in areas identified as either "hazardous" by HOLC's notorious red line mortgage risk maps or within zones designated as slums targeted with clearance through federally supported urban renewal programs.

3.1. Phoenix

Phoenix best illustrates the impact on *Green Book* locations of an overlapping mesh of racialized policies and practices that, beginning in the 1930s, denied Black and Hispanic neighborhoods investment and stability and then used neighborhood conditions resulting from that disinvestment as justification for slum clearance in the 1950s and 1960s (Figure 1). The area just north of Union Station and the rail yard, which contained the majority of Phoenix *Green Book* listings was described in HOLC maps as follows:

> "In the Negro section are some very good homes, considering their occupancy by colored people. Other houses in the area are cheap. There is within this area a mixed occupancy, including Mexicans, foreigners, etc."

Another area with a cluster of *Green Book* listings was described as "very ragged, occupied by Mexicans, Negroes and the low class of white people." Homeowners or would be home owners in areas deemed hazardous, largely due to the racial and ethnic makeup of inhabitants, could be denied mortgages and insurance and these areas

were often avoided by businesses such as grocery stores (Rothstein, 2017). The result was systematic, race-based disinvestment in these areas, even as a post-war housing boom benefitted homeowners elsewhere. Poor housing conditions resulting from this disinvestment was then used as justification for slum clearance efforts in the 1950s and 1960s, spurred by the 1949 Housing Act which provided federal funding for identifying and clearing blighted areas, largely in central city neighborhoods.

3.2. Tucson

Tucson was not redlined, but the traditionally Mexican American parts of the central city, which contained half of Tucson's *Green Book* listings, were labeled as blighted and cleared through the Pueblo Center Urban Renewal District in the 1960s (Figure 3). In her book about this particular urban renewal project, Otero (2010) describes a common pattern of systematic disinvestment in first half of the 20th Century followed decades later by efforts to use the results of that disinvestment to justify labeling the area as blighted in order to clear it for redevelopment.

3.3. Different displacement patterns since 1960

Nationally, about 80% of residents displaced through urban renewal were Black (Nelson & Ayers, 2020). Of the 1,223 families displaced through urban renewal in Phoenix between 1950 and 1966, 59% were families of color. This figure likely represents displaced Black families, as the U.S. Census did not include a "Spanish origin" or Hispanic until 1970. In Tucson, 1,007 families were displaced beginning in 1958 to make way for new government buildings, a convention center, hotel, and parking lots. Eighty-two percent of families were white, which likely consisted largely of Hispanic/Latino residents.

The Black populations in central Phoenix and central Tucson, areas where *Green Book* listings concentrated, has dropped since 1960. In Phoenix, the Black share of the population in these areas was 31% in 1960. This share dropped to 14% in 2000 but has remained steady from 2000 to 2018. In Tucson, the Black share of the population in central Tucson was 22% in 1960 and has continued to drop through the decades, with 4% in 2018 (Figure 4).

While the Black population of central Phoenix and Tucson declined, one key difference is evident in the data. The decline in Black population of central Phoenix occurred at a time when the overall population of central Phoenix declined at a similar rate (from just over 30,000 in 1960 to about 16,000 in 2018), largely due to physical displacement resulting from the construction of freeways and the expansion of the central business district, including office buildings, civic buildings, and sports facilities as Phoenix grew into what is now the fifth largest city in the United States. The areas of central Tucson that historically had sizable Black populations have grown in population since 1960 (from roughly 16,000 to just over 20,000) even as the Black population has dwindled from 22 percent to 4 percent. With the exception of the Pueblo Center Urban Renewal District just south of downtown other areas with historic Black populations, including several *Green Book* locations remain physically intact.

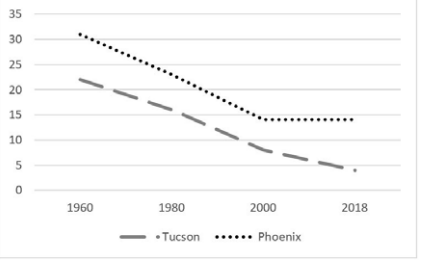

Figure 4. Black share of the population in central Tucson and Phoenix between 1960 and 2018 (Source: census data compiled from Social Explorer by author2).

CONCLUSION

This study of the locations of Arizona's urban *Green Book* listings illuminates the past ethnic and racial mixture of urban neighborhoods as well as co-occurring practices and legacies of racialized mortgage financing and displacement through urban renewal. *Green Book* listings, viewed together with HOLC mortgage security maps, Sanborn fire insurance maps, and urban renewal documents, provide a snapshot of African American spaces in Arizona cities during the early-highway, pre- and immediately post-war period. By viewing demographic and physical changes in these locations we begin to untangle a complex web of racialized policy, market, and physical interventions that have transformed these places in subsequent decades.

From the perspective of historic preservation, the temporal character of *Green Book* businesses, and the demographic changes within neighborhoods, present challenges. Current residents, who tend to write the place-based histories, no longer represent past residents; the businesses serving African Americans have left or changed; and contemporary Black travelers tour differently (Lawrence-Zuniga 2016). The conservation of districts and buildings must not only confront these absences and changes but also address the reality of past racial and ethnic diversity (Robinson, 2017). From the perspective of planning, legacies of segregation, displacement, and erasure – and their lasting economic impacts – are still very much at the fore of community conversations about contemporary planning decisions. In Tucson, for example, past urban renewal efforts have entered into conversations about transportation and other neighborhood investments in communities concerned with ongoing processes of underinvestment and gentrification (Ingram et al., 2017). This paper provides the context necessary for the work of planners, preservationists, and architects to benefit from the documentation and analysis of complex histories of race, urban renewal, and displacement.

ACKNOWLEDGEMENTS

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PAPER #6.13

THE EVOLUTION OF THE SPANISH BUILDING CODES: AN OVERVIEW FROM THE SEISMIC DESIGN PERSPECTIVE

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ABSTRACT

When assessing an architectural building, it is essential to know not only in which period it was designed but also which constructive recommendations and technical standards were at force at that very moment.
This information is a must when the aim of the analysis is to use consistent techniques and materials in the retrofitting or repair process, but it is also needed with regards to define the structural and constructive quality and the seismic response in the occurrence of an earthquake.
This paper establishes seven different constructive periods for the last 100 years, considering the evolution of the construction techniques and the corresponding Spanish building codes, evaluating the influence of the legislative framework in the quality of the materials, the design and execution of the structures and the consideration of the seismic loads in the analysis.
For that purpose, not only the legal framework has been analysed considering the date in which every document has been approved and published, but also the transition periods in which different codes were in force. Prescriptions and compulsory conditions have been compared discussing improvements in the proposed constructive details and calculation parameters.
Finally, a proposal about how to consider the influence of the constructive periods in the seismic vulnerability assessment has been included.

KEYWORDS

Spanish building codes; constructive periods; seismic design; architectural buildings; retrofitting.

INTRODUCTION

The Iberian Peninsula shows low to moderate seismicity (Capote 2011) with minor earthquakes, due to the convergence of African and Eurasian plates. Occasionally, earthquakes of catastrophic consequences may occur in the future with a foreseeable maximum magnitude of around 7. The most destructive earthquakes that affected the Iberian Peninsula in the past occurred before the 20th century (Martínez 2003). Fig. 1 shows the seismicity in Spain. Most of the central plateau (Castilla-Leon, Madrid, Castilla-La Mancha), the north (Cantabria, Asturias, Galicia) and the central eastern area (Castellón) are of low seismicity; the northern Provinces of Andalusia, Catalonia, Aragon, the Basque Country and Navarra are of medium seismicity, being the Betic chains (Granada, Almeria, Murcia and the south of Alicante) the most active seismic zones of the Iberian Peninsula followed by the Pyrenees.
The majority of the Spanish cities, like many other regions in the world located in areas of low or moderate seismicity, reveal a high seismic risk, due to the vulnerability of their buildings. Even though current advances in technical knowledge provide a variety of construction and structural systems to withstand seismic actions, a large number

of buildings in these cities don't fulfil the recommendations, mainly because they were built before the first seismic regulations came into force.

The objective of this paper is to organise in periods the residential buildings built in Spain during the last 100 years, taking into account the evolution of the construction techniques, the improvement of the structural materials, the design of construction details and their execution, as well as the influence that the technical standards, in force at each moment, have had on their seismic performance. The seven construction periods that have been established are described in this document. Following other Spanish researchers' recommendations (Lantada 2007, Feriche 2012) they have been grouped in pre-seismic code, low-seismic code and high-seismic code periods according to the seismic standards. The ranges of dates corresponding to each period have been defined considering the approval of the different regulations, as well as the transition years in which different seismic codes were in force.

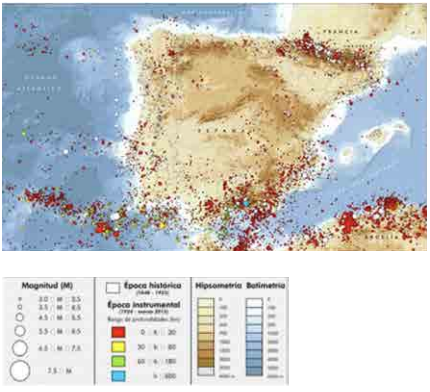


Figure 1. Seismicity in Spain. Source: (Instituto Geográfico Nacional 2015)

1. PRE-SEISMIC CODE BUILDING CONSTRUCTION PERIODS

Three periods are defined before the approval of the first Spanish seismic standard came into force, namely, prior to 1940, from 1940 to 1962 and from 1963 to 1968.

1.1. First period: Prior to 1940

The main characteristics of the first period (prior to 1940) are the absence of technical building regulations and the poor quality of the building practices.

Since the end of the 18th century, most of the Urban Police ordinances requested, for every construction work, to present a scale drawing of the building plan and elevation, signed by the Master Builder, and lately, in the 19th century, signed by the Architect in charge of the technical project management and supervision. One of the main duties of the Mayor Master Architect (Age of Enlightenment) and of the Municipal Architect (technical municipal body created by Royal order in the 19th century) was "*to examine the design and to correct any defect that exists, both in terms of solidity and in terms of symmetry and good shape*" (Anguita 1995). However, in practice, these bylaws were seldom adopted, and it was common that projects at that time lack of any architect or technical project supervisor.

The prevailing vertical structural system in this period consisted in load-bearing unreinforced masonry walls without any bracing system, designed to withstand only gravitational loads. The horizontal structural system changed from timber beams and joists floors to cast iron[1] beams and joists floors at the end of the 19th century and finally, since the first quarter of the 20th century to reinforced concrete floors.

At that time, timber and cast iron floors were calculated by means of tables. As an example, Fig. 2 shows two tables to design cast iron beam floors, a novel structural

[1] The main difference between cast iron and steel is the presence of carbon. Alloys with a carbon content higher than 2.1% are known as cast iron, being the carbon content of structural steel around 2º/$_{00}$

system in Madrid in 1883. These tables and the explanation of their practical application were proposed by Page (1883), director of public works, in a paper published in the Public Works Journal. In 1925, this journal, published a similar article about the construction of reinforced concrete floor slabs (Laffon 1925). In this paper, the author (a civil engineer) explained his personal experience in the dimensioning of the tension and compression reinforcement of a site-cast concrete rib with the abacus of Fig. 3.

In this period, apart from the fact that there weren't any regulations applicable to the calculation of the structural elements, there were no requirements regarding the minimum documents and the level of detail required to apply for a construction permit. Projects used to contain a distribution plan, a drawing of the facade and a short technical report that barely included a brief description of the construction work that was intended to be done in terms of materials and structural elements. The technical report of a project signed by Joaquin Rieta in 1931, can be seen, as an example, in Fig. 4 (Rieta 1931).

"We do not think that these tables require any explanation, however, to facilitate their application we will give them:
Table number 1 gives the loads that the floors must bear, according to the uses to which they are destined, loads that, as it is seen, vary from 300 to 600 kilograms per square metre, and it is the first one to be consulted.
Determined that load, for example, 350 kg per square metre, which is what we have adopted in our constructions, which we classify as ordinary houses, we look for table number 2: first the row in which this load appears; second, the average distance between beam and beam, equal for all floors, which in the present case is 0m,60; and third, the bay or span width, which varies in our case from 4m,50 in the basement to 5m,40 on the fourth floor, so considering the average, which is 4m,95. Finally, it is obtained from the same table the height of the above mentioned beams: 16 centimetres, and its weight per linear metre: 15 kilograms.
To complete this work, the dimensions of these double T beams must be detailed; but once given the height and weight, the best iron distribution cannot be done better than by the manufacturer"

NUMERO 1.

TABLA *que dá las cargas que deben sufrir los suelos segun el uso á que se los destina.*

CLASES DE EDIFICIOS Y HABITACIONES DE CADA CLASE.		Espesor del suelo.	SUELOS CON YESO Y CASCOTE. CARGA POR METRO CUADRADO. Del suelo.	Sobre carga.	TOTAL.	SUELOS DE LADRILLOS HUECOS. CARGA POR METRO CUADRADO. Del suelo.	Sobre carga.	TOTAL.
1.°—Casas ordinarias.	Resultan poco numerosas. . .	0,30	275k	75k	350k	225k	75k	300k
	Boardillas	id.	id.	id.	id.	id.	id.	id.
	Alcobas y cuartos de vestirse.	id.	id.	id.	id.	id.	id.	id.
Casas de lujo.	Salones de los pisos 1.° y 2.° .	0,35	300	100	400	245	105	350
	Grandes salones de los pisos 1.° y 2.° .	0,35	320	130	450	260	140	400
	Almacenes del piso bajo para mercancías de peso pequeño respecto al volumen.	id.	id.	id.	id.	id.	id.	id.
	Oficinas.	0,30	275	175	450	225	175	id.
Edificios públicos.	Salones para reuniones ordinarias.	0,35	200	200	500	245	205	450
	Salones para las grandes reuniones	0,40	350	250	600	260	290	550

REVISTA DE OBRAS PUBLICAS 9

NUMERO 2.

SUELOS CON VIGAS DE HIERRO.

TABLA *que dá la altura y peso por metro de las vigas, en relacion con la distancia á que se coloca y la carga por metro cuadrado.*

HIERROS USADOS EN EL COMERCIO. Altura de las vigas. Centíms.	Peso por metro lineal. Kilóg.	Longitud del vano en metros.	CARGA DE 300 KILÓGS. POR METRO CUADRADO. Distancia entre las vigas. 0m,50	0m,55	0m,60	0m,65	0m,70	0m,75
12	11		4,13	4,23	4,04	3,89	3,74	3,62
14	14		5,44	5,11	4,88	4,70	4,51	4,37
16	15		5,81	5,58	5,33	5,13	4,93	4,77
18	20		7,09	6,78	6,47	6,24	5,95	5,80
20	24		8,26	7,90	7,54	7,26	6,98	6,76
22	26		9,00	8,61	8,22	7,93	7,61	7,36
CARGA DE 350 KILÓGRAMOS POR METRO CUADRADO.								
12	11		4,40	3,92	3,74	3,60	3,43	3,35
14	14		4,91	4,72	4,52	4,34	4,17	4,04
16	15		5,40	5,16	4,94	4,74	4,56	4,42
18	20	id. id.	6,56	6,28	6	5,76	5,54	5,36
20	24		7,62	7,30	6,98	6,70	6,45	6,25
22	26		8,32	7,96	7,62	7,30	7,03	6,81
CARGA DE 400 KILÓGRAMOS POR METRO CUADRADO.								
12	11		3,83	3,65	3,50	3,36	3,24	3,13
14	14		4,63	4,41	4,22	4,06	3,91	3,78
16	15		5,06	4,82	4,62	4,43	4,27	4,13
18	20	id. id.	6,14	5,87	5,61	5,39	5,19	5,04
20	24		7,15	6,82	6,53	6,27	6,04	5,84
22	26		7,79	7,43	7,14	6,83	6,59	6,36
CARGA DE 450 KILÓGRAMOS POR METRO CUADRADO.								
12	11		3,63	3,45	3,30	3,18	3,06	2,96
14	14		4,37	4,17	3,98	3,82	3,69	3,59
16	15		4,76	4,56	4,35	4,18	4,04	3,90
18	20	id. id.	5,80	5,54	5,29	5,08	4,90	4,74
20	24		6,76	6,45	6,15	5,93	5,71	5,52
22	26		7,36	7,03	6,71	6,45	6,22	6,01
CARGA DE 500 KILÓGRAMOS POR METRO CUADRADO.								
12	11		3,44	3,27	3,14	3,00	2,89	2,81
14	14		4,14	3,95	3,78	3,62	3,50	3,38
16	15		4,52	4,32	4,13	3,93	3,82	3,70
18	20	id. id.	5,50	5,24	5	4,82	4,64	4,49
20	24		6,40	6,10	5,84	5,62	5,40	5,22
22	26		6,97	6,65	6,36	6,12	5,89	5,70

Figure 2. Tables for cast iron beam floors design. Source: (Page 1883)

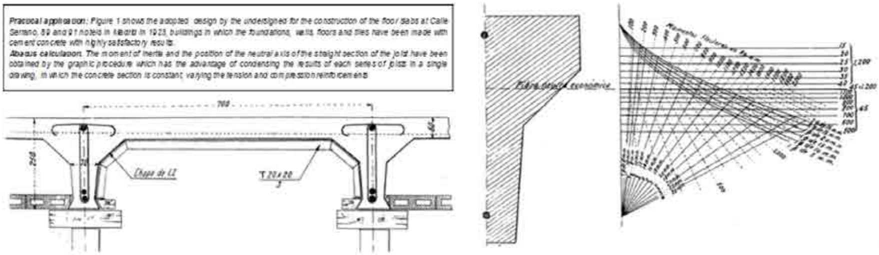
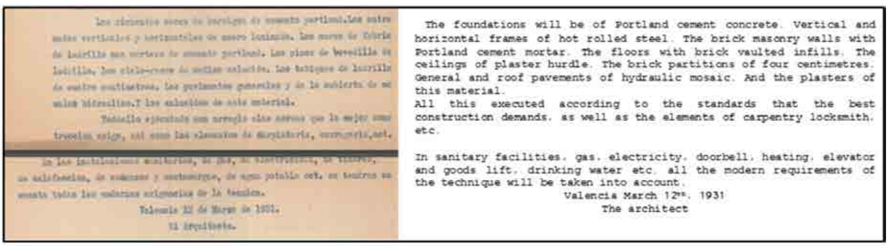


Figure 3. Design of reinforced concrete floors and abacus. Source: (Laffón 1925)



The foundations will be of Portland cement concrete. Vertical and horizontal frames of hot rolled steel. The brick masonry walls with Portland cement mortar. The floors with brick vaulted infills. The ceilings of plaster hurdle. The brick partitions of four centimetres. General and roof pavements of hydraulic mosaic. And the plasters of this material.
All this executed according to the standards that the best construction demands. as well as the elements of carpentry locksmith. etc.

In sanitary facilities. gas. electricity. doorbell. heating. elevator and goods lift. drinking water etc. all the modern requirements of the technique will be taken into account.
Valencia March 12th. 1931
The architect

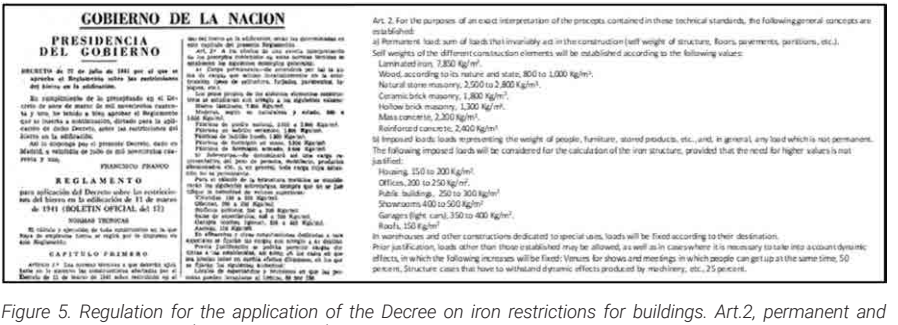
Figure 4. Technical report with description of the structure. Source: (Rieta 1931)

1.2. Second period (1941-1962)

After the Spanish Civil War, an increase in the economic stability favoured the improvement of the constructive systems and the use of better-quality materials

In 1941, the first antecedent of the Spanish technical regulations was approved: Regulation for the application of the Decree on iron restrictions for buildings (*Reglamento para aplicación del Decreto sobre las restricciones del hierro en la edificación*, BOE 02/08/1941). This document established the "Technical standards of knowledge and unavoidable application" to be considered in the calculation and execution of every construction work in which iron was to be used. One of the recommendations for the reinforced concrete framed structures (the most common in this period) was the removal of the compression reinforcement in all the beams and the reduction of the reinforcement in the structural elements under combined bending plus compression. Fig. 5 shows the first part of this Regulation. In article 2, the concepts of permanent and imposed loads, respectively, are defined for the first time, specifying the values that must be adopted in the structural analysis. However, what is most significant in this document is the restriction on the use of iron, a circumstance that, on the one hand prevented the design and construction of steel structures, moving away once again from the trends in Europe and, on the other hand, forced the reduction to a minimum extent of reinforcements in reinforced concrete structures, leading to the execution of a low-strength concrete. The specification regarding the iron restrictions in floors is included in Fig. 6, while Fig. 7 shows an excerpt from a technical report signed in 1941, justifying the reduction of iron in concrete columns following these requirements.

In 1944 came to force, with minor changes, the first code for design and execution of concrete works, (*Instrucción para el Proyecto y Ejecución de Obras de Hormigón*, BOE 1/6/1944) formerly published in 1939 (BOE 16/2/1939) but subject to further confirmation. It was mandatory only for public works.



GOBIERNO DE LA NACION

PRESIDENCIA DEL GOBIERNO

DECRETO de 17 de julio de 1941 por el que se aprueba el Reglamento sobre las restricciones del hierro en la edificación.

REGLAMENTO

FRANCISCO FRANCO

Art. 2. For the purposes of an exact interpretation of the precepts contained in these technical standards, the following general concepts are established:

a) Permanent load: sum of loads that invariably act in the construction (self weight of structure, floors, pavements, partitions, etc.).

Self weights of the different construction elements will be established according to the following values:

Laminated iron, 7,850 Kg/m³.
Wood, according to its nature and state, 800 to 1,000 Kg/m³.
Natural stone masonry, 2,500 to 2,800 Kg/m³.
Ceramic brick masonry, 1,800 Kg/m³.
Hollow brick masonry, 1,300 Kg/m³.
Mass concrete, 2,300 Kg/m³.
Reinforced concrete, 2,400 Kg/m³

b) Imposed loads: loads representing the weight of people, furniture, stored products, etc., and, in general, any load which is not permanent.

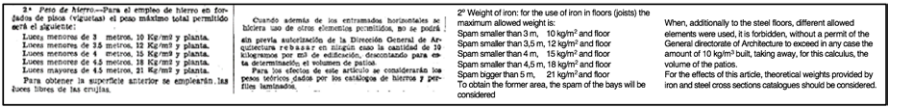
The following imposed loads will be considered for the calculation of the iron structure, provided that the need for higher values is not justified:

Housing, 150 to 200 Kg/m².
Offices, 200 to 250 Kg/m².
Public buildings, 250 to 300 Kg/m²
Showrooms 400 to 500 Kg/m²
Garages (light cars), 350 to 400 Kg/m².
Roofs, 150 Kg/m²

In warehouses and other constructions dedicated to special uses, loads will be fixed according to their destination.

Prior justification, loads other than those established may be allowed, as well as in cases where it is necessary to take into account dynamic effects, in which the following increases will be fixed: Venues for shows and meetings in which people can get up at the same time, 50 percent. Structure cases that have to withstand dynamic effects produced by machinery, etc., 25 percent.

Figure 5. Regulation for the application of the Decree on iron restrictions for buildings. Art.2, permanent and imposed loads. Source: (BOE 12/03/1941)



3ª *Peso de hierro.*—Para el empleo de hierro en forjados de piñas (viguetas) el peso máximo total permitido será el siguiente:

Luces menores de 3 metros, 10 Kg/m² y planta.
Luces menores de 3,5 metros, 12 Kg/m² y planta.
Luces menores de 4 metros, 15 Kg/m² y planta.
Luces menores de 4,5 metros, 18 Kg/m² y planta.
Luces menores de 5 metros, 21 Kg/m² y planta.

Para obtener la superficie anterior se emplearán las luces libres de las crujías.

Cuando además de los entramados horizontales se hiciera uso de otros elementos permitidos, no se podrá sin previa autorización de la Dirección General de Arquitectura rebasar en ningún caso la cantidad de 10 kilogramos por m² de edificación, descontando para esta determinación el volumen de patios.

Para los efectos de este artículo se considerarán los pesos teóricos dados por los catálogos de hierros y perfiles laminados.

2º Weight of iron: for the use of iron in floors (joists) the maximum allowed weight is:

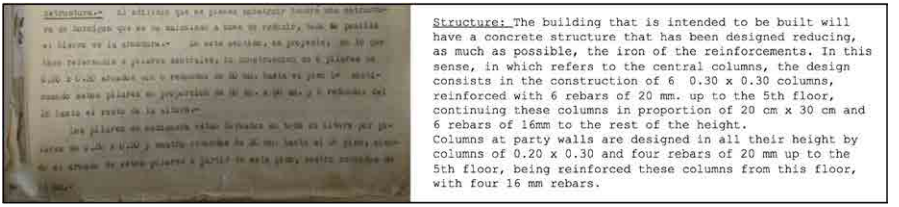
Spam smaller than 3 m, 10 kg/m² and floor
Spam smaller than 3,5 m, 12 kg/m² and floor
Spam smaller than 4 m, 15 kg/m² and floor
Spam smaller than 4,5 m, 18 kg/m² and floor
Spam bigger than 5 m, 21 kg/m² and floor

To obtain the former area, the spam of the bays will be considered

When, additionally to the steel floors, different allowed elements were used, it is forbidden, without a permit of the General directorate of Architecture to exceed in any case the amount of 10 kg/m² built, taking away, for this calculus, the volume of the patios.

For the effects of this article, theoretical weights provided by iron and steel cross sections catalogues should be considered.

Figure 6. Regulation for the application of the Decree on iron restrictions for buildings. Iron restrictions in floors. Source: (BOE 12/03/1941)



Structures: The building that is intended to be built will have a concrete structure that has been designed reducing, as much as possible, the iron of the reinforcements. In this sense, in which refers to the central columns, the design consists in the construction of 6 0.30 x 0.30 columns, reinforced with 6 rebars of 20 mm. up to the 5th floor, continuing these columns in proportion of 20 cm x 30 cm and 6 rebars of 16mm to the rest of the height.
Columns at party walls are designed in all their height by columns of 0.20 x 0.30 and four rebars of 20 mm up to the 5th floor, being reinforced these columns from this floor, with four 16 mm rebars.

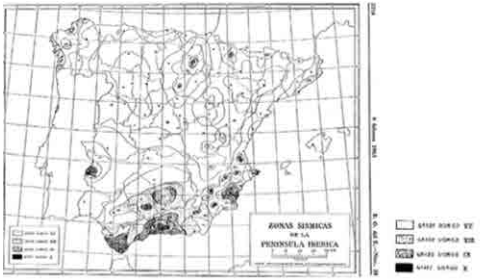
Figure 7. Technical report justifying the reduction of iron in columns. Source: (Albert, 1941)

1.3. Third period (1963-1968)

The beginning of the third period is marked by the publication of the MV 101, Actions on Buildings (*Acciones en la Edificación*, BOE 9/02/1963). Although not a seismic code, it was the first time that seismic actions were included in a Spanish regulation. These actions were to be considered, compulsorily, in cities with a seismic grade on the Wood-Newman Modified Mercalli Intensity Scale (also known as Modified Mercalli Intensity, MMI) equal to or greater than VII, being optional to take them into account in cities with a seismic grade equal to or smaller than VI. Fig. 8 shows the established seismic zones in Spain according to the values of MMI.

The horizontal seismic load was obtained from the vertical gravitational load acting on the structural element multiplied by the seismic coefficient, obtained from the table in Fig. 9, according to the building type and the seismic grade of the city.

Furthermore, this standard repealed the restrictive provisions of the use of iron in buildings. Consequently, the quality of the reinforced concrete structures with respect to the previous period was improved.



Cities with seismic grade equal or bigger than VII:
Almería,
Córdoba
Coruña
Jaén
Pontevedra
Sevilla

Cities with seismic grade equal to VIII:
Badajoz
Cádiz
Granada
Málaga
Murcia

Figure 8. Seismic zones in Spain. Source: (MV 101, 1962)

TABLA 7.2 **SEISMIC COEFFICIENT** COEFICIENTE SISMICO

Tipo de construccion / Building Type:	Valor del coeficiente sísmico en localidades cuyo grado sísmico es: / Value of the seismic coefficient in locations where the seismic grade is: ≤ VI	VII	VIII	IX	X	
Construcciones enramadas sobre:						
a) Terrenos compactos (rocas, gravetas y arenosos gruesos, arcillosos duros, etc.)	0	0.02	0.05	0.07	0.10	Compact soils (hard rocks, gravel and thick sand, hard clay etc.
b) Terrenos semicompactos (arenosos finos, arcillosos semiduros, etc.)	0	0.04	0.08	0.10	0.15	Medium dense granular soils (thin sand semi-hard clay)
c) Terrenos blandos, arcillosos blandos y fluidos, etc.) y construcciones sobre pilotes	0.01	0.05	0.10	0.15	0.20	Soft cohesive soil and foundation by piles.
Torres, depositos elevados, casas analogas	0.01	0.05	0.10	0.15	0.20	Towers and deposits in height
Construcciones con muros de fabrica, no entramados	0.01	0.05	0.10	0,15	0.20	Buildings with masonry walls. Not-framed.
Ornamentos aislados y elementos en mensula vertical u horizontal	0.02	0.10	0.20	0.30	0.50	Isolate ornaments and cantilever elements (vertical or horizontal)

Figure 9. Seismic coefficients. Source: (MV 101, 1962)

2. LOW-SEISMIC CODE BUILDING CONSTRUCTION PERIODS

Two periods are part of this block. They are marked, respectively, by the approval, the entry into force and the years of application of the first Spanish seismic standards: The Seismic Code PGS-1 (BOE 4/02/1969) and the Seismic Code PDS-1 (BOE 21/11/1974).

2.1. Fourth period (1969-1974)

This period starts in 1969, when the first Spanish Seismic Code (PGS-1) was published. This document included very basic requirements and a static method of analysis applied to structural and construction elements, although there weren't any recommendations related to the structural design and detailing.

The national territory was classified into three zones of low, moderate and high seismicity according to the Macroseismic intensity. As shown in Fig. 10, most of the national territory was associated to zone A of low seismicity, in which the application of the standard and the consideration of the seismic actions in the structural analysis was optional.

The analysis, design and execution of the structures were improved with the recommendations of a series of mandatory standards which came into force throughout this period. It is worth mentioning, on the one hand, the Codes for design and execution of plain and reinforced concrete works (EH-68 and EH-73) and, on the other hand, two standards which focused on the structural analysis of steel structures for buildings (MV 103, BOE 28/6/1973) and on the design of loadbearing brick masonry walls (MV 201, BOE 31/5/1972), respectively. As an example of this improvement in the design, it is important to point out that the MV 201 made mandatory

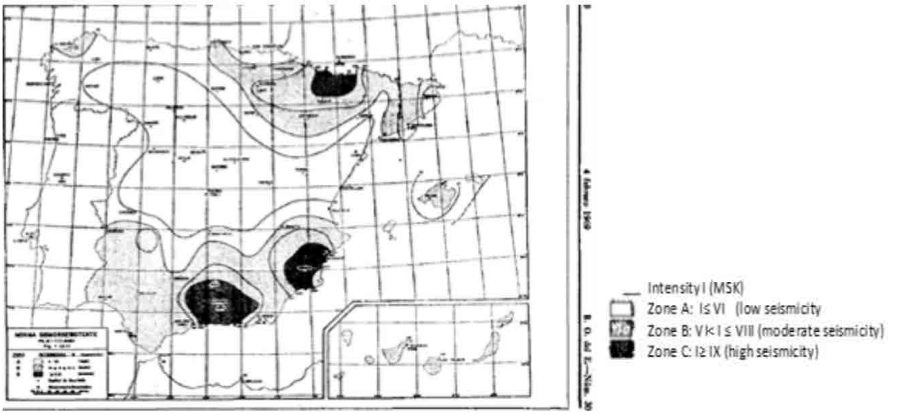


Figure 10. Seismic zones in Spain. Source (PGS-1,1968)

to connect the floors with the loadbearing and transversal walls by means of reinforced concrete ring beams.

2.2. Fifth period (1975-1996)

In this period, the structural analysis of buildings under seismic actions, defined by the Seismic Code PDS-1 (PDS-1 1974), was addressed in a more systematic way. The seismic hazard map remained nearly unchanged with respect to the map of the previous seismic code including the zones with low seismicity in which the consideration of the seismic actions in the design and structural analysis weren't mandatory.
It is also worth noting that during this period, the government decided to create a unified framework for all the building regulations, transforming the technical standards in force at that moment (MV) into the Basic Building Standards (NBE, *Normas Básicas de la Edificación*), mandatory for all the building agents (architects, construction managers, product suppliers, etc.), leading to a higher control and to a new improvement of the quality of the constructive process. Amongst them, it is worth highlighting the NBE AE-88, (Actions on Buildings (BOE 17/11/1988) and the NBE EA-95 (Building Steel Structures, BOE 18/1/1996). Several codes for design and execution of plain and reinforced concrete works (EH-80, EH-82, EH-88, EH-91) and for prestressed concrete works (EP-77, EP-80 and EP-93) and a set of non-mandatory Standards, but good building practice recommendations called Building Technological Standards (NTE, *Normas tecnológicas de la edificación*) were also published during this period.

3. HIGH-SEISMIC CODE BUILDING CONSTRUCTION PERIODS

Two periods are identified as high-level building construction periods with regards to the seismic regulation. They are defined, respectively, according to the entry into force of the Spanish Codes for Seismic Design of Buildings NCSE-94 (NCSE-94, 1994) and NCSE-02 (NCSE-02, 2002) which included for the first-time technical design and constructive prescriptions.

3.1. Sixth period (1997-2004)

The beginning of the sixth period is established in 1997, just after the two-year transition from the Seismic Code PDS-1 to the new Spanish Code for Seismic Design of Buildings, NCSE-94 (BOE 08/02/95).
This document was a turning point in the Spanish seismic standards, since it included design and constructive prescriptions in addition to defining the parameters and methods of structural analysis, leading to a significant qualitative improvement.
The seismic hazard map, based on probabilistic studies, was presented, for the first time, in terms of ground acceleration, instead of intensity, providing the value of the basic seismic ground acceleration (a_b) across the country for a 500-year return period (Fig. 11 a).The application of the NCSE-94 was mandatory for buildings of normal importance located in areas with a basic seismic ground acceleration (a_b) equal or bigger than 0.06g, increasing, consequently, the number of cities which should consider the seismic actions in the structural analysis and comply with all the design prescriptions.
The code identified three methods of structural analysis namely the modal spectrum analysis, the dynamic analysis and the simplified design method, in which the dynamic earthquake effects were approached by horizontal static forces applied to the structure. This method could only be used for building structures which met several requirements related to the geometric, stiffness and mechanic regularity, the number of storeys above ground level or the building height among others.
It is worth pointing out the approval of the Code on Structural Concrete, EHE-98 (BOE 13/1/1999), which included, for the first time, the plain, reinforced and the prestressed concrete in an only document. According to this code, the minimum values of the compressive strength for plane and reinforced concrete were increased up to 20 N/mm^2 and 25 N/mm^2 respectively.

3.2. Seventh period (2005 up today)

The current Spanish Code for Seismic Design of Buildings NCSE-02 (BOE 11/10/2002), was approved in 2002, establishing a regulatory adaptation period of two years. Its mandatory enforcement, in 2005, marks the starting point of the seventh period.
The seismic hazard map (Fig. 11b) has minor changes with respect to the one presented in the NCSE-94, but it was updated in 2015, after the Lorca Earthquake (11^{th} May 2011), by the Instituto Geográfico Nacional (IGN 2015).
The novelty was that the application of the NCSE-02 is mandatory for buildings of normal importance located in areas with a basic seismic ground acceleration (a_b) equal or bigger than 0.04g, or equal or bigger than 0.08g when the frames are effectively braced in all directions.
Apart from this, the most relevant improvement consists in the seismic detailing requirements to achieve better ductile structural behaviour.
The Building Act (*Ley de Ordenación de la Edificación*, BOE 06/11/1999), approved in 1999, established a building regulatory system with a performance- based approach, setting in terms of objectives the Basic Building Requirements on functionality, safety and habitability which were developed, subsequently, in the Spanish Technical Building Code, CTE (BOE 28/03/2006), approved in 2006. The CTE comprises a set of different Basic Documents, currently in force, to guarantee the fulfilment of the above-mentioned building requirements such as structural resistance, serviceability, durability, robustness, among others.

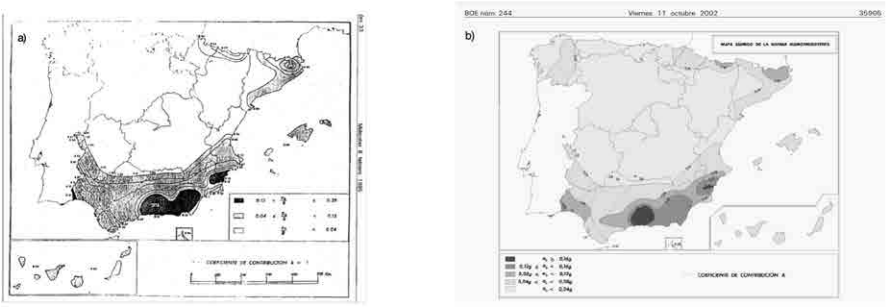


Figure 11. Seismic zones in Spain defined by a) NCSE-94; b) NCSE-02. Source: (NCSE-94 and NCSE-02)

4. INFLUENCE OF THE CONSTRUCTIVE PERIODS IN THE VULNERABILITY ASSESSMENT

The structural and the constructive quality of the buildings affect their seismic vulnerability and, therefore, their seismic performance in the event of an earthquake.

A suitable method to assess the seismic vulnerability of the residential buildings in urban areas is the Risk-UE level 1 Vulnerability Index Method (Milutinovic, Trendafiloski 2003). A vulnerability index is assigned to each building according to its typology and then adapted to the its specific characteristics by means of regional and behaviour modifiers. The regional modifiers account for the quality of the building at regional level based on the technical, structural and constructive characteristics of the buildings which are basically related to the period in which they were built, except when the building has been completely retrofitted.

Different values for these coefficients have been proposed for Barcelona (Lantada 2007), Granada (Feriche 2012) or Valencia (Guardiola-Víllora, Basset-Salom 2015), and modified considering the seismic performance of the masonry and RC buildings damaged during Lorca May 11th 2011 earthquake (Feriche et al. 2012; Basset-Salom, Guardiola-Víllora 2014; Martinez-Cuevas, Gaspar-Escribano 2016).

CONCLUSION

Despite several destructive earthquakes occurred before the 20th century, most of the Spanish cities show low to moderate seismicity. Consequently, many residential buildings show high vulnerability because they were calculated neglecting the seismic actions. To consider the structural and constructive quality in the seismic vulnerability assessment, the evolution of the Spanish building codes has been described, classifying the buildings into different periods according to the entry in force of the seismic standards.

The pre-seismic code periods (prior to 1969) are characterised by poor construction practices and absence or very basic national regulations for concrete and cast iron structures. Buildings were designed to withstand only vertical loads and suffered, for many years, a restriction in the use of iron which reduced the quality of the structures. This restriction was repealed with the approval of the MV 101, the first in representing the seismic actions considering equivalent horizontal loads.

From 1969 to 1996 (low-seismic code periods), construction and structural design were regulated by several building standards such as the NBE, the codes for design and execution of steel and concrete structures

(which were updated along the period) or the non-mandatory NTE. The seismic standards in force were, respectively, the PGS-1 (fourth period) and PDS-1 (fifth period), addressing more systematically the structural analysis of buildings but without any seismic design recommendations.

In the last two periods (from 1997), the enforcement of the NCSE 94 and the NCSE 02 caused a great impact in the seismic vulnerability of buildings, being mandatory to include the seismic loads in the structural analysis and to follow the design prescriptions. The approval of the Technical Building Code (CTE) and the Code on Structural Concrete (EHE-08) have also been relevant in the improvement of the construction quality of buildings and their seismic performance.

The regional modifiers of the vulnerability indices are defined for the most common residential buildings' structural typologies, based on the constructive periods. These modifiers can be implemented in other Spanish regions with similar seismicity and construction practices.

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PAPER #6.14

THE SPECIAL PROTECTION PLAN FOR THE HISTORIC 'CIUTAT VELLA' DISTRICT (VALENCIA, SPAIN). A NEW TOOL TO APPROACH HERITAGE ENHANCEMENT AND MANAGEMENT

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[a] Universitat Politècnica de València, Valencia, Spain

ABSTRACT

The Special Protection Plan for the historic district of the city of Valencia is a heritage and urban-use planning tool proposed by the City Council to protect the historic centre called the 'Ciutat Vella' (officially known as District 1). This district was designated as a Cultural Asset of National Interest (BIC in Spanish) by the Decree passed by the Valencian Government (Generalitat Valenciana) in May 1993.

This Special Protection Plan is a tool that unifies and adapts several urban planning and heritage rules in a single recast instrument. It will replace the five existing Special Protection and Inner-city Regeneration Plans (PEPRI in Spanish) for El Carmen, Velluters, Mercat, Seu-Xerea and Universitat-San Francesc, as well as those Special Protection Plans for the Buffer areas applied to the Cultural Assets of National Interest (PEP-EBIC in Spanish) of District 1.

This paper analyses this protection, enhancement and management tool. The methodology for this study is based on a bibliographic review of the legal documents and the Plan itself. Likewise, consultations and interviews have been carried out with experts. In addition, field research consisting in visits to the district affected by the Plan has been conducted in order to identify the existing problems on-site.

The results point out the more innovative aspects, such as: a) codifying all the heritage and urban planning legislative instruments applicable to District 1 in a single text, under the same legal standards; b) updating the current state patrimonial and urban legal system in accordance with the Valencian legislation in force; c) recognising and regulating the urban uses according to the current social situation, paying special attention to the residential and tertiary uses; and d) the enhancement and management of the architectural, urban and landscape heritage of this historic centre.

KEYWORDS

Historic centre; heritage; urban planning; legal management tools.

INTRODUCTION AND OBJECTIVES

As a heritage element, in the 20th century, sites of historic interest were addressed in numerous international treaties and conventions that highlight their value and the need for their legal protection and proper management. Examples include the Athens Charter (1931), the United Nations Conference (1962), the Venice Charter (1964), the UNESCO World Heritage Convention (1972), the Amsterdam Declaration (1975) and the Nairobi Declaration (1976), among others. Such agreements have allowed specific criteria to be consolidated and unified for application around the world. At the Spanish regulatory level, historic city centres are also considered heritage elements and can therefore be granted legal protection. Due to their double condition as a heritage element and an urban ensemble, both heritage and urban planning regulations are applicable for their protection.

The aim of this work is to analyse the successive urban planning and heritage administration instruments applied to the historic city centre of València that have led to the current regulations, which are set out in the Special Protection Plan (Plan de Especial Protección – PEP) for the "Ciutat Vella" of València that was approved on 26 February 2020. From the methodological point of view, the present work is based on the review of normative documents and specialised literature, but it also examines the current regulations and the proposals included in the Special Protection Plan for the "Ciutat Vella" of València. Likewise, consultations and interviews have been carried out with experts. In addition, field research has been conducted, consisting in visits to the district affected by the Plan, in order to identify the problems that currently exist on-site.

1. REGULATORY BACKGROUND

In this section, we will review the history of the heritage protection and urban planning in District 1, "Ciutat Vella" of València. Prior to the approval of the Spanish Constitution in 1978, the first glimpses of the legal treatment of heritage can be found in the Municipal Works Statute and Regulations (*Estatuto y Reglamento de Obras Municipales*) of 1924, the 1926 Decree governing the Protection, Conservation and Growth of Artistic Assets (*Decreto de 1926 sobre Protección, Conservación y Acrecimiento de la Riqueza Artística*), and the National Historic Heritage Law (*Ley Nacional de Patrimonio Histórico*) of 13 May 1933. In relation to urban planning regulations, there is the Land Act (*Ley del Suelo*) of 1956, which mentions the Special Plans (*Planes Especiales*) that were intended to protect historic and artistic sites and ensembles, and also the Inner-city Regeneration Plans (*Planes de Reforma Interior – PERI*). This state regulation also mentioned that it could

> *"lay down special rules for the cataloguing, conservation, restoration and improvement of buildings or urban ensembles and of natural elements or spaces, and establishes the limitation of uses or the facilities incompatible with their nature".*

Cataloguing was declared mandatory and the PERI had to

> *"contain a comprehensive study of the social and economic consequences of their implementation, justifying the existence of the means needed to carry it out and adopting the necessary measures to ensure that the interests of the population are defended".*

In addition, the law took into consideration the harmony of the sites and proposed that *"the constructions should be adapted to the environment in which they are located".*

Under these regulations, various specific assets and sites were declared to be of cultural interest, simply on the basis of their exceptional nature, their historical and artistic value being crucial in this respect, as is the case in València of the Lonja de Mercaderes (BOE 04/06/31), Baños del Almirante (BOE 16/02/44), Atarazanas-Grao (BOE 24/11/49), and Edificio del Antiguo Almudín (BOE 01/04/69), among others.

Article 46 of the Spanish Constitution of 1978 establishes the obligation of the public authorities to guarantee *"the preservation and promote the enrichment of the historic, cultural and artistic heritage of the peoples of Spain"*, as well as "*of the property of which it consists, whatsoever its legal status and to whomsoever it may belong*". Thus, in response to this constitutional mandate, the Spanish Historical Heritage Law was passed in 1985, followed by the 1992 Land Law.

The first of these two laws establishes the concept of Cultural Asset of National

Interest (*Bien de Interés Cultural – BIC*) with different categories for those elements that are recognised as having the most relevant historical, artistic and cultural value (Casar Furió, 2009). It also introduces the obligation for local councils to develop a Special Protection Plan to guarantee the conservation of the assets, in accordance with its Art. 20.1:

> *"declaring a Site of Historic Interest, Historical Site or Archaeological Zone as Cultural Assets of Interest will determine the obligation of the Municipality or Municipalities in which they are located to draw up a Special Protection Plan for the area affected by the declaration or some other planning instrument of those provided for in the legislation on town planning that, in any case, fulfils the requirements set out in this Law".*

This period coincides with an awareness of the importance of European sites of historical interest, as at that time many of them were in a state of deterioration and abandonment.
The first major attempt to enhance the value of València's historic city centre was carried out in 1984. In that year, a set of Special Protection Plans were approved en bloc for the "Ciutat Vella" District. District 1 "Ciutat Vella" is the administrative denomination currently used to refer to the historic city centre of València. These municipal plans developed the 1966 General Urban Development Plan (*Plan General de Ordenación Urbana* – PGOU), regulated by new state legislation (Revised Text of the 1976 Land Act and its regulatory development). These were plans with very ambitious objectives that basically referred to

> *"the maintenance of the road network with the generalised elimination of large operations involving the opening of new thoroughfares except for just a few cases that were deemed necessary; the maintenance of architectural typologies and urban scenes; the definition of road traffic proposals suited to the area with the progressive incorporation of pedestrian routes; the reinforcing of the residential attitude and the maintenance of the existing social structure with restrictions on the tertiary uses derived from traffic; the establishment of public facilities compatible with the historical urban structure".*

However, they were in fact a set of plans that were little more than just a declaration of intent.
In addition to this planning drawn up in 1984, the Inner-city Regeneration Programme of the old riverbed of the River Túria (*PERI del Jardín del Túria*), published in the Official Gazette of the Province on 11 October 1984, placed special emphasis on the city's urban landscape. Subsequently, a new PGOU for València was approved in December 1988. The implementation of this plan included the introduction of the planning instrument called the Special Protection and Inner-city Regeneration Plan (*Plan Especial de Protección y Reforma Interior* – PEPRI). This tool is similar to the previous special protection plans, but takes into account the heritage element in urban planning and also deals with inner-city reformation (decongestion, creation of urban provisions, community facilities, cleaning up unhealthy neighbourhoods, circulation, improvement of the environment or public services, etc.). Thus, between 1990 and 1993, the PEPRI for El Carmen (1991); Velluters (1992), Universitat-Sant Francesc (1992); Seu-Xerea (1992) and Mercat (1993) were approved, still in accordance with the State Revised Text of the 1976 Land Act and the implementation of the València General Urban Development Plan of 1988.
Shortly afterwards, in 1993, the historic city centre of València was declared a Cultural Asset of National Interest (BIC in Spanish) in the "Site of historic interest" category, in accordance with the Spanish Historic

Heritage Law (*Ley de Patrimonio Histórico Español*) of 1985.

The implementation of the aforementioned PEPRI raised expectations in view of the obvious ineffectiveness of the 1984 PEPs that they were replacing, which had not achieved any structuring actions or management models that would allow these tools to be considered really effective (Gaja Díaz et al., 2001). These PEPRIs of the 1990s generally advocated the conservation of the urban fabric and selective "sponging" (selective demolition of buildings in dense, historical urban environments to make way for public spaces or rights-of-way of some sort), with the introduction of management techniques such as expropriation.

During these years, moreover, certain competences in the 1978 Constitution were transferred to the Autonomous Communities. As a result, the Valencia Region passed its Law Regulating Valencian Urban Development Activity (*Ley Reguladora de la Actividad Urbanística Valenciana*) in 1994 and the Valencian Cultural Heritage Law (*Ley de Patrimonio Cultural Valenciano*) in 1998. These regional regulations reinforced the joint treatment of the heritage element in urban planning (Casar Furió, 2008).

With the new State 1992 Land Law and Valencian regulations (Law Regulating Valencian Urban Development Activity in 1994 and the Valencian Cultural Heritage Law in 1998) and the declaration of the historic city centre as a BIC (1993), the need arose to standardise all the regulations. Consequently, for the development and execution of the urban planning of the "Site of Historic Interest of the city of València", a series of framework collaboration agreements were entered into between the Generalitat Valenciana and the City Council of Valencia. The first agreement was the Plan of Integral Rehabilitation of València Antigua (RIVA 1992-1997), signed on 16 June 1992, for the intervention on the historic centre. Thus, a new stakeholder is introduced into the historic city, in addition to requiring the supervision of the Department of Culture and the Department of Urban Planning of the Generalitat Valenciana, along with the City Council itself for these interventions (VVAA, 1999).

For the implementation and management of the provisions of this agreement, the management offices of the València City Council were created (València Antiga S.A.) and the RIVA Offices on the part of the Generalitat Valenciana, both with a specific budget allocation for the rehabilitation of the historic city centre (Jimenez Alcañíz, 2000). These were mixed public-private initiatives, focused on redeveloping and re-qualifying the uses of urban spaces, improving the economic and commercial fabric, and providing social and cultural facilities. By so doing the aim was to rehabilitate neighbourhoods that were, at the time, very run-down and both the resident population and commerce were undergoing a sharp decline. The biggest problem in the implementation of this agreement was its high economic cost; so funding was insufficient and many goals were eventually not accomplished. However, the living conditions and quality of life in these city centre neighbourhoods improved substantially, leading to economic, heritage and cultural revitalisation, so that a certain recovery of demographics and local identity was achieved, and they also started to become a focal point for tourists.

Following this beginning, in the 21th century, the historic centre of Valencia firmly established its status as a cultural and tourist district thanks to the promotion of trade and the hospitality industry and enhancement of heritage buildings that were acting as cultural attractions or containers and institutional administrative headquarters.

However, these PEPRIs from the 1990s proved to be equally insufficient and ineffective (Gaja Díaz, et al., 2010). Therefore, in order to resolve the discrepancies that arose in

relation to urban planning interventions and heritage protection measures, in 1994 another framework collaboration agreement was signed between the Department of Culture of the Generalitat Valenciana and the City Council of València for the development and execution of the urban planning of the site of historic interest.

In the 21th century and within the legal-technical framework of the Valencian Autonomous Community, numerous urban planning regulations have been approved and modifications have been made to the Valencian Cultural Heritage Law, including the figure of "Cultural Asset of Local Interest" (*Bien de Relevancia Local Valenciano* – BRL) and subsequent independent regulation (Decree 62/2011, of 20 May, issued by the Consell regulating the declaration procedure and the regime of protection of Cultural Assets of Local Interest).

To overcome the shortcomings of the Spanish Historical Heritage Law as regards the Buffer areas of the BICs, the Valencian Cultural Heritage Law develops criteria to define them (Casar Furió and Taberner, 2010). For this reason, the Special Protection Plans for the Buffer areas of Cultural Assets of Interest (EBIC) were expressly provided for, as stated in Art. 39.3. Thus, a Special Protection Plan for the Buffer area of the Cultural Assets of Interest (PEP-EBIC 06-07) was approved to regulate the heritage, urban planning and landscaping aspects of 29 monuments in the city centre area. The Special Protection Plan (PEP-EBIC 08) was also approved for the Buffer areas of the Cultural Assets of Interest of the Puerta de Serranos, Iglesia y Convento de Santo Domingo, Museo de Bellas Artes, Monasterio del Temple, Palacio de Justicia y Ex-convento del Carmen e Iglesia de la Santa Cruz. They were finally approved in 2016.

Thus, these were the last legal-technical precedents before the approval of the current Special Protection Plan for the "Ciutat Vella".

2. THE SPECIAL PROTECTION PLAN FOR THE "CIUTAT VELLA"

The Special Protection Plan (PEP) for the "Ciutat Vella" of València derives from the 1998 Valencian Cultural Heritage Law which, in imitation of the National Heritage Law, establishes the obligation for municipalities in which a BIC is declared a "Historic Site" to carry out a Special Protection Plan (Taberner, 2016) for it. On the other hand, Art. 43 of the current Valencian urban planning regulations, which are the Law on Land Use, Urban Planning and Landscape (*Ley de Ordenación del Territorio, Urbanismo y Paisaje*) of 2014, with its modification in 2019, also includes the Special Protection Plan as an instrument of heritage management. This Law refers to the Valencian Cultural Heritage Law of 1998 (Arts. 34 and 39) to provide content for the regulation of this plan (Casar Furió, 2008). Therefore, the City Council of València detected the need for an urban plan that contemplates an adaptation of the state and regional regulations and, at the same time, combines the legal aims regarding urban planning and heritage to achieve coherence and sustainability in its management. Hence, the Special Protection Plan for the "Ciutat Vella" of València was finally approved on 13 February 2020 (BOP, no. 39, supplement, announcement of approval, 26/02/2020), its scope being the current District 1, which includes the districts of La Seu, El Mercat, El Pilar, El Carme, La Xerea and Sant Francesc (Fig. 1). This Plan will replace all previous regulations governing the historic centre. The initial diagnosis for drafting the Special Protection Plan for the "Ciutat Vella" of València (Esteve, 2020) was based on the need to:

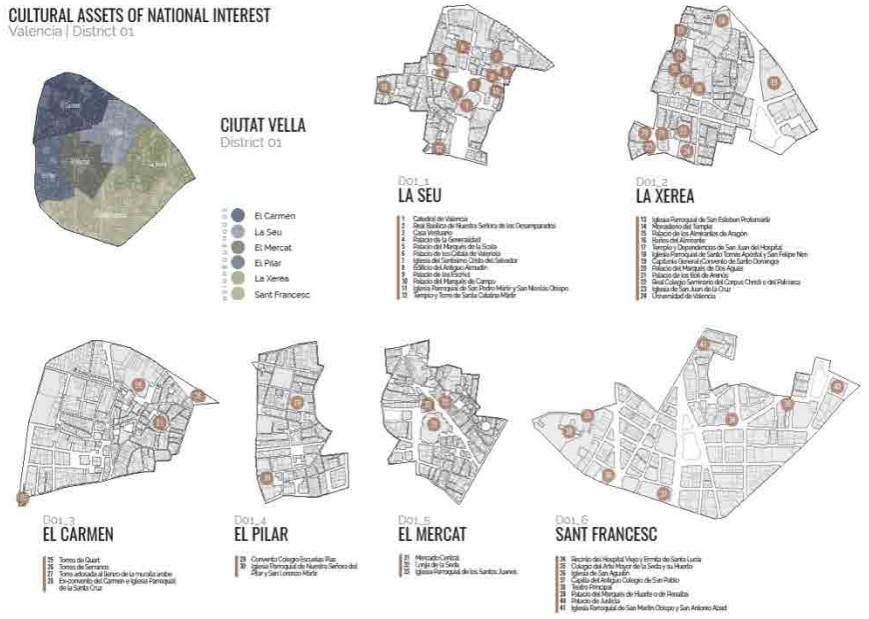

Figure 1. District 1 "Ciutat Vella" of the city of Valencia. Location of the neighbourhoods and the main Cultural Assets of National Interest (BIC).

- Update and rewrite the current plan
- Review and update the planning standards in order to guarantee a minimum level of quality in the urban planning actions that are carried out
- Recover deteriorated areas
- Conserve and enhance the value of cultural heritage
- Recover the residential fabric and the quality of housing
- Establish sustainable management of District 1 on an environmental, social and economic level
- Coordinate these actions with the current Municipal Urban Mobility Plan
- Activate and revitalise uses and activities in the neighbourhoods that make up District 1.

This Plan was developed within the framework of a broad process of public participation implemented in four phases (from October 2016 to November 2019), and taking into consideration the phenomenon of "touristification" that had been affecting the district's neighbourhoods for some time.

With regard to the updating and recasting of the current plans, it should be underlined that the Special Protection Plan will involve the homogenisation of criteria as a result of the need to adapt and unify the planning of "Ciutat Vella", which is characterised by having been regulated in a dispersed way for more than 20 years. Thus, at present, a single document brings together all the urban planning determinations of the historic urban landscape of District 1 of the city of València.

In addition, this Special Protection Plan applies to a wider area as it includes the former riverbed of the River Túria, from the Puente de las Artes to the Puente de la Exposición. On the other hand, it takes into consideration the determinations of the Sustainable Urban Mobility Plan (Plan de Movilidad Urbana Sostenible) of the city of València (2013) in relation to the urban layout, the accessibility and parking of vehicles and the pedestrian routes. The Plan thus addresses mobility as a binding determination of the planning, which tends towards facilitating the full pedestrianisation of the city centre and the use of bicycles.

With respect to the quality of the urban development actions, the Plan is oriented towards preserving the historical site, and considers the public space a priority scenario in the social life of the citizens. It was assumed that the public spaces were executed with low quality in this district (Esteve, 2020); for this reason great attention is paid to "neighbourhood or proximity facilities", as opposed to the large facilities "at the city level". It also complies with the Strategic Housing Plan of the city of València (*Plan Estratégico de la Vivienda de la ciudad de València*), approved in December 2017 for the period 2017-2021, which includes the social housing policy and social housing rental assistance in the historic centre. Moreover, according to the justification report of PEP 2020, the aim is give preference to adapting the use of provisions to meet residential needs, by promoting educational-teaching facilities, among others.

In this Special Protection Plan, cultural heritage is considered a crucial identity landmark of society and more than 2,000 heritage elements (cultural, natural and scenic) have been catalogued as protected, including BIC, BRL and new elements. It is important to point out that the Legal Register of Protections (*Catálogo de Protecciones*), as an annex to the Special Plan, includes for the first time in València, with a specific regulation within the plan itself, the protection of modern 20th century architecture. Thus, it includes elements from the DOCOMOMO Ibérico Register (Documentation and Conservation of buildings, sites and neighbourhoods of the Modern Movement).

Also relevant is the regulation that the Plan proposes for the subzone of the city, established in the detailed ordinance, called "Trama Histórica" (Historical Layout) where, as regards new buildings, it suggests particular building ordinances related to respect for and dialogue with the inherited scenarios and the traditional typologies, in close harmony with the old buildings.

On the other hand, one of the main challenges of this Special Protection Plan is the recovery of the population and the residential fabric before the advance of the tertiary use of the historic city centre, especially tertiary by the hospitality trade. Prior to 2018, there was a high demand in the city for exclusive tertiary licences for protected buildings in the historic centre (Ayora, 2019). In this way, the limitation and regulation of tertiary uses in the residential areas of the district are addressed based on checking the growth in the number of tourist apartments, among other measures. The Plan also assumes the regulation of tourist uses, achieved with the urban planning technique of zoning. Thus, it proposes a new tertiary use, called "Tourist Housing", with two modalities, the so-called "V1 Tourist Housing", which is admitted within the area of residential classification as compatible, and the so-called "V2 Tourist Housing", which is admitted as a building for exclusive use in the predominantly tertiary areas, both cases subject to certain requirements and in accordance with the regulations on urban planning stipulated in the Plan.

It seems that a lot of attention is going to be focused on the issue of the tertiarisation and the "touristification" of the historic centre in the near future, because since the Plan was drawn up until now, the growth forecasts for the tertiary sector have already exceeded the estimates made.

CONCLUSIONS

As final considerations, it can be noted that:

- The Special Protection Plan for the "Ciutat Vella" of València constitutes a great regulatory advance due to the fact that a single urban planning instrument for a historical complex includes and homogenises State, regional, heritage and urban planning regulations regarding its organisation and management.
- It is a widely debated social document, implemented within a broad framework of public participation. It has gone through four phases of public participation where the allegations made have been taken into account at all times throughout the process. However, we believe that amendments made in 2019 to the Valencian Law on Land Use, Urban Planning and Landscape have made the current regulations more accurate (closer citizen participation in the public participation provided for in Art. 49 bis) since, for the first time, the Valencian legislator provides for public consultation before drawing up the first draft of the Plan.
- The Plan has a highly protectionist vision as regards heritage; it presents a large number of protected assets, which will make it a complex management challenge.
- It is a tool that was intended for public use from the outset, with regulation of uses bearing in mind residential use as a priority (it protects residential use in the majority of buildings in the centre; the constructed floor area of non-residential premises is limited; a transitory system is implemented for occasional tourist housing). However, this is a challenge because it is anticipated that it will be difficult to attract a stable population on a permanent basis.
- One of the great challenges of this Plan will be to manage the restriction on tertiary use, which today, shortly after the approval of the Plan, is already exceeding the growth forecasts.

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PAPER #6.15

OVER-ELEVATION AS A MEASURE OF URBAN RENEWAL

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ABSTRACT

Demographic growth has promoted new approaches of cities development. Although extensions are a recurrent practice, this work focuses on the extensions in height through increased building volume. This method, in addition to increasing the demand for housing, promotes urban renewal. The chosen buildings always have an added value such as their privileged urban zoning or their aesthetic component. In this type of expansion, industrialized construction is the form of intervention that takes advantage. These over-elevations are previously manufactured in an industrial unit, where the main elements of structure are assembled, as well as enclosures and conditioning systems. The result forms different modules that are embedded together at the corresponding location. This way of working is given by the need to generate new homes with a higher level of energy efficiency and sustainability, and with a reduced construction time in the building site itself. The reduction of working hours is one of the main advantages; nevertheless, the predominant obstacles are the assembly of the modules with the existing construction. Therefore, advantages and disadvantages of this new form of execution are assessed, with methods and periods substantially conditioning this constructive practice.

KEYWORDS

Cities; over-elevations; buildability; offsite; industrialized construction.

INTRODUCTION

Throughout history, cities have experienced substantial population increases. Urban morphology and mode of growth have been affected accordingly. As an example, a fact that significantly marked the growth of the city was the Industrial Revolution, from hosting 3% of the world's population to 13%. This percentage was already 50% in 2007 and is expected to continue to rise (Joan Artés 2018, 370). In this rapid evolution, current cities have covered these needs in different ways, and it is common to see the creation of a model of city that increases its extension, is often dispersed, disordered and inefficient (José Bailach 2018). In the face of this rapid development, which causes uncontrolled land use and consumption, a new model of compact, more efficient city with optimised infrastructures, reduced environmental impact and, therefore, lower energy consumption can be considered. This choice results into a more sustainable city model. This new model of city, in view of the need for new surface area proposes underground spaces and new heights, and therefore an increase in buildability. The extension in height takes advantage of the volumetry allowed by the urban planning regulations not consumed by the existing building (Joan Artés 2018, 369). This practice means an elevation of the existing building in exchange for an improvement of common elements such as facades or conditioning systems. All this improvement, promotes an urban re-activation in the central areas of the cities, which by their antiquity probably need a restoration. We could refer

to the architects Lacaton & Vassal, who in many projects propose the adaptation of architecture against demolition and subsequent construction. The approach of this study is based on "Working with the existing," to revalue and reuse the built elements. In addition to responding to current issues such as flexibility or sustainability (Druot, Lacaton, Vassal, 2007). While this expansion strategy generates a benefit for the city's architectural heritage, it should not be forgotten that new housing must respond to a sustainable model, and respond to concepts such as Net Zero Energy Building (Net ZEBs), that is, low energy demand buildings powered by renewable energy systems (Garde et al. 2014). In this study we will focus on the residential sphere, considering both the existing building and the newly generated dwellings.

1. METHODOLOGY

During the course of this research, we have consulted different proposals that companies and offices are making nowadays, especially in the city of Barcelona, where several firms are making multiple penthouses in the nineteenth-century quarters. Based on documentation from these enterprises and bibliographic consultations, a critical view of this technique has been drawn up and frequent solutions in this type of construction of over-elevations, have been compared.

2. BUILDING EXTENSIONS. A RECURRING PRACTICE

Over-elevation in existing buildings is a relatively current option. However, extensions of buildings, in public ones or single-family housing, have been a very common practice. The dynamics of any extension are led by two clearly differentiated actors. The first is the primitive element, understood as the starting point. The second element is the new volume or surface area, which must adapt to the conditions of the first one and the urban and technical regulations. The most common extensions in architecture usually correspond to a horizontal extension (fig. 1.A). There are numerous designs such as the extension by David Chipperfield Architects at the James Simon Gallery, or the extension of the Reina Sofía Art Centre by Jean Nouvel, or even the Bois-le-Prête by Druot, Lacaton & Vassal housing tower, a very visual example of expansion and remodeling in residential buildings. Another form of extension corresponds to the connection of two separate buildings which are connected through a junction element, for instance a footbridge or even an underground corridor (fig. 1.B). A very recognizable example is the Skywalk Rennweg in Vienna by Studio Solid Architecture, or also the ABC Museum by Aranguren y Gallegos in Madrid. Another recurrent practice when it is not possible to build on an adjacent site is to build within the courtyard of the building itself (fig. 1.C.). This situation is most often observed in administrative buildings. On the other hand, when it is not possible to grow horizontally, it is usual to increase the surface area manipulating the cross-section of the building. A possible solution, usually employed in warehouses or shops, is the construction of a new floor or mezzanine within the main volume (fig. 1.D.). Finally, the case that we will deal with more detail in the rest of this study is the incorporation of a new volume on the roof of the pre-existing building (fig. 1.E.). An example of this construction can be found in CaixaForum Madrid by Herzog & De Meuron.

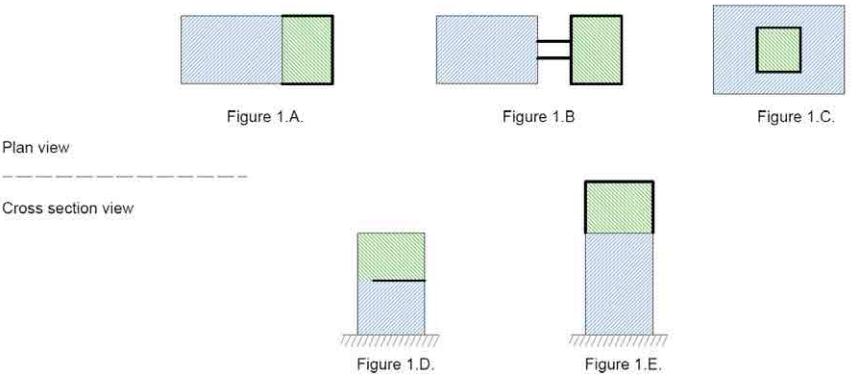

Figure 1. Schemes of expansion types, both in plant and cross-section views

3. THE OPPORTUNITY OF OVER-ELEVATING IN RESIDENTIAL BUILDINGS

This new alternative of over-elevations paves the way for historical city centres such as Barcelona, Madrid or Paris. The construction of new penthouses in residential buildings offer the possibility of reusing unused rooftop terraces to complete a city. On the other hand, the creation of new housing revalued existing buildings from the improvements made, thus helping the urban reactivating of downtown areas (José Bailach 2018).

The working methodology applied in these extensions tries to respect the values of the heritage. The roof terraces are intervened in careful way without losing the architectural value that characterizes them. Another determining factor is the industrialized building technique, which favours respecting deadlines and guaranteeing minimum qualities (Nicolás Millán 2018). In addition, this type of construction is also concerned about ecological value, aiming to get certifications such as LEED (USGBC) or GREEN (GBCe) that qualify the environmental performance (José Bailach 2018).

The total construction of the over-elevation has in general terms two phases: design and execution. During the design, and due to the high exigency of the project, it is necessary an exhaustive and complete study of the building to be completed, to know all the legal aspects of city-planning codes, the technical exigencies required by the different current regulations, the economic resources, in addition to a logistic of transport and complete assembly of the whole project. Regarding the execution, this is the most characteristic stage of this type of work and, unlike conventional work, it has two locations: initially the industrial unit where the modules are built, and finally the building which is going to receive the extension where the modules are assembled and the refurbishment and improvement work is carried out (fig. 2). These works are offered to the property in exchange for the extension of the building (Nicolás Millán 2018).

The improvement works of the building rely on several internal and external factors. Internally, these works depend on the condition of the architecture piece, either at an aesthetic, functional and structural level.

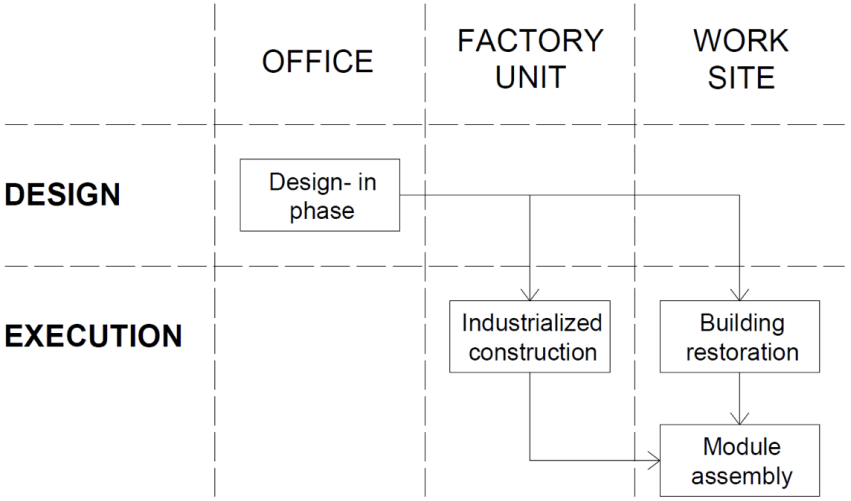

Figure 2. Diagrams of the phases that follow the projects of over-elevations

Externally, it depends on the agreement between neighbours and investors and the possibilities offered by the property object of investment.

Firstly, a study of the building deficiencies must be carried out in order to determine the actions to be taken. Once these points have been decided, all the rehabilitation and improvement work will be agreed upon based on an agreement with the neighbourhood. Normally this falls to questions of accessibility, such as works in the stairwell and lobby, incorporation of a lift and elimination of architectural barriers.

Aesthetic aspects and correction of pathologies, for example, rehabilitation of facades and courtyards, and restoration of architectural heritage elements. In addition to an improvement or replacement of obsolete conditioning systems, which must already be taken into account in the whole project due to the increase in the number of dwellings. All these improvements mean that the owners obtain, apart from the new upgrades, a revaluation of their homes (La casa por el tejado 2020).

Before receiving the new housing modules, it is necessary to have studied the viability of the intervention. To do this, it is essential to understand the structure of the building and how it works. Depending on the load to be added, the structural state of the building and the constructive and logistic conditions, the interventions will be different. Initially, we have the possible reinforcement of the foundation, where there are multiple repair and reinforcement techniques (Emma Colom 2016). If necessary, in addition to acting on the foundations and the upper structure, the rooftop terrace must be prepared to receive the new housing modules.

Once the rooftop terrace is cleared, it is time to execute the new structural elements where the modules will be supported. It should not be forgotten that the modules must be adapted to the structural elements of the existing building. The structure of these buildings is usually load-bearing walls parallel to the façade, and must

be taken into account for the support of the new modules. Therefore, the original structure will condition the new structural elements, and also the spaces.

Simultaneously to all the on-site work, the new housing modules are executed in the industrial unit thanks to the industrialised building technique. Each house is composed of different modules that are formed in a factory. All this three-dimensional structure is made of steel profiles that will be subsequently treated for both corrosion and fire as indicated by the regulations. Next, the partitioning made of plasterboard is placed. At the same time, as progress is being made with the partition walls, the plumbing, draining, electricity and telecommunications systems are installed. Finally, works on the wall coverings, tiling, flooring and suspended ceilings are solved. Once interiors are done complete, work is done on the exteriors, installing the carpentry and the façade coverings (Jon Kepa Areitio 2017).

Being the modules prepared, the transport and assembly logistics are organised for their placement at the final location. During the days of hoisting and assembly, everything has to be well planned. In addition, an organization with public roads is necessary for special transport and crane placement (Jon Kepa Areitio 2017).

Due to the type of building technique, the modules are practically finished in the industrial unit, but once there, the last details are carried out, such as joints, connection of conditioning systems, last details, waterproofing and sealing. Simultaneously, the improvement work on the existing building is being performed.

The building and the manufacturing of the modules in the industrial unit takes usually three months. Subsequently, the raising of the modules means several days. Then, the assembly of modules for new homes with the existing building and all the completions usually last between two and three months (Joan Artés 2018, 373). Therefore, the total time, without taking into account the project phase and legal procedures such as the license obtaining, is close to five or six months.

Some of the companies that are carrying out this type of construction are *La casa por el tejado*, a construction company that, in collaboration with an external team of technicians makes these houses. In addition, new companies related to this modality are emerging, such as *Growing Buildings*, which makes passive houses, or *Inbesters*, an investment consultancy for real-estate projects (Nicolás Millán 2018). It bears mentioning the *Abracadabra project*, a plan financed by the *European Commission* based on the energy renovation of existing buildings taking advantage of the creation of new housing on the roof (European Commission 2020)

4. LA MARINA 285. OVER-ELEVATION EXAMPLE IN BARCELONA

The elevation project carried out by La Casa por el Tejado is located in the Eixample district of Barcelona, at La Marina 285. The existing building has a ground floor and three floors, and it is located between party walls. On the other hand, the extension consists of the supplementation of two floors. These are the first premises for the development of the project.

The vertical structure of the building to be extended is made up of 15 cm load-bearing walls, except for the wall on the outside, which is 30 cm (Jon Kepa Areitio 2017). In addition, the type of roof corresponds to the Catalan roof. In the city of Barcelona, a large part of the buildings corresponds to a similar type of flat rooftop terrace. The peculiarity of this type of roof is its inner air chamber, with a depth between 40 and 60 centimetres (Joan Artés 2018, 374). This double-layer roof creates an air current that minimises high temperatures and prevents condensation.

First, once the structural and constructive performance of the existing building was studied, the foundation was reinforced. In this case, the option was for micro-piloting and reinforcement of the existing footings. This had

a positive effect on the rooftop, because the air chamber did not have to be demolished, unlike in other cases. Once the necessary demolitions and adaptations to the rooftop had been made, the 15x20 section concrete edge beams were installed in line with the load-bearing walls. Once the concrete has been poured, the metal plates are placed, at the points where they will receive the modules. These plates will be responsible for providing the new houses with precise flatness (Jon Kepa Areitio 2017). An important point between the extension and the existing building is the structure. In this case, the support structure of the modules had to coincide with the load-bearing walls of the lower floors, and the extension of the vertical communications nucleus. Four different types of modules were established. Therefore, we found 4 modules of 17 m deep by 3.25 m wide, 2 modules of 17x2.6 m, 4 modules of 9x3.25 m, and other 2 of 7x2.6 m, with a total of 12 modules for the two floors.

Once the roofing work had begun, another important point was the installation of an elevator and the refurbishment of the hall. Here the problem lay in the installation of the elevator because, as it had limited dimensions, the space had to be reconfigured. The first flight of stairs was demolished, ramps were added to the entrance to access the elevator, and the new electricity and water meters were relocated (Jon Kepa Areitio 2017).

Although unforeseen works may occur on site, this is not usually the case in factory construction. Once all the exact dimensions were collected and the project was completed, the company assemble the pieces in the workshop without any problem. In this case, the edges of the box were made from steel tubulars, in which the wooden slabs were placed in order to significantly reduce the load, a very important premise in this type of action. As for the enclosures, sandwich panel with SATE system (Exterior Technical Insolation System) was used, which favors the creation of a housing model with greater energy savings (Jon Kepa Areitio 2017).

Once the main square was assembled, the fire resistance treatment was carried out, using fireproof mortar for beams and intumescent paint for pillars. Then, the installation and finishing works were done, as well as the transport to its final destination (Jon Kepa Areitio 2017).

The biggest problem of this work was the assembly on site. Once the modules are being placed on the rooftop, everything has to be very measured. In this case, one of the modules was located a few centimeters away from its correct position, which caused the incompatibility of the next one. This caused temporary delays due to the displacement of the incorrect module (Jon Kepa Areitio 2017).

5. RESULTS AND DISCUSSION

This practice of over-elevation in historic-residential buildings arises from a problem of city growth. Despite this methodology favours an efficient city model, there are points to improve and to debate not only on an urban level, but also in the construction methodology itself.

At the urban level, there are many advantages. The most obvious advantage is shown in the use of the existing fabric and facilities, which are more optimised due to the increase in density of the neighbourhoods (Nicolás Millán 2018). Furthermore, the actions on the façade, the restoration of architectural elements, the levelling of coronations between buildings and the elimination of blind walls raise the value of the urban environment (fig. 3). All these improvements contribute to regenerate the city. Indeed, there are policies for the rehabilitation of neighbourhoods and sustainable development. For example, in 2007 the Leipzig Charter on Sustainable European Cities was adopted. Although these aspects are positive, it must be the urban regulations those which limit the buildability taking into account the available infrastructures of the

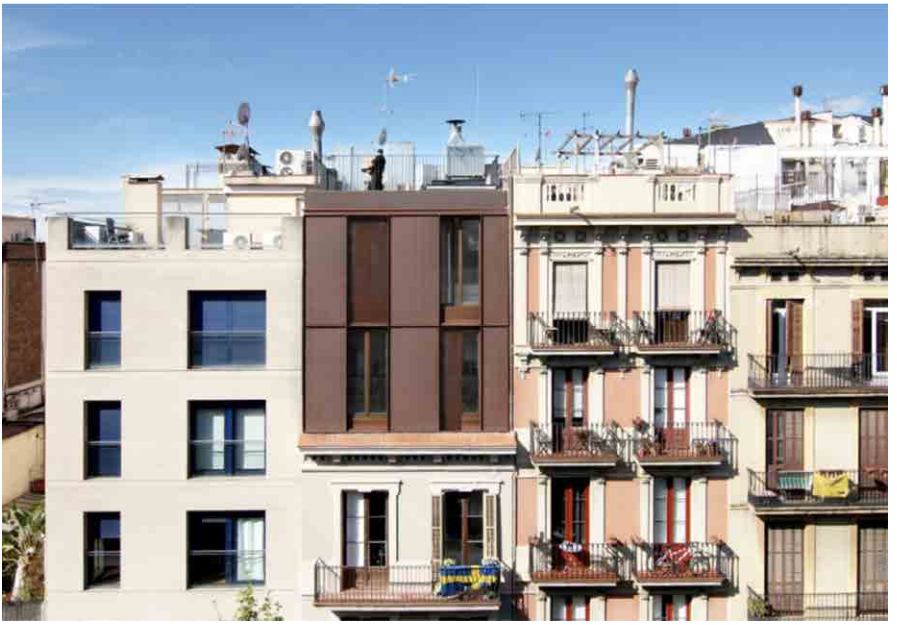

Figure 3. Over-elevation housing in Barcelona. Source: (Oriol Vives 2016)

city so that do not hold up and negatively affect these infrastructures (Nicolás Millán 2018).

Constructively, industrialized manufacturing has a number of benefits in itself. Due to its *off-site* concept, production is carried out in a more controlled and automated way, and therefore makes the system more productive, efficient and with a better optimization of resources. In addition, the construction is not altered by weather conditions, which often causes delays in conventional construction. All these facts entail a reduction in time and, consequently, costs. Although these favourable aspects seem to be on the investor's side, the existing building and its inhabitants also get a benefit. The control in the industry unit is higher than in conventional construction, and moreover the influence in case of human error is not that meaningful. Likewise, a high definition of the project is necessary for it to fit in its final location, the dimensional accuracy is more than evident. In fact, one of the drawbacks is observed when there is a lack of definition in the project, due to manufacturing outside the final location, any element not considered in the design, will affect the placement of the modules on site.

As mentioned before, new houses must have certain minimum quality and comfort conditions. This construction process not only guarantees these factors, but also, thanks to technology and research into new materials, makes houses more sustainable and more energy efficient. But the new housing does not only respond to energy aspects, but also to the need of reduction of load on the existing building, due to the remarkable lightness of the systems

employed (Meggers et al. 2012). In fact, this new search for materials responds to criteria of weight. Surely, the step to follow in order to achieve better results with these over-elevations is the search for new materials that guarantee a lighter, sustainable and modular systems.

Lightweight and industrialized construction is the optimal methodology for over-elevations. This requirement is given by the building to be completed, which initially was not designed for an increase of floors and, therefore, of loads. In addition, industrialized construction correctly solves the energy aspects (Meggers et al. 2012). Finally, it leads to a reduction in the time which it takes to build on site, reducing the inconvenience to a community of neighbours who will be bothered with the noise, rubble, etc. for less time.

Despite the advantages and opportunities offered by over-elevation, there is a lack of knowledge at the social, technical and constructive level about this practice, which still does not make it frequent. That means that building companies and their workforce should adapt in the future to this methodology and its required skills. Although society might be still rather reluctant, there are growing initiatives for example those by Descombes & Thieulin Architects which use the resource of over-elevation. Or projects such as *The Skyscape Rooftop House* by WARarchitect in Thailand. This new working methodology for the growth of cities is not only being applied at a particular level in different buildings. There are other types of proposals that follow along the same lines on a larger scale, such as the *Up project* in the city of Zaragoza. This proposal aims to build new passive, lightweight and quickly executed housing through the use of buildability, and a general refurbishment at a city level (José Bailach 2018).

CONCLUSION

Cities themselves offer options for sustainable and controlled growth by means of over-elevation. This possibility is not intended for outskirts or empty plots, where it would be more normal to think of brand new buildings. On the contrary, over-elevation is an opportunity for historical centres of cities and their first expansion dense neighbourhoods. It promotes the renovation and refurbishment of our architectural heritage, which on many occasions is deteriorated because of time and political and social negligence.

While at an urban level it promotes a more efficient system, the same is true at a construction level. Industrialised construction has an optimized manufacturing process. This favours the whole sequence of the work, which will benefit from a reduction in time, and therefore the inconvenience caused to the community of neighbours will be shorter. In addition, this type of construction offers a more sustainable service, with better energy value, precision and lightness. Despite the use of more sophisticated technology, new ways must be found to respond to greater comfort, energy and sustainable demands, based on modular and lightweight solutions.

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PAPER #6.16

ADAPTIVE REUSE IN FRAGILE CONTEXTS. COMBINING AFFORDABLE HOUSING SOLUTIONS, NEW JOB OPPORTUNITIES AND REGENERATION OF URBAN PERIPHERIES

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ABSTRACT

The proposed contribution considers living spaces in relation to the themes of affordable housing, work accessibility, adaptive reuse of existing heritage, and regeneration of peripheral areas. It presents the first results of an ongoing research-by-design experience, undertaken at Politecnico di Milano's Department of Architecture and Urban Studies, within the "Territorial Fragilities" Project, and bringing together two lines of research dedicated to contemporary housing solutions and to town and city peripheries. The research is also developed through teaching activities as part of the "Affordable Housing" Final Thesis Studio (MSc in Architecture – Built Environment – Interiors). The aim is to define innovative housing solutions obtained from adaptive reuse of non-residential, underused or abandoned public assets (offices, schools, hospitals, depots, barracks). The architectural solutions will seek answers to profound socio-economic-demographic changes (transformation of family structure, labour market insecurity, migration) and the criticalities they trigger (inadequate space, functional rigidity, lack of targeted services, poor affordability). Housing access is often conditioned by unemployment, therefore the research challenge consists in producing scenarios where a building can become not only a home but also contribute to reactivating the finances of people who are in need of a life experience that goes beyond just a roof over their heads. In this perspective, housing is seen as a tool for starting empowerment processes – of people and buildings – that define new space and type solutions able to produce effects, especially in fragile contexts when supported by special policies. The contexts touched upon by the research are fragile areas: buildings and neighbourhoods found in town and city peripheries. The intervention aims to reinforcing economic and relational networks already present within the context, impacting the surrounding public spaces and encouraging an alternative way of living.

KEYWORDS

Territorial fragilities; affordable housing; peripheries; adaptive reuse; home-work link.

INTRODUCTION

Our contribution addresses the subject of living space designed in the perspective of access to housing, the home-work connection, the adaptive reuse of existing stock, regeneration of peripheral areas and fragile contexts. The text presents the initial results of ongoing studies developed within the "Territorial Fragilities" project put in place by Politecnico di Milano's Department of Architecture and Urban Studies. Two distinct lines of research[1] are brought together: *ForDwell*, considering forms, uses and spaces for contemporary living, and *PeriFrag*, observing projects and policies for

[1] Overall, this paper is the joint work of the two authors. However, §1 and §2 were written by Fabio Lepratto; part §4 by Elena Fontanella; the abstract, the introduction, §3 and §5 were written together.

architectural, urban and social regeneration of town and city peripheries. The argument developed here refers to the first stage of a research-by-design experience, aimed at defining new forms of accessible living, achieved by the inventive redevelopment of non-residential, under-utilized or derelict public stock. The research was developed within the Affordable Housing Final Thesis Studio at Politecnico di Milano,[2] which was a place for research and design experimentation using a multidisciplinary approach.

1. ACCESS TO HOUSING

Italian housing conditions are in a critical state, with an average regression of affordability and institutions seriously challenged in coping with the growing crisis, which also extends to new forms of fragility that affect even regular user profiles (Baldini 2010). If it is true that "one hundred years of housing policies in industrialized countries have never eliminated housing exclusion" (Tosi 2017), it is equally demonstrable that it is actually a growing phenomenon (Nomisma for Federcasa 2016), in Italy and across most of Europe (Pittini et al. 2017). There are between two and three million Italian families facing housing difficulties, many of whom suffer social marginalization (Tosi 2017). Over 1,700,000 households are at similar risk of succumbing to forms of default and loss of their home.[3] In the face of these high numbers, public housing stock, estimated at just over 850,000 dwellings, is not proportionate to the number of people experiencing acute housing difficulties.[4] This growing "fragilization" of housing conditions is a process simultaneously encountering social, spatial and institutional issues, faced with the rapid change in economic conditions and, above all, with difficulties in accessing employment and income. The sheer speed at which the latter vary impacts the population much more quickly than the ability of institutions to react with policies or of spaces to adapt to changing needs (Balducci 2018): a misalignment that accentuates social marginality, neglect, deprivation.

The correlation between access to housing and access to employment, especially in peripheral areas, has been addressed in recent programs and policies promoted by local institutions, linked to cohesion and social inclusion projects, financed at national and community level. For example, the special program for urban redevelopment and safety in peripheries launched by Naples Municipal Authority merges the right to housing with the right to work, education and training. The joint goal of the "Agenzia Sociale per la Casa" ["Social Agency for Housing"], financed with PON (National Operational Program) funds for metropolitan areas, is to counteract those housing problems generated by lack of income because of unemployment. In addition to receiving a living space, the people engaged by the program are included in guided independence courses, aimed at rebuilding employment and so indirectly resolving right to housing issues.[5]

Similarly, in Milan's Lorenteggio district, ongoing urban requalification is aided by a plan to support training, professional requalification and self-employment for the most fragile subjects and the unemployed. The aim is to strengthen the economic

[2] Politecnico di Milano, School of Architecture Urban Planning Construction Engineering, Master of Science in Architecture - Built Environment Interiors, Final Thesis Studio "Affordable Housing: Domesticity Reloaded. Form, Uses, Spaces, Practices and Policy for Contemporary Dwelling", Professors: Massimo Bricocoli, Gennaro Postiglione, Stefania Sabatinelli. In collaboration with the Research Team "ForDwell-DASTU Dipartimento d'Eccellenza": Gaia Caramellino, Stefano Guidarini, Fabio Lepratto, Simona Pierini, Roberto Rizzi; and with AIUC School scholars: Barbara Brollo, Antonio Carvalho, Lorenzo Consalez, Elena Fontanella, Francesca Gotti, Marco Jacomella, Massimiliano Nastri, Ingrid Paoletti; in cooperation with Double Degree program TU Graz prof. Andreas Lichtbau.

[3] Less than 4% of Italy's housing stock: one of the lowest percentages in Europe.

[4] Source: Nomisma research for Federcasa "Il ruolo dell'ERP negli interventi di rigenerazione delle periferie-Stato di fatto e prospettive future" ["Public Residential Building's role in regeneration actions for peripheries – state of affairs and future prospects".

[5] www.coesionenapoli.it/bandi-e-avvisi/pon-metro-napoli/

fabric of the neighbourhood, in tandem with the improvement of spatial quality. The various actions envisaged, with POR-ESF funds for 2014–2020 and the European Regional Development Fund, also 2014–2020, combine support for micro-businesses and the creation of social impact enterprise. Only the future will tell if these actions are successes or failures. It is nonetheless interesting to register how housing and employment are perceived as interacting issues, which cannot be addressed separately. Moreover, what kind of space do these kinds of projects require? What role could be played by a rethinking types of living spaces? What prospects open up for abandoned public buildings in developing opportunities that combine access to housing and access to jobs? This research considers the idea of starting over from unused buildings and their repurposing, to trigger positive reactions in the relationships between spaces, societies, institutions, and economies. The boundaries of the project research are therefore determined by the recognition of two main issues: the need to act on the home–work link, and the desire to seek opportunities for reclaiming extant public – and not solely residential – stock.

2. THE HOME-WORK LINK

The problem of having access to housing is the fallout of failure to find employment. In the current conditions of uncertainty and high unemployment, a large part of the population is marginalized, without a continuous and adequate income that would allow stable access to a decent home.

The architectural relationships between work and living spaces stand as a concrete expression of the different economic models following on over time, with specific building types emerging for each model, distinguished by the ways in which the settings are conceived and organized. For example, the archetypal shared work and living space of the Medieval house-shop or the rigid functional separation, typical of Fordism (Holliss 2015). Starting from the 1970s, changing economic models brought new practices in the use of space and triggered type changes (still incomplete), which highlight how existing dwellings are often unsuitable for current needs, especially if referred to today's forms of economic livelihood (van Gameren et al. 2019). This occurs in an era where work or productive environments demand compatibility with living spaces and installation in urban areas (Melotto, Pierini 2012; Misino 2018). We refer not only conditions rendered favourable by current technologies that enable efficient remote or home working (as the spread of smart working activity due to Covid-19 pandemic has shown), but also the return of manufacturing, artisanal or digitized production, within the urban fabric (Rappaport 2015). Nonetheless, the most recurrent experiments proposing new architectural solutions do not seem to fall within the realm of affordable housing.

Among the most popular type variants, the concept of a single building accommodating "co-living" and "co-working" combinations has taken hold in Europe and the United States, also attracting attention in the academic field (Coricelli et al. 2018). It is worth pointing out, however, that this is a commercial product, targeting subjects who do not face economic problems: generally young professionals who do not see themselves in traditional housing models and are willing to commit themselves economically to live within solutions they consider most congenial to their needs. There seems to be room for exploring new architectural solutions therefore, which might offer scenarios for rethinking the status of the dwelling and transforming it into a spatial support for accommodation but also assisting in the reactivation of the finances of those requiring a housing experience that

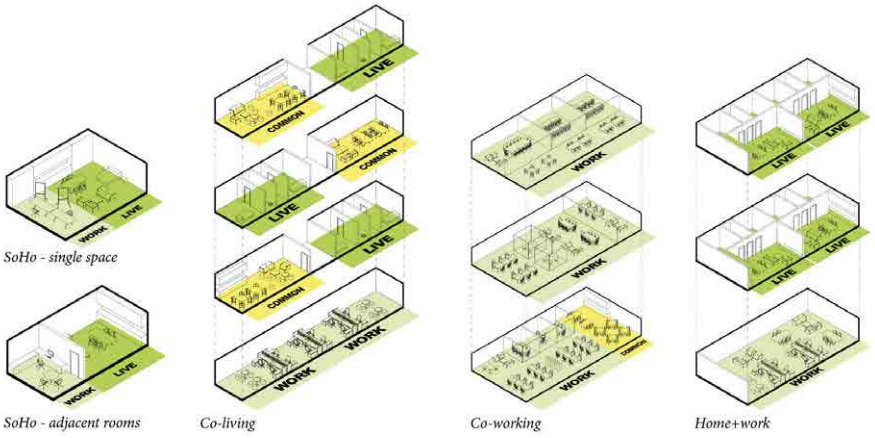

Figure 1. Contemporary housing+working models, ranging from private to public way of interaction between the different embedded activities (Cui, Mendoza 2019). From left to right: SoHo (with a single space or adjacent rooms), Co-living, Co-working, Home+work. In light green: working spaces, in green: living spaces, in yellow: common facilities.

goes beyond just having a roof over their heads. By combining accessible housing, a productive environment and upgrading of extant properties, a dwelling can then become a device for initiating processes to redeem people, buildings and urban contexts by defining innovative space and type solutions, integrated with targeted policies and services.

3. STARTING OVER FROM EMPTY PERIPHERAL SPACES

Italy is littered with public structures in a state of neglect but with huge redevelopment potential. As detailed by many studies and much research,[6] Italy has a large pool of unfinished works, derelict buildings, unused structures, assets confiscated from organized crime, etc. Part of the huge extent of this legacy – comprising offices, schools, hospitals, depots, boarding schools, barracks, warehouses, sports facilities, and much more – can be brought under the microscope thanks to a number of databases, including real estate surveys conducted by public authorities and made available by the Ministry of Economy and Finance, or the list of assets confiscated from organized crime, collected from the open platform OPEN RE.GI.O.[7]

Faced with the question research asks about how unexploited public assets can be put to good use in an approach seeking interaction between residential spaces and work opportunities, development potential may vary according to different factors, which include prompting from contexts, social networks, local opportunities and resources, public and private players, the type of

[6] Among them: Re-cycle Italy PRIN (Projects of Relevant National Interest) research (https://recycleitaly.net/); Ri-formare Milano and Ri-formare Periferie: a teaching and research project promoted by the School of Architecture of Politecnico di Milano (http://www.riformaremilano.polimi.it/); The Abandonment Atlas for the Metropolitan City of Milan, promoted by the Centro Studi PIM (http://www.pim.mi.it/atlante-abbandono/); The research developed by the Permanent Laboratory on Abandonment Places of the Università degli Studi di Milano, Dipartimento di Beni Culturali e Ambientali (http://users.unimi.it/labb/index.html).

[7] Official platform of the National Agency for the Administration of Distressed and Confiscated Assets from Organized Crime (Anbsc): https://openregio.anbsc.it/.

artefact, its size and state of repair, the user profiles (ordinary or fragile) to be engaged.
The reference contexts correspond to areas that are experiencing or have experienced fragilization processes in the past and focusabove all on "rejects" located in town and city suburbs, where there is more marked social and material vulnerability, often accompanied by strong housing pressure. Within these town and city contexts, the presence of abandoned or underutilized buildings simultaneously represents a "fragility" and a "spatial resource". Indeed, while the presence of abandoned buildings contributes to degradation in peripheral areas (Bianchetti 2003; Petrillo 2018) by intensifying the perception of a daily absence of care, it also represents an opportunity for redevelopment that will trigger or support regeneration processes. The quest for accessible housing solutions able to integrate work opportunities and accommodation spaces becomes a chance to overturn the predominantly monofunctional residential status that is often the case in peripheral areas and contributes to the development of new centralities. This could translate into the ability to spark changes through architectural projects, acting on the spatial dimension of suburban fragility in towns and cities, while engaging social and economic fragilities. When synergies develop for housing, employment, social policies, and the regeneration of metropolitan suburbs, the effects produced by spatial conversions strengthening the home–work link could possibly contribute to generating better effects for economic and social factors. Architectural actions on abandoned buildings also aim to strengthen relationship and economic networks found in the reference context and generate further transformations to impact neighbouring public spaces, promoting an alternative way of life able to "make a city". The various options for redevelopment of buildings abandoned in the urban fabric are closely linked to the specific construction features (both in spatial and structural terms) and to the characteristics of the reference contexts. However, in more general terms, we can identify various openings that support ideas for conversion into economically accessible residential buildings that can accommodate work and production spaces, where spatial potential derives from the type of public building where neglect is prevalent. In particular, considering the presence in Italy of state-owned barracks, schools, hospitals, mental homes, and indoor markets, in a state of neglect or severely underutilized,[8] we can suppose that these types of construction lend themselves to redevelopment projects both in short-term and long-term scenarios. In point of fact, these categories frequently combine the presence of large spaces, often on the ground floor (gyms and refectories in the case of schools; canteens or garages in the case of barracks) with smaller circulation areas set along corridors (for example classrooms or hospital rooms), and with large distribution and circulation spaces. The categories mentioned feature not only individual buildings but also groups of constructions vaunting open spaces that connect seamlessly with public areas. Opening these up, and quickly, may offer an opportunity to rethink the relationship with the surroundings. These opportunities for repurposing and redevelopment could open the door to unforeseen combinations that precisely through the integration of domestic and production spaces contribute to enhancing existing areas that have lost their active role in the life of contemporary cities.

[8] The Italian Ministry of Economy and Finance completed an accurate Survey of Public Administrations Real Estate, including that in state of abandonment. The data are collected according to art. 2, paragraph 222, Law 23 December 2009, no. 191. Administrations inform the Ministry: about 80% for the 2016 survey.

4. LEARNING FROM PRACTICE: THREE CRUCIAL "INGREDIENTS"

The first step declared in the research project discussed here aims to work on integrating the more strictly private and domestic dimension of living and working the same place. It intends to observe with coherence the accessibility of dwelling and working in peripheral urban and metropolitan contexts by enhancing existing spatial resources.
In this sense, it intends to recover the complexity often found in a number of types in the past, which has gradually been lost. To do this, the (minimum) "ingredients" deemed necessary for the definition of innovative structures that would integrate living and work areas were identified and explored with reference to recent works and experiments in the Western context. This breakdown is required before proceeding to the subsequent phase of re-composition, articulation and hybridization, which will be addressed by the project in its role as an outright instrument and field of research. There are three ingredients – understood as components for pursuing the relationship between access to a home space and access to a work space – identified as "domestic spaces", "production spaces" and "shared spaces".

1) *Domestic* –in particular *affordable– spaces* can be considered an essential ingredient, beginning from adaptive reuse of non-residential public buildings, an approach that opens up the possibility of increasing the number of accessible dwellings, starting with abandoned public resources. In this respect, the Vandkunsten Architects *Apartments in the Constable School* project, put in place in Copenhagen in 2015, is a particularly relevant reference. These small student apartments were devised in a school building that had been abandoned for decades, in the up-and-coming Margretheholm district. The project focused on redevelopment of the entire building, to which a new layer was added that did not erase what already existed and allows appreciation of the brickwork textures near staircases and windows. The contrast between new and extant also permeates internal spaces, where the housing units are integrated and completed by collective spaces (areas for studying or socializing). The Gantry Studios project in London, designed by Architecture 00 + HawkinsBrown (2017), is another interesting case study of the potential of infilling work and shared space with an existing structure. Indeed, the project was born from an existing framework used as a warehouse for the 2012 Olympics and averted its probable neglect by seeing the potential for redevelopment. The twenty-one units mimic the archetypal house concept and are arranged on the three levels of the structure. Each is finished in different colours and materials, while the supporting structure was constructed from prefabricated wooden modules. These two examples take two approaches recurring in the conversion of existing structures: the first corresponds to the reutilization of the entire building, starting from the intervention on the envelope, while the latter exploits the extant as a support into which smaller elements are introduced to make the space habitable.

2) The *production spaces* intended to be integrated into the design experiments, range from more traditional types of work environments (art studios, manual workshops, ateliers, offices) to more innovative spaces linked to new forms of production, including cultural. Strathcona Village, built in Vancouver (2018) to designs by GBL Architects, shows how integrating production spaces into residential complexes can affect the base layer of buildings, combining light industrial production, commercial spaces and offices. A BETA Office project in progress in Amsterdam – *NDSM Treehouse* – develops a concept for 100 affordable studios for young emerging artists. This incremental structure built from recycled materials combines individual

workspaces with two large area for hosting exhibitions and workshops, concentrating on the interaction between private, collective and open spaces.

3) It is precisely the latter dimension, the *collective space* and "communal area", that represents a third important ingredient. Referable to both the domestic and the productive component, the communal areacan build the way to opening towards the context of reference and the local community, as in the case of the *Ru Paré Community*, which redeveloped a school into a community centre, to a design by BETA Office. In a suburban district of Amsterdam (Slotervaart, 2017), the redevelopment devised by this project refers both to the building itself and to the surrounding district, with the added aim of stimulating the local economy. The old classrooms allowed placement of different functions related to the new community centre, while the presence of a gym – initially considered an element of weakness because of its position inside the building – developed into a resource. By relocating the building's entrance to the gym and adding a vertical opening and closing system, this area became a foyer that manages the transition from the interior to the exterior. Communal areas thus became the core of the project. The case of *Hal7 Makers Corner* is also interesting for the role played by communal spaces in hybrid programs. Realized by Vandkunsten Architects in Roskilde (DK, 2017), the conversion worked on redeveloping a disused industrial shed by modifying the structure itself and installing new buildings inside it. The new building units are then made by upcycling waste, in particular by repurposing disused shipping containers. The spaces created inside the readapted and suitably insulated containers are dedicated to work and light production, while the intermediate spaces are designed to welcome both those who work inside the structure daily and as a meeting point for the local community.

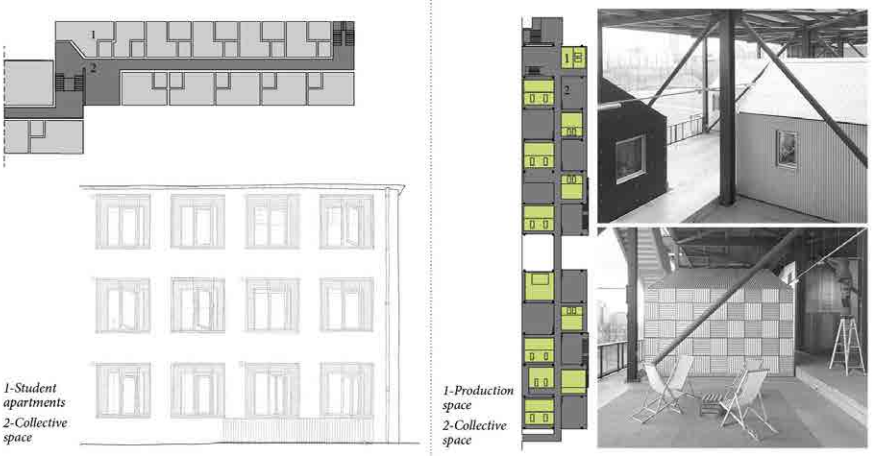

Figure 2. Two adaptive approaches to make the space habitable: reusing the entire building within the envelope (I), exploiting the extant as a support for introducing smaller units (II). Left side: Student Apartment in the former Constable School, Vandkunsten Architects, Copernhagen 2015 (Diagram and sketch: Lepratto 2020). Right side: The Gantry Studios. Architecture 00 + HawkinsBrown, London 2017 (Diagram: Fontanella 2020, photos: Lepratto 2020).

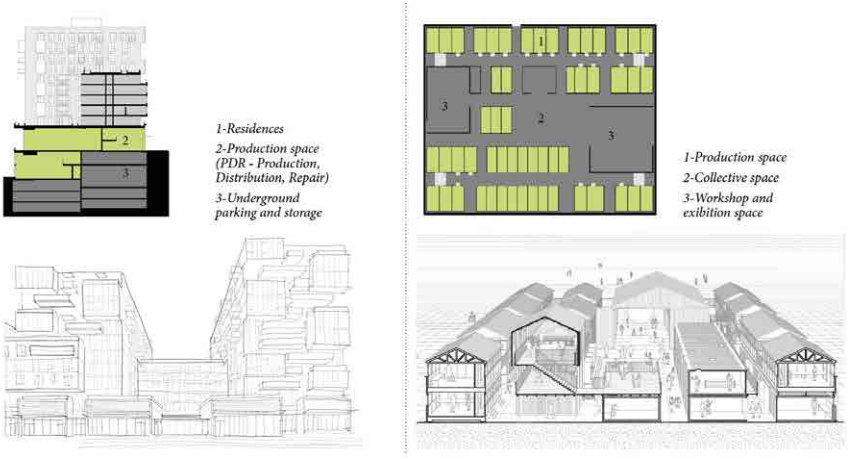

Figure 3. "Productive spaces" in recent developments. Left side: Strathcona Village, GBL Architects, Vancouver 2018 (Diagram: Grassano 2020, sketch: Lepratto 2020). Right side: ADSM Treehouse, Beta Office, Amsterdam (ongoing) (Diagram: Grassano 2020, perspective: Beta Office 2019).

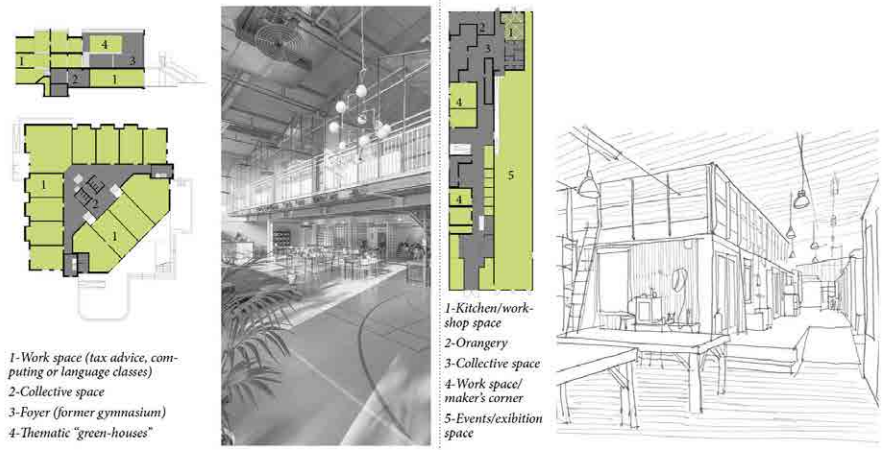

Figure 4. Collective spaces and communal areas. Left side: Ru Paré Community, Beta Office, Amsterdam 2017 (Diagram: Grassano 2020, photo: Marc Faasse - Beta Office 2019). Right side: Hal7 Makers Corner, Vandkunsten Architects, Roskilde 2017 (Diagram: Grassano 2020, sketch: Lepratto 2020).

CONCLUSIONS: FIVE POINTERS FOR ARCHITECTURAL DESIGN TRIALS

By studying and comparing an extensive number of past and contemporary case studies – some of which were described in the previous paragraph – we drafted initial input for defining some points crucial in outlining a possible functional program that will be tested and implemented through future research by design. These points range from the scale of functional areas to relationships within the building, and also look at the rapport with the contexts.

Domestic spaces

In an attempt to redefine living spaces perceiving them in relation to workspaces, we can define a domestic environment by suggesting a number of architectural configurations, even far removed from what we usually call "home". Finding dedicated resources and spaces for working, in an affordable housing context may require compression of private domestic arrangements, partially offset by planning for shared spaces and services. We see not only the construction of small apartments, occupied by a single-family, but also of "clusters" of rooms or mini-lodgings, grouped around communal spaces,[9] as well as independent micro units, prefabricated boxes positioned to render large-scale structures habitable, with sound and heat insulation, air-conditioning, and building services. Depending on each case, the challenge posed by finding a physical demarcation line between the home and the work environments will differ. Sometimes these two dimensions share a single space and a boundary is established simply by the time of day. In other situations, home and work are in adjacent rooms, separated by furnishings or a door, and only the actual user is involved. In yet other cases, the two dimensions are installed in the same building, connected by a distribution system, and the workers are not obliged to reside there or residents to work there.

Productive environment

The space of the productive environment can be organized to meet the requirements of different work situations: self-employed, business, contractor, etc. Some workplaces are fluid, complex to describe; others are more static and traditional. Design then needs to conceive and/or combine environments that have very different characteristics and scales: the minimum space required by a freelancer who may need nothing more than a PC; the environment required by a small business; a medium-sized production area for companies or cooperatives. In the first case, a workspace can overlap with a dwelling (Small Office Home Office – SoHo categories) or it can be integrated into shared spaces, where it is possible to rent meeting rooms or occasionally work with other professionals (co-working spaces). The latter two cases, albeit on different scales, require spaces with boundaries, properly separated from a domestic area, often for hygiene, safety or access control reasons. They include home–workshops, where the two functions interact but are separated by a boundary, and production surfaces integrated into neutral mixed-use buildings, available to host activities compatible with – even if not directly connect to – housing. In the three cases, if the working activity is visible from the outside, it is a positive element that may foster business development.

Communal areas

Communal spaces play an important negotiating role for areas in the building, first of all managing the relationship between the dimensions of personal and working lives, acting as filters to ensure coexistence of the two aspects in a single construction. Shared

[9] For instance, the Mehr als wohnen project (2009-2015), designed by the Duplex Architekten firm of Zürich.

spaces can be configured as informal areas, extremely adaptable and thus versatile in use. They may allow an integration of leisure and socialization activities and shared services (laundry, gym, communal kitchens etc ...). They are often intersected by distribution spaces, transforming stairs and corridors into timeout or observation spaces for the many activities going on in the complex. They have different levels of accessibility that correspond to just as many levels of sharing: some are aimed at the general public, others are only for the entire community of resident and/or workers who have settled in the building, or part of it. Finally, other environments can be shared by a few individual users, generally to complement their compact homes.

Adaptive reuse

The identification of abandoned public buildings can be considered a relevant starting point for definition of non-conventional adaptive reuse projects focused on the home–work relationship. If the presence of unused buildings in a state of neglect inevitably generates forms of degradation around them, regardless of their location, their redevelopment comes as a great opportunity in the urban fabric for upcycling *rejects* into *resources* to avoid further consumption of land and waste of embodied energy. The adaptive reuse of vacant public buildings can open up forms of temporary living tied to specific situations demanding immediate responses, but also be involved in long-term planning. Such time constraints will inevitably correspond to different levels of conversions, use of economic resources and materials. In a perspective targeting environmental sustainability, the latter can be identified as part of virtuous recycling and upcycling processes.

Periphery Regeneration

In peripheral areas, converting what is discarded and no longer used into resources also offers an opportunity to start or support wider-ranging regeneration processes. Within these, the relationships between living and working spaces can play an active role in abolishing residential or production monofunctionality, which is often a connotation, fostering mixité, leveraging local specificities. In contemporary suburbs, developing the home–work connection can translate into the possibility of promoting opportunities for exchange that may allow these contexts to be opened up, engaging them with their surroundings by intercepting flows and attracting a non-resident population. At the same time this could contribute to the strengthening or building – when absent – of a sense of belonging to a community and a place. In this perspective, the energies (like non-profit associations and cooperatives) already present in these territories, which very often perform different activities in these contexts in support of the local population, represent an additional resource with which experiences such as those already mentioned for Naples and Milan could come into contact and build fertile interactions.

The preliminary work presented here targets a perspective of design research commensurate to the different scales of architecture; housing, social and urban planning policies; economics; and social sciences. From a methodological standpoint, the role attributed to future architectural experimentation is considered crucial as a further investigation to increase knowledge of the described topic. The project is used as a probe capable of testing redevelopment actions in paradigmatic situations. The experiments will help to understand complex realities that intercept the material, social and institutional dimensions. The research key combined with clearly stated intentions to act are intended to produce narratives, stimulate new scenarios, asking interacting disciplinary sectors open questions, tracing generalizable and/or replicable actions that increase disciplinary knowledge.

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PAPER #6.17

SINGLE-WALL TIMBER GRANARIES BOX CONSTRUCTION IN TURKISH AND SPANISH RURAL ARCHITECTURE CONTEXTS

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ABSTRACT

This paper offers a comparative overview and analytical dissections of the elements of two semi-identical vernacular structures built in similar environments but in very distant locations: The Eastern Black sea region of Turkey, and the northwest of the Iberian Peninsula in Spain. Serander of the Black sea region in Turkey, and Hórreo in Spain are two elements of vernacular architecture, which have similar appearances; functions and construction techniques. Not surprisingly, the two elements are products of similar environmental and economic conditions. Changing social and economic conditions, migration to cities, and abandoning farming has left the old structures empty but with a wealth of knowledge particularly on single-wall timber construction techniques. Unfortunately, these endangered and unprotected structures are being demolished and disappeared in a rapid rate. It is important to document, protect and preserve these unique structures, as there is much to learn from their construction methods. Various aspects of both Serander, and Hórreo are thus surprisingly similar. Both of them were built and detailed for disassembly. Many of the Hórreos are well preserved and well protected, but it is not possible to make a similar statement for Seranders, which are in the process of perishing, due to changes in economic activities and life-patterns in the modern Turkish society. This paper is based on an extensive fieldwork throughout the Eastern Black sea region during the summer of 2014 and the review of relevant literature of Horreos. A digital reconstruction of the construction assembly process was also prepared for this paper.

KEYWORDS

Vernacular architecture; hórreo; serander; single-wall timber construction; black sea region; Spain.

INTRODUCTION

Serander of the Black sea region in Turkey and Hórreo in Spain are two forgotten elements of vernacular architecture, which have similar appearances; functions and construction techniques (Figure 1,2). Not surprisingly, both are products of similar environmental and economic conditions (KARPUZ 1999). Serander is part of a rural residential typology founded by natural and economic conditions of the Eastern Black sea region. A simple single-wall timber structure constructed on posts over a platform (Ali and O'Brien 2016). This building is usually used to store grains and food, while some are used for residential purposes as guest houses. Serander consists of a front terrace (logia) called 'Çardak' or 'Sofa', and a storage space at the back. In some examples, there exist an intermediary space between the Çardak and the storage space. Seranders are classified either according to the position of the logia (positioned on either one, two, or three sides), or according to its size, in the case of which the number of load-bearing posts are taken into consideration (4-post, 4/6-post, 10/12-post). Serander often have

carved timber ornamentations, regardless of its type and size. Serander is considered as the most important adjacent structure to the typical country house in the region. Serander is constructed approximately 4-5 meters away from the rural house but close to the roadside. Anyone who is wealthy enough in the countryside would own a Serander. It is suggested that the original source and the word Serander comes from two words: "Kseros", which means dry in Pontus Greek, and "Andiro" means balcony/ terrace. Kseros" + "Andiro" = "Kserosandiro" "Kserander" "Hserander" "Serander". Which means literally drying place, "drying balcony" for corn and hazelnuts (Türk Dili Dergisi Sayı 630, Prof. DR. Hasan EREN). The Eastern Black sea region of Turkey is geographically separated from the inner regions of the Anatolian Peninsula by a chain of mountains. The four-season rainy climate created a green flora, and settlements were established at the skirts of the mountains up to 3000 meters high. Villages were established at the banks of several rivers arising from the mountains and reaching to the sea. Due to topography, an isolated culture was developed in the Eastern Black sea region (Usta 2012). In the two cities of Rize and Artvin, a rich wooden craftsmanship has been developed. Traditional wood and masonry construction methods were used in building masjids (mosques), houses and grain storages. Although an irregular settlement is commonly observed in the Eastern Black sea villages, there are clustered houses in some neighborhoods and villages. A barn is added to the house plan and placed at the ground floor due to steep terrains. A kitchen (*Aşhana*), bedroom, and storeroom were located at the first floor. The main components of the kitchen are; a stove in the middle, an oven located by one of the walls, a ground washbasin (*Suluk*), and a cabinet. Besides, a seating bench (*Peyke*), a stove, and a ground washbasin are also located inside the room. The typical Eastern Black sea house layouts were divided into two types; East of the city of Trabzon where houses with porch (*Hayat*) and west of Trabzon where houses with kitchen (*Aşhana*). Rooms were located around the porch, which is interconnected to the kitchen. On the other hand, there was no porch in the houses with kitchen, and two rooms (one is a storeroom) were connected directly to the kitchen (KARPUZ 1982). A barn is located at the ground floor and a storeroom (for milk and cheese) is connected to a kitchen. In Trabzon, a combination of stone and wood construction were used, however in Rize and Artvin, a timber log construction and masonry techniques were used (SÜMERKAN 1991).

Figure 1. House (left) and Serander (right), Pervane Köyü Araklı Village in Trabzon. Source: (Author 2014)

Figure 2. Elements of a typical Spanish Hórreos. Source: (Flicker / Artilanes.com 2008)

1.HÓRREO

Hórreos are traditional rural storage buildings usually found in the northern part of Spain and primarily used for storing food and grains. The particular type of Horreos discussed in this paper is located in the Asturias, within the Iberian Peninsula (de Aldecoa 1999). Its shape and configuration are different from the traditional Galician Horreos (Rouco 2001). Hórreos were the solution to provide natural ventilation, while preventing access to unwanted rodents. They are typically built of timber, stone, or masonry with a grain chamber (warehouse box) elevated and isolated from the ground and with ventilation openings on the side walls (Perez-Garcia et al. 2010). The Iberian granaries were mainly constructed in two different materials: stone and timber. They were completely constructed of thick slabs of granite. The platform or pillars below, the frame system of the granary, the gridded walls between the frame system and even the roof were made of stone (Özcan 1999). Similar to Seranders, Hórreos were an indispensable separate structure for the locals living in the rural parts of the region. The unique structures were developed with outstanding aesthetical appearance yet surprisingly functioned as the modern fridge. Many kinds of food, especially hazelnuts and corns were dried and stored. These structures sometimes functioned as guest houses. Hórreos were typically built on 4 thick pillars. On the intersection points between these pillars and the warehouse box, wheels or disks approximately 70-80 cm diameter, a part of which is plain, and the other part is domed are placed. The purpose of these wheels was to prevent mice to reach the stored food and grains. Hórreos were covered with terracotta or slate tiles and surrounded by wooden bars. A room and balcony made of timber sticks were also part of the Hórreo. Hazelnut and corn were dried in the balcony and the room was usually used as storehouse (Ozen and Keles 2008).

2.SERANDER CONSTRUCTION PROCESS

The The sequence of a typical Serander construction was as follows: first, timber posts were erected with a height that is taller than a regular person. The posts were then laterally supported with buttresses or knee-bracing system (figures 1). In sloped terrains, posts were seated on tree trunk bases. There are also circular, wooden or stone headpieces (wheel) that sit on the top of the posts to prevent rats and other animals from climbing up through the structure. Thick wooden beams that carry the main warehouse box structure are placed on the headpieces. The main structure, which is made of 5-7cm-thick chestnut or hornbeam wood planks, is seated on these beams. Serander, is built with wooden masonry construction method (similar to log construction by stacking the structural members horizontally). Timber members are combined to each other primarily by the mortise or lab joints, but corners are joined using scarf joint techniques (figure 5). Since no nails were used in the assembly, Seranders were designed to be disassembled and moved to other villages (Eruzun 1977). The warehouse box floor system was usually constructed as grid shaped, knitted branches of a tree called “Kumar” underneath. Grills for ventilation on the openings of the sidewalls are necessary to circulate air inside the storage box and air circulation is primarily obtained inside the warehouse through this system. The roofing system of Serander is typically built with wooden truss members from trees and designed as a “saddle-headstock” roof (sloped to two sides) or “four shoulder” (sloped to four sides). The roofing material was either wood shingles (Hartama) or fired clay roof tiles (Figure 5). Below the storage box, where the load baring posts stand, not only the tasks like shucking corns, sorting hazelnuts took place, but also woodpiles or beehives etc. were stored. The upper semi-covered section of the Serander is designed

as a balcony, gallery or logia. In some parts of the region, the logia is called "Hayat", and in other parts called "sofa". The logia is usually located at one or four sides of the structure. Corn cobs are hanged, and some foods and pickle jars are stored in the logia. Grinding of flour with a hand mill is also a task that is usually done in that section.

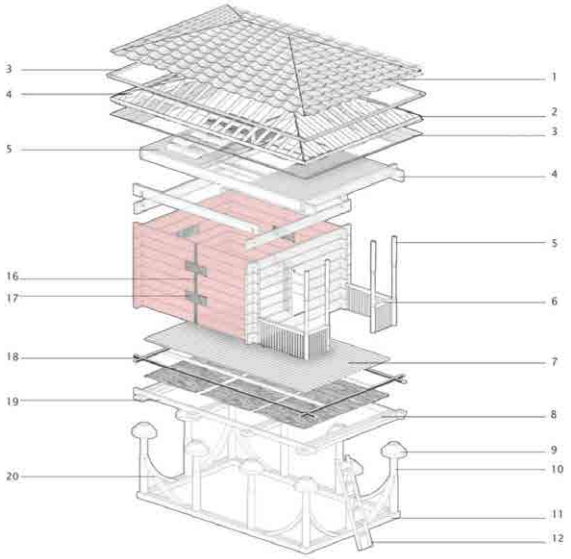
The main space of the Serander is the warehouse box. Peeled corns are stored and sometimes dried there. Some of the warehouses include a half-story floor (mezzanine), where corn clusters and hazelnuts are dried. The warehouse sections are divided into two parts in some Seranders. These are called "two-section Serander". There is a small storage section called "sofa" between the logia and the warehouse in some layouts. In this middle section, corns are threshed, and small spaces or storerooms exist for placing corn, flour, and beans. These middle sections can be observed in the villages of Akçaabat and Tonya. Serander types are categorized among the locals according to their sizes, and the size of a Serander is determined primarily based on the number of its posts. Özgüner suggested a different typology based on the logia/warehouse relation: Seranders with a logia on one side, two sides, three sides, and four sides (ÖZGÜNER 1970). Another size-based typology of Seranders were suggested as small Seranders with four posts, mid-size Sranders with 6-8 posts, and big Seranders with 10-12 posts (Eruzun 1977). The common single-story Serander types are mainly used for drying corn, storing materials and food supplies. They are also used as a guesthouse and/or resting place when necessary. In hot summer nights, people use the Serander to socialize after a long day of work. The function of the guestroom, an important element in Turkish architecture, is provided through placing a room at the ground floor of the two-story Seranders. The ground floor is used as a cellar and sometimes as a storeroom.

Figure 3. Entrance (ornamented) to the box from logia, Muhtar Bey house, Trabzon. Source: (Author 2014)

Figure 4. Corn and hazelnuts inside the storage room, Muhtar Bey house, Trabzon. Source: (Author 2014)

Serander is a special structure that represents the wealth of a village house owner. Because of that, the structure is elaborately ornamented. Beams at the front of a Serander, the entrance door, and the ventilation openings of the warehouse section are also ornamented. The ornamentations are done with wood engraving and hemstitch (auger) techniques. Rims and panels made with geometric and botanical patterns were included. Symbolic examples as pinwheel and star-crescent exist among other traditional patterns. No sufficient information regarding the sources of these wooden decorations and folk architecture exists. It is presumed that the oldest examples in this region were around 200-250 years old.

2.1. Serander elements and assembly process



1. Örtü (roofing material)
2. Ayna (facia)
3. Tavan döşemesi (ceiling slab)
4. Duvar tahtasi (side boards)
5. Balkon direği (balcony post)
6. Korkuluk (railings)
7. Hasir (reed mat)
8. Kiriş (beam/girder)
9. Teker (disk/wheel)
10. Direk (post)
11. Sal bağı (raft knot / wooden beam)
12. Merdiven (ladder)
13. Çita (lath)
14. Mertek (framed structure)
15. Raf (shelf)
16. Kanalli dikme (slotted/ channeled mast)
17. Havalandirma deliği (ventilation opening)
18. Döşeme alti çitasi (slab bottom lath)
20. Çalman / payanda (buttress)

Figure 5. Exploded drawing of the elements of a typical Black sea region Serander. Source: (Author 2014)

1. Örtü (roofing material): The earlier versions of the seranders' roofs were covered in sliced hornbeam tree trunks, called "Hardoma". Trunks were sliced in boards that are approximately 8-10cmx100cm and 1cm thick, then they were overlapped on each other from the sides to the center to cover the roof. Since nailing the hornbeam tree was hard, heavy stones were placed on top for protection from wind effect. Later on, a roof tile material called "Alaturka" (ottoman style tiles) were used. However, low-income families couldn't afford neither wood boards, nor tiles, therefore they reused tin containers after cutting and unfolding it and were nailing them on the roof instead. In order to protect the tin layer from corrosion they coated them with tar. This is the reason why some of the Serander roofs in the black sea region appears black. In the Paphlagonia region (between Kastamonu and Sinop) in both houses and Seranders "kayrak taşı (slate stone)" was used (similar to Seranders in asturias-kalicia regions of Spain "*Horreo*").

2. Ayna (facia): This wood part called "ayna" was nailed for covering the end points of the "Mertek"s (framed structures). Ayna is typically ornamented with wood carvings.

3. Tavan döşemesi (ceiling slab): Above the ceiling of Serander was never completely sealed with wooden slabs. When viewed from inside upwards roof Merteks (framed structures) can be seen. The roof beams stretch from the sidewalls only about 80-100 cm (like a big shelf) in order to use that space as a storage or for drying fruits. These shelfs are also called "Caçel, Tarzel or Tarcel" in the town of Rize.

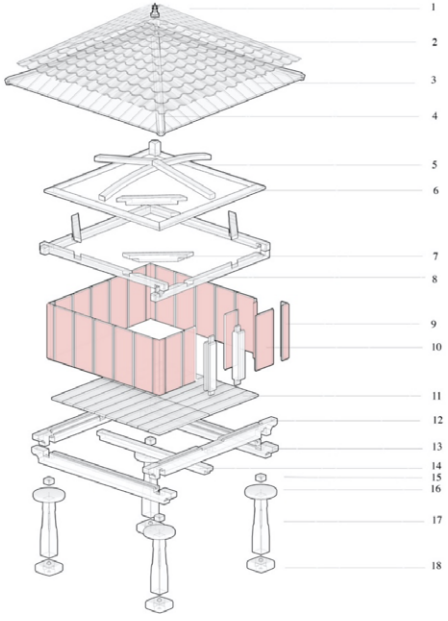
4. Duvar tahtasi (side boards): Almost all around the Black sea region interlocking wood parts by notching their head parts is called "Boğaz (throat-interlock)" (boğaz serander (throat/interlock serander), Boğma Serander (jamming/throttling Serander)).

5. Balkon direği (balcony post)

6. Korkuluk (railings): Usually railings are between 50-60cm high.

7. Misir odasi (corn room): The room floor (ground of the serander room) is covered with chestnut tree wood (no space between woods) in artvin, rize and regions of trabzon close to rize (sürmene). In this case the ventilation openings should be enlarged. On the other hand, in other regions the ground of the serander room is covered by 1cm spacing between wood parts in order to allow air circulation.
8. Kiriş (beam/girder)
9. Teker (disk/wheel)
10. Direk (post)
11. Sal bağı (raft knot / wooden beam): wooden beam is called "sal bağı". The name comes from the vehicle raft. As the raft carries the load upon it, the "sal bağı" carries the load of the Serander.
12. Merdiven (ladder)
13. Çita (lath): No matter what is used as roof covering, in order to attach the covering to the roof laths are nailed (like laths under tiles in modern architecture).
14. Mertek (framed structure): elements used in roof frames and structure are generally called "Mertek".
15. Raf (shelf)
16. Kanalli dikme (slotted/channeled mast): head parts of the side boards from both sides are penetrated into the channel opened in this mast.
17. Havalandirma deliği (ventilation opening) these grilled windows are placed on four sides of the warehouse box. These openings allow air circulation in order to ventilate and dry the corns inside. The patterns of these openings vary in different regions.
18. Döşeme alti çitasi (slab bottom lath)
20. Çalman / payanda (buttress) In modern architecture it is called Payanda (buttress). However, in many places in the Black sea region it is called "Çalman".

2.2. Hórreos elements and assembly process



1. Moños (Bows cover)
2. Tejas (Ceramic roof tiles)
3. Cabrios (rafters)
4. Aguilónes (Vertices Beams)
5. Vigas del queso (curved tie rods)
6. Orilleros (end beams)
7. Gatos (corner bracing)
8. Liños (decorated head beam)
9. Engüelgos (Box Bracing)
10. Colondras (decorated vertical wood planks)
11. Pontes (floor wooden planks)
12. Trabe superior (upper floor beam)
13. Trabe durmiente (lower floor beam)
14. Sovigaño (central bridge beam)
15. Tazas (square wooden levelers for the main beams)
16. Muelas (stone disks or squares/ post head/rodents shield)
17. Pegollos (posts wood, stone or masonry)
18. Pilpayos (column isolated base/ slab on grade)

Figure 6. Exploded drawing of the elements of a typical Spanish Hórreos. Source: (Author 2014)

1. Moños (cantapaxarinos, obispos): The bows, besides fulfilling an aesthetic function, are the finishing pieces that cover the cuts of the tiles or the zenith slates to avoid a possible entrance of water. They are generally formed by two stones, a slab that can be square, round or irregular, placed horizontally and over it a stone more or less conical or pyramidal. There are also ceramic bows in the form of pinnacles that adorn some granaries built in the first half of the twentieth century.
2. Tejas (teyes, teas, teichas, techas, teixas): Tejas are the ceramic roofing tiles that shed water from the roof. The tile traditionally used in hórreos is the curved tile, known as "Arab tile". Also original is the flat tile of industrial manufacture (Asturian pottery of San Claudio, Guisasola ceramics), used in some hórreos and Paneras. The old Arab tiles better protect the roof from wind force uplift because they are heavier, as well as the frost, since their resistance is guaranteed by the years that they are exposed to the elements.
3. Cabrios (cobrios, quebrios, clabios): Cabrios are rafters that form the roof surface. They are nailed with lathes to the burrows and embedded in the watering of the gables. They typically varied in width and have a thickness of between 3.5 and 5.5cm.
4. Aguilónes (aiguilones, aguiles, aligues, anguilones, aquilones): Gables are the beams that define the vertices of the roof in granaries and Paneras. They are placed on the plane, anchored in the insertion of the burrows and connected to each other or to the ridge at the top. They have a longitudinal watering on their two lateral faces, where the heads of the cabrios are inserted. The section of the gables oscillates between 16 x 10cm and 25 x 14cm. The positioning of the gables defines the eaves length and the percentage of inclination of the roof, this can vary from 30 to 40% slope for Arabic tile, and between 40 to 60% for slates. The length of the eaves can vary between 60 to 120cm.
5. Vigas del queso (perros, crucetes): These are two pieces of rectangular timber section, typically curved, to make tie rods in order to counteract the horizontal pushes of the cover and thus avoid the bulging of the lines. In Paneras these beams also serve as support for the pairs that hold the ridge. Its diminsion oscillates between 12 x 10cm and 22 x 15cm.
6. Orilleros (orelleros, agueros, aguaderos): Orilleros are the members that cross the eave perimetral and are typically attached to the ends of the Cabrios.
7. Gatos: Gatos are the bracing members that hold the warehouse box avoiding possible deformations. Gatos are not essential pieces in the granaries, but they are useful to serve against lateral forces.
8. Liños: These are rectangular section beams smaller than the Tabes, that fit on the Colondras and joined using a lab joint. In some cases, Linos are decorated with carvings and paintings, it is common that the heads of the files are carved. Its section is variable, oscillate between 9x14cm to 18x32cm.
9. Engüelgos (embuelgos, engüelbos) Engels are the pieces that form the corners of the box. They are usually made in one piece in the oldest hórreos or made from two Colondras nailed. The swivels give the box stability against possible lateral stresses and have the same thickness and length as the Colondras.
10. Colondras (colondes, corondies, curondes, curondies, cureñes): The Colondras are rectangular planks, with its exterior face carved, that arranged in vertical position conform the box of the granary. On some occasions the Colondras have carved or painted decorations, as well as decorative and functional vents. Its length vary from 100cm in the oldest granaries to 160cm in the most modern. They are made in varied widths, depending on available timber. The thickness oscillates between 4 to 8cm.
11. Pontes (pontis, puentes, puontes, puöntis): Floor planks are found in the oldest granaries and Paneras and are formed by timber boards of varied widths from 6-12cm.
12. Trabe superior (madres): Trabes are the main girders that support the Hórreo load. They do not necessarily have to be straight in

their horizontal face, since typically they take the form of the trunk from which they were sawed. They are joined together by a lab joint. The inner faces of the two longer girders have a length of approximately 6 x 6cm or 7 x 7cm in which the heads of the bridges are arranged. The girders have to span between 3 to 5 meters and their section varies from 16 x 25cm to 25 x 40cm.

13. Trabe durmiente (madres) secondary girders or beams

14. Sovigaño (alcarcelera, carcelera, sobregañu, sobrigañu, sobregaño): Sovigaño is a beam that is centered in the frame which prevents the deflection of the bridges, or, in case the floor is made of boards, There are cases in which, for this same function, two or more overlaps are used. Although it is a piece that is not essential, in most cases it is necessary. The section of the Sovigaño can be square or rectangular and oscillates between 12 x 12cm to 20 x 20cm.

15. Tazas (taces, mollideros, mullideros, tacos, tocos, tecos): A square-shaped prismatic wooden blocks that are placed between the wheels and the girders (chairs), used to level the frame, as well as centering and damping the weights on the wheels. Its dimension oscillate between 12 x 12 x 3cm to 20 x 20 x 12cm.

16. Muelas (mueles, pegolleres, pegulleres): Muelas are stone slabs (rarely made of wood) of square, round or irregular shape, that are placed horizontally on the Pegollos to avoid the access of animals and rodents to the granary or Panera. Its measures oscillate between 60 x 60 x 7cm to 80 x 80 x 20cm.

17. Pegollos (pegullos, peollos, peullos, pigollos, piollos, pegoyos, pigochos, piales): Pegollos are the columns/posts that support, balance and level the granary. Depending on the areas and the antiquity of the construction, they can be made of wood, stone or masonry bonded with mortar of lime or clay.

18. Pilpayos (pilpaños, soleres): Pilpayos are the slabs on which the whole weight of the Hórreo rests on, their function is double, since in addition to cement, they avoid the access of the humidity of the ground to the Pegollos. Its surface dimensions are always greater than the base of the Pegollos and its thickness can never be less than 12cm.

3.SIMILARITIES OF TYPOLOGIES AND CONSTRUCTION METHODS

It is evident that when studying the construction, proportions and materials of traditional architecture, we can realize the simple yet complex machines these objects are; how everything has a reason to be and nothing is superficial or meaningless in them. These folk structures share not only construction, material and form features, but also the areas where they can be found have common climatic and geographic conditions despite the physical distance (Rodríguez, G. G., & Velasco, S. A. 2013). General elements of both Serendars and Horreos can be summarized as the following:

1. Foundations: Drying sheds built in stone needed more carefully planned foundations than wooden ones since they were heavier, but despite this fact, they all must have a solid support.
2. Feet (Posts): They were built in wood or stone and shapes typically varied from circular to square and rectangular. They were conceived as pillars and appeared in different even numbers depending on the size of the drying shed and the style it is built in.
3. Corbels (post capitals): Pillars were typically capped with stone or wooden slabs (wheels/disks) where beams later rest on. These slabs were larger than the columns and beams they serve, and it was because they prevented animals and rodents from reaching corn and hazelnuts. Corbels are structural elements and protection devices at the same time.
4. Grill (matt) This subfloor ventilated layer allowed air to flow around the warehouse box removing high levels of humidity

and allowing constant air replacement. It prevents moisture to reach the storing chamber and acted as a natural barrier for rodents to access the maize.

5. Warehouse (box): The floor system always laid on beams set on top of the structure supports and can vary in size as well as in layout. The first case is the most primitive type and reminds of big knitted baskets in atruncated cone shape with irregular openings all around its perimeter.
6. Roof: In the earlier versions, roofs where movable as the warehouse was loaded from the top. Every year straw was replaced as it didn't keep its properties longer, and the drying shed was loaded with a new crop. Later on, it became a stationary roof as straw was replaced by more endurable roofing materials and an access on the walls was opened for loading maize.
7. Stairs (Ladders): were typically built next to the construction as a separate object. They were never connected to the upper level and the void left corresponds to human dimensions and proportions, preventing rodents or snakes from reaching crops. Sometimes, removable ladders were stored somewhere else when not needed, or stationary isolated steps designed for human proportions.

Figure 7. Tectonics in Serander detail of the corner & ornamentation, Trabzon, Turkey. Source: (Author 2014)

Figure 8. orreo corner detail. Asturias and Galicia, Spain. Source: (iberianature.com N. Lloyd)

4. COMPARISON OF ELEMENTS

The warehouse box structural assembly and construction techniques developed in the mountainous region of the Iberian Peninsula of Spain is fundamentally different than the one developed in the Black sea region of Turkey. While both structures utilized timber board single wall approach, the timber boards in the Horreos were assembled vertically, however in the Seranders were assembled horizontally, similar to timber log construction techniques. The Turkish horizonal arrangement of the single wall boards allowed the development of the resilient corner lap joint which provided the box with more structural stability at the same time the flexibility to cope with seismic forces (the Black sea region have been prone to earthquakes and seismic forces). It could be argued that the corner lab joint was developed as a result of similar techniques that could be traced to timber log construction in the region, similarly assembling the timber boards horizontally could be traced to ship and boat building traditions in the region given the proximity to the sea. The vertical board assembly in the Horreos however were developed without a lab joint at the corners and therefore the box was prone to lateral forces. The examination of many timber Horreos documentations revealed that the majority of structures lost

stability due to earth and wind movements. It could be argued then that the warehouse box typology although seemed similar in both countries, they astonishingly differ in their structural and architectural approach. As seen in figure 7, The development of the corner in Seranders allowed for a sophisticated tectonic expression through the elements and wood carvings. An elaboration of the importance of the structure to folk and vernacular architecture. The following observations could summarize the study findings:

1. These warehouse box granaries structures in Turkey and Spain were prosperity indicators, prestige structures in the cultural life of the two countries. These separate structures served as guest houses, food, and valuables were stored and dried, entertainment and resting activities took place.
2. Both of the two structures were constructed to store grains, and host guests nearby the rural house.
3. Both of the structures were constructed with hybrid wooden and masonry techniques. Loadbearing posts, single wall timber box, and roof systems were similar, however structurally different as explained, and therefore, both could easily be demounted, diss-assembled and transported.
4. Both of the structures had similar sections. Storage-warehouse box, free standing posts with wheel capitals, and a Logia in front or all around were common elements in both structures.
5. The elaborate ornamentation with wood engraving technique or paintings were originated from the importance given to them. However, it was more developed in the Turkish example.

Figure 9. Post/ head/ disk/ and logia detail. Source: (Author 2014)
Figure 10. Scarf joint corner detail. Source: (Author 2014)
Figure 11. Knee bracing and corner post detail. Source: (Author 2014)

CONCLUSION

It is known in the architecture history, especially vernacular architecture, that in similar physical and environmental conditions, similar architectural language and vocabulary are created. Warehouse structures typology found in the country sides of Scandinavia, the Iberian Peninsula, and the Black sea region shared a simple yet sophisticated elements of architecture that were born out of necessities. The two compared examples offered in this study namely Serander in Turkey and Horreo in Spain, while both seemed similar in their structural techniques, a deeper investigation on the box single wall structure revealed a fundamental difference in dealing with lateral forces. It is possible to argue that the geographic timber craftsmanship that were developed in the Black sea region were a major influence in more resilient warehouse box structure that coped with seismic movements. A construction technology that issurprisingly absent from the Iberian Peninsula type. A series of similarities can be seen between the Eastern Black sea region and the Iberian Peninsula life and folk architecture depending on the natural environment. Similar geography and living conditions ended up with creating similar solutions. Great similarities were observed in the economic activities such as: the construction techniques, house and agriculture tools, animal breeding, hunting, and forestry. Similar living styles, structure design and techniques were produced by this way. When the fundamental structures of vernacular and folk architecture are considered, there are functional similarities between the house, the main living unit, and subsidiary structures as barn and hayloft. As throughout Turkey, specifically in the Eastern Black sea region, the structures of folk architecture such as the Seranders were not researched in detail and cannot be protected at sufficient levels. Village houses and Seranders should be researched in detail and necessary protection works should be done in specific to Eastern Black sea. Changing social and economic conditions, migration to cities, and abandoning corn farming have left the old houses and Seranders empty. These empty and uncared structures are demolished and disappeared rapidly. It is an important mission to protect and cherish these unique structures of the folk architecture as architecture works, artworks, and historical places.

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7

BLOCK 7: NEW PROFESSIONAL PRACTICES AND RESEARCH PRACTICES

PAPER #7.01

DESIGN FICTION AND ARCHITECTURE

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ABSTRACT

Design fiction is a design approach emerging out of the formal disciplines of Industrial Design and ubiquitous computing (Dourish and Bell 2008, Bleecker 2009a, Grand and Wiedmer 2010, DiSalvo 2012, and Sterling 2013b, 2016). Other design fields are starting to consider the value of this approach, including architecture and urban design (Knutz et al 2014). However, it might be claimed that both architecture and urban design have long involved the production of fiction and fictional environments in their pursuit of novel or aspirational project outcomes. The architectural design ideas competition can be traced back as far as the documented history of architecture – at least two and a half thousand years (Kreiner 2010, Lipstadt 1989) – and has been focused on reimagining our built context through visionary futures. Architectural environments are a staple in media representations of future-orientated imaginings. All design can be defined as exploring possible futures through formal outcomes as the products of a design process do not yet exist but will possibly come into being. This begs the question of a more precise understanding of design fiction and its role as both a positioning approach as well as a methodology for its use in architectural design. As such, this paper examines the nature of design fiction and reveals its close relation to a group of design approaches related to future-forecasting but also the growing consolidation of its definition through a design research structure, recurrent method frameworks, the translation of literary tactics and focus of diegetic environments.

KEYWORDS

Architectural fiction; design fiction; diegetic environments; rhetoric; design research.

INTRODUCTION

Design fiction is an emerging approach that has developed out of several independent sources (Sterling 2005; Dourish and Bell 2008; Bleecker 2009a) and, while reaching some level of agreement, remains somewhat ambiguous in its definition and application (Barbas 2017). While the approach has its origins in product design and ubiquitous computing (ubicomp) through science fiction representations of technological artefacts in literature and film, it has been connected with all of the formal design disciplines including architecture (Knutz et al 2014). The current, and oft quoted, definition of design fiction given by science fiction author Bruce Sterling is "the deliberate use of diegetic prototypes to suspend disbelief about change" (Bosch 2012) stressing *plausible futures* rather than proposed futures. There are various interpretations of what exactly this means in application. Other theorists have expanded or restated the Sterling definition, describing design fiction through "narrative elements to envision and explain possible futures for design" (Tanenbaum 2014b), the use of world-building and prototypes within those worlds to produce a discursive space (Lindley and Coulton 2015) and "a conceptual design placed within a broad cultural context focusing not just on product functionality but potential social consequences of use" (as quoted in Blythe & Encinas 2018, 16).

While the various definitions introduce some nuances, there is a general agreement of key concepts needed to be present for an approach to be defined as design fiction. These are *diegetic artifacts present through narrative structures* (Bleecker 2009a; Sterling 2013a), the suspension of disbelief in near future forecasting (Girardin 2015) and understanding artefacts as *socio-technical representations* rather than simply technical objects (Bleecker 2009a; Dourish and Bell 2014). Each of these concepts need unpacking a little to clarify their effect and importance as part of the overall approach. Diegetic is a term imported into design theory from film studies and refers to something that exists within the world of a narrative rather than external to that world. A simple example is the difference between music playing on a radio in a film versus the overlaid score that builds an emotional tone. The former is diegetic as it is heard by the characters and embedded in the narrative – it exists in the narrative world. The latter is not diegetic as it is heard only by the audience is not part of the narrative world. For designers, then, a diegetic prototype is a "kind of techno-scientific prototyping activity" embedded in "a story into which the prototype can play its part in a way different from a plain old demonstration." (Bleeker 2009a, 39) The prototype, the designed artifact, is explored by its presence in the narrative through subtle interactions with narrative elements rather than presented as a discrete and independent to its surroundings. In this, a diegetic artifact is very different to traditional design visualization tools such as sketches, renderings, product placements, or presentation boards as the designed object is not the focus but there to move "the story forward while at the same time subtly working through the details of itself." (Bleeker 2009a, 39). The presence of the diegetic environment requires logical consistency – even if we don't know exactly how things might work, the artefact must present its operation as defined through the internal logic of the narrative (Tanenbaum 2014a).

The purpose of the diegetic prototype is the suspension of disbelief for a plausible future as an extension of reality rather than the production of fantasy. In this way, design fiction is a form of realism which "implies self-consistency in both the real world and the story world." (Kirby 2010, 46). It could be said that all design activities engage future conditions as designers envision objects and environments that do not yet exist in the particular context, composition, adjacencies and relationships of the proposal. However, design fiction is focused on the plausible rather than the probable as one type of possible future (Hancokc and Bezold 1994). Fiction, in this case, is not a form of speculation and, therefore, design fiction includes the intention to produce valid knowledge in a structured way as part of design research (Grand & Wiedmer 2010; Markussen & Knutz 2013). This shifts the purpose of design fiction away from being a creative technique, a tactic of divergence which allows an author to imagine a world that does not yet exist, to be instead a legitimate research method.

While design fiction prioritizes the technological, the diegetic artifact is co-created with the socio-cultural context in which it exists which makes the artifact a *socio-technical representation*. There are two effects of this relationship. First, the artifact is co-dependent on the social values, social identity political, ethics and morality of its narrative context as well as the interactions, beliefs and construction of social expectations for the users or occupants. Design fiction makes visible a fundamental fact of design: namely there is no way to separate a designed object or environment from its context as all applied design is situated. As Bleecker (2009a: 76) states, "the implications of culture are not something that happens after design. They are always part of the design". Second, the role of the artifact as an aspect of socially constructed knowledge and the construction of belief

systems allows an entry point to influence those belief systems. The fictional world, and its elements, is a persuasive rhetorical device as it "has taken the time to take user experience and technology seriously" (Tanenbaum et al 2016, 4). This introduces a point of tension into the theory as defining design fiction as a research method is epistemologically in conflict with understanding design fiction as an agent in changing values and perspectives - shifting what we believe in or what we desire to bring into being or, as Bleecker names it, an "epistemological wrench" or "swerving systems of meaning" (2009b). The interaction or conflicting purposes between these two aspects of design fiction are not well resolved or even identified in the theoretical literature.

This paper expands on the points above to consider design fiction as a possible approach for architecture. This includes its relationship to other discursive design approaches as well as the design tactics and general frameworks used to generate outcomes. The examination brings more clarity to design fiction while generally considering its application to architecture as a formal design discipline.

1. CLARIFYING THE THEORY

1.1. Discursive design and its variations

The term *design fiction* came into its current meaning through a seminal essay by Julian Bleecker of The Near Future Laboratory (Bleecker 2009a). It was this essay that positioned the approach as having a socio-technical focus, stressing the diegetic nature of the artefact and its role in influencing human belief systems. Previous to this, the term design fiction had been used by Bruce Sterling (2005) and, even earlier, Sterling introduced the term *architectural fiction* to refer to the production of built environments for use in narrative construction (Sterling 2003a). As discussed below, architectural fiction and design fiction differ in definition and theoretical approach although they both belong to a group of design practices labeled as discursive design (Tharp and Tharp 2009, 2015). These include, along with design fiction, critical design (Dunne 2005), forecast design (Buhring & Koshkinen 2017), and speculative design (Auger 2013). Discursive design approaches are part of a social constructivist epistemology and can be defined as design research since the result is the generation of knowledge as an outcome rather than production of a product. Being social constructivist in worldview, discursive design practitioners and researchers are primarily focused on the interrelationship between technology, designed artifacts and socio-cultural interactions where the ability to treat artifacts as isolated and inert objects is impossible.

The primary purpose of discursive design practices is "to communicate ideas [and] encourage discourse. These are tools for thinking; they raise awareness and perhaps understanding of substantive and often debatable issues of psychological, sociological, and ideological consequence" (Tharp and Tharp 2009). These operate through provocation, production of uncanny situations or uncomfortable reflection (critical design) but also through narratives using a story or fictional situation (Auger 2013, 4-5). The differences between these practices are quite subtle and often do not operate with strict boundaries. A discursive project might align with several approaches although each practice has its differences in intention, cognitive tactics (i.e. the major tool in their method construction) and approach to epistemology.

Critical design, for example, is used to challenge social expectations and generate a debate focusing on current concerns by using a designed artifact in the same way as "a critique, like a political essay or satirical sketch" (Blythe & Encinas 2018, 12). It uses design outcomes, specifically product and industrial design artefacts, as a way to probe and interrogate social practices and values with a focus on consumer culture (Tharp and Tharp 2009). The

driving question for critical design is: we can do this, but should we? As such, critical design is focused on the present and uses satire and the uncanny as major design tactics.

Forecast design is intended to engage preferable futures rather than the *plausible futures* that is the focus of design fiction (Buhring and Koskinen 2017). While both forecast design and design fiction are concerned with the near future, the purpose of forecast design is to predict what might happen considering current trends. Design fiction, on the other hand, is not engaged to predict a future but to create a future that would not normally manifest, to influence through the design fiction outcomes. The alignment is closer to critical design than forecast design, but less as a critique of social ethics but "to spark conversations about the near future, check the sanity of visions and uncover hidden perspectives" (Girardin 2015, 7).

It is speculative design that is often confused with design fiction (Auger 2013). Kirby makes a clear separation between the two through a discussion of the role of diegetic prototypes in contrast to speculative scenarios. He considers a speculative scenario to

> "represent highly implausible and impractical situations and technologies that film-makers and science consultants imbue with a sheen of plausibility, so that they look possible within a film's narrative. They make these technologies look plausible, knowing that they are impossible to achieve in real life. In contrast, technological advocates who construct diegetic prototypes have a vested interest in conveying to audiences that these fictional technologies can and should exist in the real world." (2010, 46).

This definition would consider speculative design as producing daydreams, fantasies and imagining for pleasure. Speculative design does not require the internal or narrative logic to be aligned with perceived reality. In the end, the results of a speculative exploration have no requirements or possibility of coming into being. As such, these technological fantasies, while seeming possible, are not engaged to build desires – i.e. they lack the epistemological focus of design fiction (Bleecker 2009a). In addition, speculative design might suggest possible futures but as interesting explorations. Design fiction, in contrast, is positioned as a critical research tool. The outcomes of design fiction are understood as experiments to return usable information through a design approach (Grand and Wiedmer 2010; Markussen & Krutz 2013; Krutz et al 2014; Coulton et al 2017).

1.2. Design fiction and architectural fiction

One of the difficulties in clearly defining the role and application of design fiction is the presence of a similar, but significantly different, term presented through popular media outlets. Before design fiction entered the lexicon, the term *architectural fiction* had already been coined in a blog post by Bruce Sterling (2003a). Sterling, a science fiction author, expounded on the lost potential of Archigram as a form of a fictional future. In a series of magazine and blog posts, Sterling drove the idea of architectural fiction single-handedly, adding Greg Lynn FORM (Sterling 2003b) and Lars Spuybroek (Sterling 2008) as his inspirations. The role he envisioned for architecture was not meant for architecture though, nor did it have the intentions to be either an epistemological device or a research tool. Rather, as Sterling (2008) writes, "Want to write a novel? A screenplay? An essay about landscape and climate change? Want to direct a music video? Start a blog? Architecture offers fuel – and amazing visuals – for all of these things". In this, Sterling is acting as a voyeur, using architectural visualizations of possible future built environments driven by technological developments to "world build" as an aid for writing.

There is a version of Sterling's architectural fiction that can be found historically within the architectural discipline. This is the ideas competition and speculative design project

which can be traced back as far as the documented history of architecture (Kreiner 2010, Lipstadt 1989). However, it has been noted by critics such as Jeremy Till that the architectural competition focuses on the building "as static object … It privileges a whole set of architectural values that are counter to what might make really great architecture" (Hopkirk 2013). In this, the focus is the *representation* of building form rather than the social effects that trends towards utopian and deterministic outcomes. In recent decades, the idea competition is closely tied to imagining complete environments based on speculating technological changes – although we could argue that most of these changes manifest at the urban or architectural engineering levels through technological line-items rather than through architectural knowledge. Regardless, we can clearly define this approach as discursive design, although it lacks the polemical and epistemological purpose of design fiction. Rather, it is a form of speculative design connected to technological utopianism. What is important about the clear excitement of Sterling when he discovered for himself the possibilities when considering the design of human environments is that one must "realize that architectural projects, by definition, entail the reimagination of how humans might inhabit the earth – how they organize themselves spatially and give shape to their everyday lives" (Sterling 2008). That is, architectural design inherently involves social and cultural content. However, architectural fiction as a form of speculative design does not have the structure or intentions to critically engage this architectural content as it lacks epistemological and research focus aligned with socio-technological environments. In contrast, Varnelis uses the term architectural fiction in alignment with the theoretical framework of design fiction rather than the form-based speculative worldbuilding of Sterling. Varnelis wonders if there is a possibility for architectural fiction to be a critical design tool that, "Instead of being Utopian or imaginative, might it be possible for architecture to shape our experiences in such ways as to approximate the effects of films or fiction? […] could architecture fiction be something that re-shapes our subjectivity?" (Varnelis 2009a) It is exactly this subjectivity that Bleecker addresses when he considers the core application of design fiction to be the shifting of human belief patterns and desires through swerving systems of meaning (2009b).

2. THE COGNITIVE STRUCTURE OF DESIGN FICTION

2.1. Process actions, tactics and tools

While there is some consolidation of theory that forms the boundaries of design fiction, there are very few discussions of the methods used to do design fiction. Methods, in general, are difficult to discuss as they are generated from the assemblage of tactics within a framework based on situated needs. This makes methods fluid and operating with great variation depending on context but also suggests that considering frameworks and tactics is ultimately more useful for designers.

2.1.1. *Frameworks*

A framework is the intellectual super-structure to which the overall form of any situated method is aligned and provides the starting position, restricts the information to be considered and provides the major testing criteria. In the case of design fiction, the frameworks are identified through the relationship to future-forecasting and notions of plausibility. The major frameworks present are *extrapolation* and *speculation* (Bleecker 2009a; Hales 2013; Bell and Dourish 2014). As Bell and Dourish note, "extrapolation and speculation as the twin bases for the production of science fiction, and which we would argue applies also to the ways in which design-oriented research is typically carried out, with an explicit focus not only

on the extrapolation of current technological opportunities, but the imaginative and speculative figuring of a world in which new technologies can be applied." (Bell and Dourish 2014, 2). However, to meet the requirements for design fiction – near-future siting, alignment with realism, plausibility rather than possibility, epistemological requirements of belief shifting, and the production of valid knowledge – speculation, in this case, cannot mean free-form and fantasy-based imagining (Bleecker 2009a). Extrapolation is based on the question: this is what we have, where does it go? It is the action of determining a future or end state based on assuming that the existing trends will continue without deviation. While the common use of extrapolation is predictive (i.e. logical future conclusions or outcomes), in design fiction extrapolation is used to explore possible alternatives (Girardin 2015). Bleecker calls this process developing "fiction from fact" (Bleecker 2009a). Lindley and Coulton reinforce the presence of extrapolation when they present a three-layer model that moves from a reality layer of the "world today as particular sets of users may know it" (2014, 2). The reality layer as source material is critical as it is used to contextualize all other information in the design fiction development. As a framework, extrapolation anchors any methods firmly into factual information present in the current environment as the starting point of any design work. The nature of design fiction would also stress that information be based on socio-technological factors. Speculation is the second framework present and it is easy to misunderstand its application in design fiction. The general definition of speculation is the act of forming a theory without facts, proof or firm evidence with "a strong leaning towards conjecture" (Auger 2013, 2). Usually, there is little concern if the generated ideas are real, defensible or "contained by the rules of real life" (Auger 2013, 2). However, design fiction *requires* the construction of plausibility with the focus to produce valid knowledge – a goal that conflicts with the general application of speculation if pursued as the production of identifiable false and fantastical scenarios. Bleecker provides clarity to the use of speculation as a framework that aligns with design fiction through an operation he refers to as "facts from fiction" (2009, 26). Rather than forming a theory without facts, speculation in design fiction operates as forming a theory (design idea or possibility) *before* facts. Open speculation of near-future possibilities ('fiction') is possible but then requires the generated idea to be anchored back into current reality and factual knowledge with the intention to make the speculation seem believable or obtainable. This is accomplished by tracing the speculative idea from the future backwards to possible ways that idea might come into being. Design fiction speculation is more complex than "what-if" scenarios we find in speculative design as the latter requires little expectation that the scenario has any relationship to current reality (Markussen and Knutz 2013, 233). Speculation in this form produces the question: this is where we want to go, how do we get there?

2.1.2. *Tactics*

A tactic is an action performed as part of a method. There are limited tactics discussed in the design fiction literature and those referenced are often standard design tools such as sketching, building models and mood boards as well as research methods such as ethnographic and behavioral mapping (Grand and Wiedmer 2010). While this might suggest that design fiction has nothing to add to the "toolbox" for generating design outcomes, there is one fact that is important to recognize: design fiction engages socio-technical information to understand the designed artifact as an active agent within the situated context in which it exists rather than an inert object. The approach does not allow an architectural designer to limit their values and decisions to only formal consideration for physical aesthetic decisions of shape-to-shape relationships. At the same time, the traditional

tactics of architecture – environmental force identification, program resolution, cultural identity through elevation, massing variations – that visualize architectural decision making do not allow access to the type of information that design fiction engages. There are tactics found in other design disciplines and literature practices that can be imported into architecture. One tactic found in design disciplines such as product design and UX/UI that directly addresses human interaction with designed objects is persona construction. A persona is a construct – we might think of it as a character against which design decisions are tested.Architecture does not normatively construct persona to determine formal choices although it could be argued to be aligned with the abstracted sense of client needs and desires formalized through a project brief. The architectural version, however, lacks a direct connection to a larger scenario or narrative construction required for design fiction. Personas have been criticized as being a representation of the designer rather than a tool of empathy as well as often "two dimensional and stereotypical" (Blythe and Encinas 2018, 17). Through design fiction, however, the persona is linked directly with "narrative voice" (Burdick 2019, 85) which requires a much deeper understanding of the motivations and actions of the user. While in other design approaches, the persona might be connected to a mood board, journey map or other visualization tool, in design fiction the persona is directly involved in the construction of scenarios and then used to "predict the goals or actions of users" (Blythe 2004, 52). Scenario construction is a key element in design fiction, and it is the interaction between persona/characterization and scenario construction that makes design fiction a research tool.

A variation of persona and scenario construction is the tactic of *pastiche scenarios* developed to address limitations in both the former. Pastiche "is a form of writing that imitates and borrows from other works and styles" (Blythe 2004, 52). When applied in a design fiction context, the designer uses previously existing characters, locations and events to develop persona and scenarios for the project. As the persona was not created for this particular design context, it introduces more richness and complexity to motivation as well as disconnects the persona traits from the expected or desired functionality of the designed artifact (Markussen and Knutz 2013). Examples of pastiche scenarios is using favorite characters of a novel as the clients of an architectural project or using an author's literary style to produce a design context. The pastiche tactic allows a designer to "very quickly evoke resonant contexts in which to place a new design or consider user needs" (Blythe 2004, 52).

Another literary tactic proposed to have relevance in design fiction is tropes. Tropes "are figurative language such as metaphor, irony, or hyperbole [that] convey an idea through terms and structures that are not literal, but rather symbolic" (DiSalvo 2012, 117). Although DiSalvo mistakes the operation of literary metaphor as equivalent to conceptual metaphor, the theoretical basis has some validity. These literary devices can be used to create a meaning "scaffold" through associating two domains of knowledge where the first provides a reference to the second. Examples could be presenting food production as a type of politics, grocery shopping as urban hunting or dinner parties as combat environments. While these are not metaphors as there is no incongruence in the association (i.e. food production does involve politics, grocery shopping is a type of food gathering), they do provide a reframing of the source material that allows us to reveal associations that are normally suppressed or obscured through societal norms. What the trope does is open up "expressions of values" (DiSalvo 2012, 117) and shifts the point of focus to consider the social implications rather than physical object. Bleecker suggests that tropes are involved in the anchoring of facts to fictional ideas as part of speculation (2009a, 15).

2. 2. Design fiction and the frame

The framing and presentation of the designed artifact is a key factor in design fiction, an aspect that makes it distinct from other forms of discursive design, and a factor that makes its use in architecture difficult. While other discursive design approaches celebrate their outcomes, producing spectacles, fantastical worlds, uncanny apparatus and strange curiosities, the artifacts that design fiction introduces are "mundane" (Girardin 2015, 2); everyday objects and spaces that are unspectacular (or anti-spectacular). Design fiction uses "real-life delivery methods" (Auger 2013, 10) that deny the existence of a frame between the object and the viewer through creating an ambiguity if the designed artefact, space or event exists or not. It is that moment of unsurety, of second guessing, which makes design fiction effective. The role of the approach is not to criticize, challenge or comment on society (that is critical design). Instead, its application is to examine possibilities in near future narrative scenarios to test if that scenario is one that we wish to bring into being and, if so, to introduce desire towards those things proposed to be present. The diegetic nature of design fiction requires an artifact, and the built environment is an artifact, to exist within a larger narrative structure. However, the artifact is not the focus of the narrative, it simply exists to support larger socio-technical interactions engaged as an act of everyday life. This process merges what is fictional with what is factually reality in a "knotting action" (Bleecker 2009a, 25) and suppresses the frame where constructed narrative is ambiguously located. The choice of media representation becomes a key aspect in the design fiction methodology and why practitioners of design fiction, such as Bleecker, Girardin and Near Future Laboratory (NFL), produce "catalogs, newspapers or user manuals from the future" but also "unboxing videos, user reviews" (Girardin 2015, 3). These media strategies are typologically normative and expected in our current reality so allows the framing of a fictional artifact in such a way to suppress the visibility of that frame. However, these media strategies are non-normative in architecture and introduce a point of difficulty in applying the approach successfully.

CONCLUSION

wDesign fiction is one of several approaches found within discursive design. The key differences between this and other discursive approaches center on 1) the ambiguity of the designed artifact existence as fictional, 2) the presence of the designed artefact as part of a larger cohesive narrative and 3) the desire to use the designed artifact and its scenario to test and shift belief systems. While some speculative designers also believe that it is "preferable for the concept to pass as real," (Auger 2013, 9), one could argue that speculative design that attempts this should be understood as a form of design fiction. At the same time, the purpose of design fiction is not fiction, which seems counter-intuitive. Rather, it is to return knowledge or affect beliefs.

Design fiction has several benefits but also introduces some difficulties for architecture. One benefit is the prioritization of the relationship between the user and the artifact. In the architectural design process, this means that attention moves from values that support the idea of a building or environment as a static sculptural object to those that are focused on the possible social and emotional positioning of its constituents. Environments are then understood as active participants in those social interactions. A second benefit produced by the shift in focus is the required abandonment of the notion of 'problem-solution' framing for design. As a research approach based in the interrelationship between humans and their constructed technological artifacts, design is understood as a situation to be acknowledged rather than a narrow problem-solution conceptualization.

The role of the persona and scenario tactics reinforces broad, and often contradictory, responses to the same design artefact as a reflective tool for designers.

Finally, the factors that design fiction provide as benefits can also introduce difficulties in architecture. It is easy to consider a building or built environment as a type of sculptural object. It is also relatively easy to consider engineering products as 'cool' features in buildings or even to imagine some non-existent technology that might be integrated into built space. However, based on our current toolset, it is much more difficult to consider the effect of both on socio-cultural systems of dwelling and identity. In addition, the media strategies used by design fiction in other disciplines, such as product design, do not exist in architecture. As design fiction is focused on technology, architecture needs to consider the role of technological elements in larger spatialized and compositional systems through social effects.

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PAPER #7.02

WHAT DO WE TALK ABOUT WHEN WE RESEARCH THE CITY? ACADEMIC PUBLISHING IN URBAN STUDIES

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ABSTRACT

When we talk about urban studies, we focus on the physical environment that gives support to social, political and economic relationships, and therefore the approach is usually transdisciplinary and diverse. Research projects are broadly communicated to the scientific community through academic publications, and particularly through journals. Therefore, these periodicals on urban studies have concentrated on specialized scopes and have been included in indexes and databases according to their relevance. The academia has agreed to trust journals for measuring the research impact, but the question is raised about its general visibility in terms of real knowledge transfer.

This paper maps the scientific production about the city through the periodicals of recent years: we census a total of 682 journals related to urban studies on the Web of Science, Scopus, ERIH PLUS and the DOAJ platforms. We aim to know which journals support what kind of works, how different areas of knowledge intersect in them, which countries produce one or another type of research, and what study methods are used in research about the city. In addition to the quantitative results, the objective is to make a critical reading about the impact of what is published. In this regard, a final comparison is also made by putting in parallel the articles included in the most relevant journals and the research projects about the city and its particular problems that have been encouraged by the last Framework Program of the European Union.

The results show a clear fragmentation of the urban studies subject area and a traditional framing of the topics, with little presence of emerging issues. Besides, the research funds percentage is lower than in other knowledge areas. Finally, this study reveals a very limited open access to research that undoubtedly determines its visibility.

KEYWORDS

Urban studies; research journals; architectural research; research impact.

INTRODUCTION: TALKING, RESEARCHING, PUBLISHING ABOUT THE CITY

The ability to select a good topic is something that researchers strive for their entire academic career. Whether it is for the opportunity to belong to a reputable laboratory or to receive a PhD grant, the thematic fields are essentially in reach, according to our knowledge on the subject. In the urban studies, different disciplines intersect that reflects the diversity and complexity of urban problems and solutions. Such as the themes outlined in this conference, the city has many sides: experiential, participative, narrative, history, technical, etc. These perspectives interact in a research proposal and contribute to improving our cities, but: what do we want to research about the city and why? How is this research generated and communicated? To answer these questions, this work follows research on urban

studies through academic publications and maps, although in a biased way, what we talk about when we research the city. Research results are transmitted in several ways in the academic world. Any policy paper from any institution establishes the difference between written output (articles, books, conference proceedings) and non-written production (patents, exhibitions, documentaries) (ACSA, 2017; ACSA, 2019). However, and because of their immediacy in the processes and their impact on the university community, the articles published in scientific journals reach a growing relevance. In terms of research quality evaluation, and regardless of our position in this regard, the journals are classified in indexes with impact factors while other contributions meet less regulated criteria. High-impact journals are the priority spaces when choosing how to communicate a project's results, among other things, because they have an impact on the careers' promotion (Clemens et al. 1995; Rawat and Meena 2014). We shall admit that this study is not without limitations due to the range of the questions asked and their restricted answers, but we aim to offer at least some information that can foster new reflections.

1. THE STUDY SAMPLE: JOURNALS ON URBAN STUDIES

Within the vast panorama of urban studies journals, we select the indexes generally best valued in terms of research results, those published on the Web of Science (WoS) platforms (by Clarivate Analytics) and Scopus (by Elsevier). These scientific information services elaborate specific databases (Science Citation Index Expanded, SCIE; Social Science Citation Index, SSCI; Arts & Humanities Citation Index, A&HCI; Emerging Sources Citation Index, ESCI; Scopus) and journals' lists (Journal Citation Report, JCR; SCImago Journal Rank, SJR), whose quality contributions are commonly accepted thanks to the review process and openly communicated editorial policies. In this specific case, and given the direction that we want to go in with this study, we add to the display the data of the European Reference Index for the Humanities and Social Sciences (ERIH PLUS) and the Directory of Open Access Journals (DOAJ). For each of the information sources, we take as a base of this study the available data according to its mediums: web pages, reports, and databases. Thus, this study includes the articles published in the journals whose categorization corresponds to Urban Studies of the WoS, Scopus, ERIH PLUS and DOAJ platforms: we census a total of 682 journals. We establish a temporary boundary between 2013 and today: these six years exceed the usual 5- and 3-year periods in impact calculations and "h" indices, and include the entire H2020 framework program with which we will try to contrast the results. The sample is not limited to geography (according to the publisher's location or according to the author's affiliation) so as not rule out possible intercontinental collaborations. The working method is of a statistical type, although bibliometric indicators are alternated with qualitative analysis of representative cases. The data interpretation should be understood within the margins of error produced by the sample and its analysis. Also, not all databases provide the same indicators, so certain readings are made only with specific information sources. Consequently, the analyses and interpretations are more from the perspective of the urban and architectural researcher than from experts in library science.

2. WHERE DO WE TALK ABOUT THE CITY?

When locating the publications for this study, we must point out that each of the databases

used has a different cataloguing of knowledge areas. In the case of the Master Journal List of the WoS, the two categories "Urban Studies" and "Regional & Urban Planning" belong to the Social Sciences area. Scopus associates the code 3322 to 'Urban Studies' that is included in the "Social Sciences & Humanities" subject area. The ERIH PLUS has recently implemented the Field of Research (FOR) system from the Australian and New Zealand Standard Research Classification (ANZSRC) but uses a 2-level structure for 2 and 4-digit codes: "1205 - Urban & Regional Planning" is included in "12 - Built Environment & Design". Finally, the DOAJ follows the categorization of the Library of Congress: the contributions are equally distributed among "Cities. Urban geography" (in the "Geography, Anthropology, Recreation" section), and "Urban groups. The city urban sociology" (in the "Social Sciences" section). A first observation is related to the scarce presence of these journals in the global publications' landscape since they do not exceed 0.5% of the total periodicals, except in the case of ERIH PLUS where it barely reached 4.5% despite being an archive of social sciences and humanities publications. Furthermore, Urban Studies journals are published primarily in Britain and the United States, although this data varies significantly according to indexes: WoS and Scopus reflect an Anglo-Saxon domain pattern, while in ERIH PLUS and DOAJ they are strongly positioned in Continental Europe and South America (Fig. 1). The countries that publish the most on urban studies are the United Kingdom with 104 journals and the United States of America with 67, followed by Brazil, Spain and Poland, with 62, 57 and 41 periodicals respectively.

3. WHAT DO WE TALK ABOUT WHEN REFERRING TO THE CITY?

In the same way that we talk about the city under multiple disciplinary approaches, journals are not classified exclusively into categories similar to urban studies but instead, belong simultaneously to other thematic areas. Visualizing these areas overlapping (according to each database classification) allows us to demonstrate a first nature of research on the city (Fig. 2).

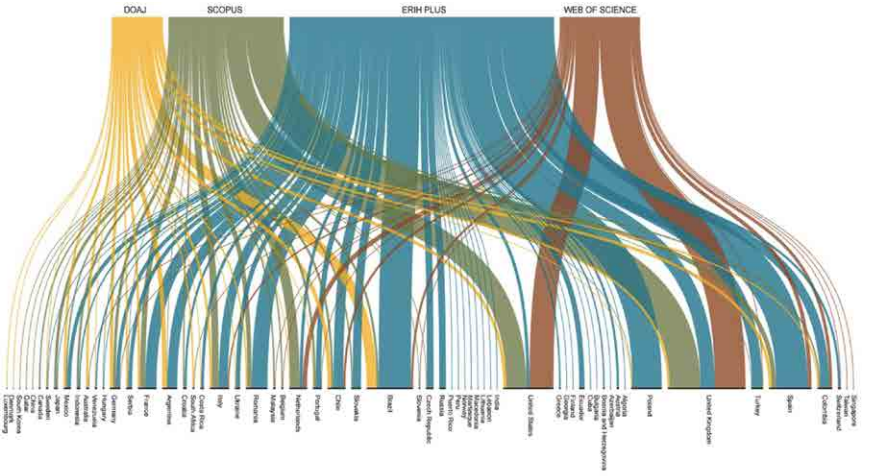

Figure 1. Geographical distribution of the journals related to Urban Studies. Sources: WoS, Scopus, ERIH PLUS, DOAJ. Online data, January 2020.

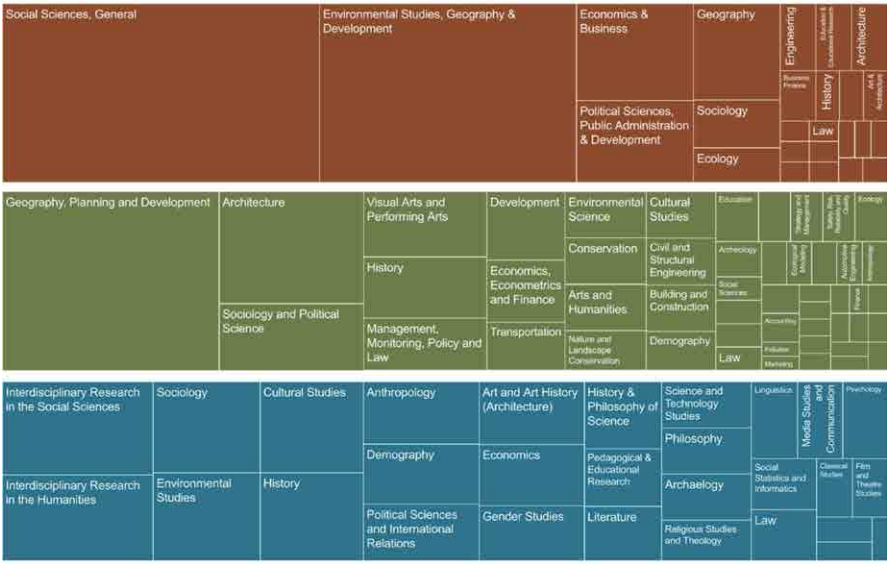

Figure 2. Disciplinary intersects of journals on Urban Studies: simultaneity with other thematic categories in a) WoS; b) Scopus; c) ERIH PLUS. Sources: WoS, Scopus, ERIH PLUS. Online data, January 2020.

The diagram for the 107 journals in the WoS sample indicates a prevailing number of publications in the category "Social Sciences, General" and in "Environmental Studies, Geography & Development". Also, it is especially significant that only 3 of the 157 journals are included in the Arts & Humanities Citation Index of the WoS. In the case of the 154 Scopus journals, the largest number of publications has to do with the category "Geography Planning & Development", followed by "Architecture". The map of disciplines that are extracted from the 353 ERIH PLUS journals is especially detailed since they are all devoted to the humanities, as corresponds to the index itself.[1] The journals of the study sample have published a great volume of texts in the last six years, but only the contributions considered as research articles are here under study. In that respect is an upward trend in the number of items in the last six years (from 6500 to 9000 in the case of the WOS) and the dominance of the WoS and Scopus products that offer 6 more times articles per year than ERIH PLUS and DOAJ. We analyse some bibliometric indicators of the most representative journals to get a general idea of the research topics. We are interested in which journals publish more articles and what they focus on (Fig. 3). A keywords analysis is carried out in the highest impact journals, though admitting that the Impact Factor (WoS), or the SJR and the SNIP (SCImago Journal Rank and Source-Normalized Impact Paper, Scopus) are related to the research visibility in the academic community (Garfield 1999; Colledge 2010). The journals that publish the greatest number of articles per year are coincident in WoS and Scopus, but if we look for the most productive journals in ERIH PLUS, the publications are completely different.[2] The DOAJ does not offer this data.

[1] The DOAJ does not allow to extract this type of information and therefore it is not here considered.
[2] However, all journals included in ERIH PLUS are also in Scopus. The differences are due to the cataloguing or to the greater number of articles published in WoS and Scopus.

Web of Science - Scopus

Source title	Country	Publisher	No. of articles (2013-2019)	Frequent keywords
Urban Studies	UK	SAGE Publications	1405	United States; **Neighborhood**; **China**; Urban Development; **United Kingdom**; URBAN PLANNING; Governance Approach; Urbanization; Metropolitan Area; Urban Economy; ***HOUSING*** Market; ***HOUSING***; England; Urban Policy;
Cities	UK	Elsevier	1284	URBAN PLANNING; Urban Development; **China**; Urban Area; Urban Policy; **Neighborhood**; Urbanization; Urban Economy; United States; Sustainability; Governance Approach; Urban ***HOUSING***
Urban Forestry and Urban Greening	GER	Urban & Fischer Verlag	1088	Greenspace; Urban Area; Urban Forestry; URBAN PLANNING; Urban Ecosystem; United States; Perception; Ecosystem Service; Tree; **China**; Urbanization; Biodiversity
Habitat International	UK	Elsevier	1012	**China**; URBAN PLANNING; Urban Development; Urbanization; Urban Area; Sustainability; Sustainable Development; Urban ***HOUSING***; ***HOUSING*** Market; Developing World
Urban Ecosystems	USA	Springer	648	Urbanization; Urban Ecology; Urban; Biodiversity; Ecosystem Services; Species Richness; Urban Biodiversity; Aves; Green Infrastructure; Urbanisation

ERIH plus

Source title	Country	Publisher	(2013-2019)	Frequent keywords
Transportation Research Part D Transport and Environment	UK	Elsevier	1326	Transportation; Vehicles; Traffic Emission; Emission Control; Carbon Emission; Electric Vehicle; Carbon Dioxide; Greenhouse Gases; Roads And Streets; Environmental Impact; Fuels; Fuel Consumption; United States; Gas; **China**
Planning Perspectives	UK	Routledge	449	URBAN PLANNING; Planning History; Urban History; Urban Development; Twentieth Century; Historical Perspective; Town Planning; **United Kingdom**; United States; Urban Design
Journal of Urban History	USA	SAGE Publications	438	United States; Urban History; URBAN PLANNING; Twentieth Century; Historical Perspective; New York [United States]; Urban Development; Urban ***HOUSING***; **Neighborhood**; Race
Journal of Urban Design	UK	Carfax Publishing	406	Urban Design; URBAN PLANNING; Public Space; United States; Urban Development; Urban Area; **Neighborhood**; **United Kingdom**; Australia; England; Urban Policy; Pedestrian; Urban Renewal
Urban History	UK	Cambridge University Press	359	Urban History; **United Kingdom**; England; Historical Perspective; Social History; Historical Geography; Planning History; Twentieth Century; URBAN PLANNING; Ireland

Figure 3. Journals with the greatest number of articles published and their most frequent keywords from 2013 to 2019. Sources: WoS, Scopus, ERIH PLUS. Online data, January 2020.

A sub-sample of the WoS and Scopus is carried out so we can attempt a visualization of the articles published in high-impact journals.[3] By combining the "Urban Studies" and the "Regional and Urban Planning" categories in the WoS, we get 109 indexed journals; in Scopus 154 journals are included in the category "Urban Studies" of SJR. If we cross both data, the resulting amount is 216 journals, 45 of which are simultaneously in both indices, and 26 of them are in the first quartile of one or both of the two rankings (JCR and SJR).

The keywords of the 10,888 published articles between 2013 and 2019 in these 26 journals of greater impact show research mainly based on planning –its development, its policies, its economic factors–, an important presence of residential issues, and a relevant number of studies located in China, the United States and the United Kingdom (Fig. 4).

Figure 4. Most frequent keywords in articles published in high-impact journals related to Urban Studies from 2013 to 2019. Sources: WoS, Scopus. Online data, January 2020.

[3] ERIH PLUS and DOAJ do not order their journals according to quantitive value. Equally, WoS journals included exclusively in the Arts & Humanities Citation Index cannot be considered either in this sub-sample as they have not an impact factor.

4. WHO RESEARCHES THE CITY?

From the previous samples, we extract two additional data related to the authorship or the promotion of the research projects on urban studies. It is relevant to know who is researching the previously indicated subjects and who is financing them (Fig. 5). It is surprising to discover that only 30.4% of the contributions acknowledge a funding source, especially if we relate these articles to research projects awarded in open calls. The funded projects are selected based on, among other things, their expected impact in solving real problems. This fact would show that approximately 70% of research in urban studies is dedicated to topics "not driven" by administrative interests. However, this same data of not-funded research decreases to values lower than 30% in areas of knowledge such as Chemical Engineering. When the articles of our sample were analysed, some of the keywords –those in blue in Figure 6– referred to research methodologies. We list here these methods by identifying them with their source titles (Fig. 6):

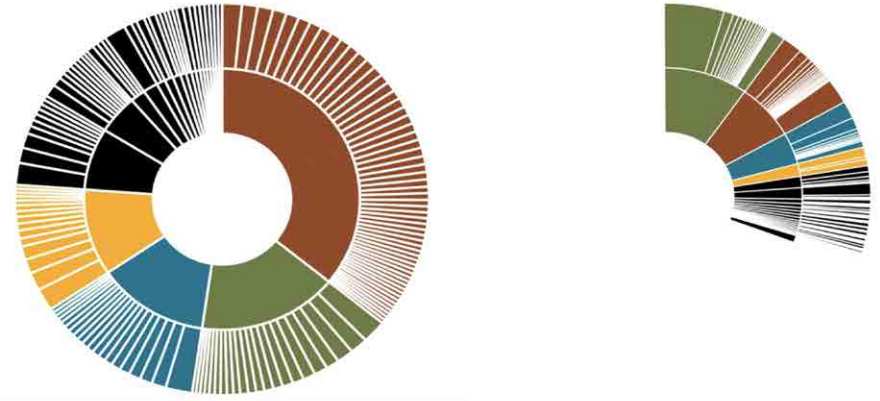

Figure 5. Authors' affiliation (left) and funding sponsors (right) in the 10,888 articles published in the 26 highest-impact journals on Urban Studies from 2013 to 2019. Right higher values: United States 36%, China 16%, United Kingdom 13%, Australia 10%. Left higher values: China 10%, United States 7%, United Kingdom 4%, Australia 1,6%. Sources: WoS, Scopus. Online data, January 2020.

KEYWORD	Frecuency	Journals when the keyword most appears
Spatial Analysis	328	*Cities; Urban Studies; Habitat International*
Conceptual Framework	265	*Cities; Urban Studies; International Journal of Urban and Regional Research*
Comparative Study	217	*Cities; Habitat International; Urban Studies*
Strategic Approach	207	*Cities; Habitat International; Urban Studies*
Empirical Analysis	191	*Urban Studies; Cities; Habitat International*
Theoretical Study	183	*Urban Studies; International Journal of Urban and Regional Research; Cities*
Participatory Approach	140	*Urban Studies; Cities; Habitat International*
Numerical Model	139	*Urban Studies; Cities; Habitat International*
GIS	121	*Habitat International; Cities; Urban Studies*

Figure 6. Frequency of keywords related to research methods in the 10,888 articles published in the 26 highest-impact journals on Urban Studies from 2013 to 2019. Sources: Scopus. Online data, January 2020.

5. HOW DO WE RESEARCH THE CITY?

As an addition to the parameters observed so far, this work explores some of the articles in these journals to analyse how research is done and how it is shown. The differences between some journals are not significant: these are works based on empirical analyses that attempt to quantify the results to build general frameworks for debate. The manuscripts are fundamentally written with little graphic material. Last but not least, we also make visible the vast quantity of research published through "paying walls". The figures for open access publications in Urban Studies are neither better nor worse than the rest of the disciplines, but they do not seem to account, for example, for the Open Access mandate in H2020 (European Commission 2017), or similar policies that exist in many European countries. In our sample, the open access articles only represent 7.67%, and if we extend the analysis to all the journals included in the WoS, the result rises to 20.37%. We can now understand why the DOAJ only included 677 articles on urban studies in 2019 compared to the 9,065 ones indexed by the WoS.

6. WHAT IMPACT DOES RESEARCH ON THE CITY GENERATE?

Research impact is a thoughtful and complex topic. The open calls for project proposals generally ask researchers to specifically state their expected results and what their impact will be. We understand the academic impact as the proof of new knowledge within the scientific community; we mean by "social impact" or "knowledge transfer to society" what has been improved in social problems thanks to an investigation. In the first case, the academic impact is measured through citations. This parameter is not always realistic since only the citations in indexed journals are counted. Alternatively, it can be more inclusive when any mention of media work is computed, as it happens with Google Scholar. The scientific impact of our sample's articles is obviously among the highest level since the journals are located in the first quartile of the JCR (WoS) and SJR (Scopus) lists. The data show how some articles have had up to 289 citations in the last 180 days (and 1793 citations since 2013), and this highlights the thematic link between one contribution and another, that is, the construction of knowledge in a consistent research path. It is not easy to track the impact of research, because the transfer of knowledge can be done in very diverse ways. However, we can outline a possible approach by glancing at the list of urban studies projects granted by the European Union (EU) framework programs (FP) in recent years. The FP has substantially determined the research in terms of financing since its inception. In FP8, known as Horizon 2020 (H2020), the Societal Challenges pillar supported research that "target society and citizens" and included areas such as "Demographic Change", "Smart Green and Integrated Transport", "Climate action and environment", "Inclusive, innovative & reflective societies" and "Secured Societies". Almost all of these issues come from similar denominations since FP4 (1994), although it should be noted that some are newly created: the term "security" appears for the first time in FP7 (2006), and the concern for social integration is incorporated only in H2020 (2013) (Reillon 2017). The preliminary structure of Horizon Europe includes in the pillar of "Global Challenges and European Industrial Competitiveness" various clusters with the aforementioned areas. This structural evolution shows an intention to obtain breakthrough solutions coming from multi-disciplinary collaborations. Regardless, the funded projects of these open calls are endowed with financial resources and must demonstrate the impact of their results through academic publications and dissemination actions.

Funding programme	Achronym and Project title	Website	Keywords
H2020-EU.3.3.1.3.	REMOURBAN - REgeneration MOdel for accelerating the smart URBAN transformation	http://www.remourban.eu	plan; replicability; **energy**; model; strategy; city; citizens; urban **regeneration;** cities; nottingham; lighthouse; eskisehir; **sustainable**; deployment; **renovation;** tepebasi; valladolid
	GrowSmarter	https://grow-smarter.eu/home/	plans; cities; mobility; industrial; grids; **reducing emissions**; **renewal**; **smart**; quality; market; demonstration; business; follower; citizens; lighthouse; waste; urban; **sustainable**; **energy**; lower; **grow smarter**; rollout; solutions; preparing
	Triangulum: The Three Point Project / Demonstrate. Disseminate. Replicate.	http://triangulum-project.eu	six; replication; cities; deployment; **energy**; cutting; dynamic; triangulum; **smart**; cross; city; technologies; urban
	CITYKEYS - Smart City performance measurement system	http://www.citykeys-project.eu	cities; horizontal; transparent; performance; monitoring; evaluation; cityKeys; comparability; **smart**; framework; kpis; recommendations; stakeholders; data; solutions; validate; urban
	ESPRESSO - Systemic standardisation approach to empower smart cities and communities	http://www.espresso-project.eu	city; framework; cities; models; horizontal; data; **smart**; interoperability; sectors; standards
	SHAR-LLM - Sharing Cities	http://www.sharingcities.eu	**smart**; **energy**; citizens; digital; efficiency; solutions; city; infrastructure; economic; cities; mobility; true; accelerate; market
	REPLICATE - REnaissance of Places with Innovative Citizenship and TEchnolgy	https://replicate-project.eu	urban; buildings; cities; **smart**; solutions; districts; citizens; deployment; city; transport; residential; technologies; local; replicate services; replication; complexity; tools; ict; **energy**; natural; plans
	SMARTER TOGETHER - Smart and Inclusive Solutions for a Better Life in Urban Districts	http://smarter-together.eu	**energy**; housing; lighthouse; citizen; districts; follower; ict; cities; data; solutions; **smart**; smarter; business; created; mobility
	SmartEnCity - Towards Smart Zero CO2 Cities across Europe	https://smartencity.eu	**energy**; city; coordinated; urban; **smart**; extensive; citizens; **renewable**; cities; local; carbon; benefits; planning; supply; clean; demand; actions
H2020-EU.3.6.1.4.	RELOCAL - Resituating the local in cohesion and territorial development	https://relocal.eu	policy; place; **justice**; nations; spatial; local; **cohesion**; territorial
	IMAJINE - Integrative Mechanisms for Addressing Spatial Justice and Territorial Inequalities in Europe	http://imajine-project.eu	national; empirical; **justice**; policy; imajine; economic; data; insights; **inequalities**; spatial; political; territorial; disciplinary; conceptual
	COHSMO - Inequality, urbanization and Territorial Cohesion: Developing the European Social Model of economic growth and democratic capacity	https://www.cohsmo.sbu.dk	recommendations; territorial; instruments; capacities; local; **inequality**; **justice**; sensitive; cross; democratic; spatial; theories; **cohesion**; relation; policy; policies; economic; place; **social**; cohsmo; scales; location; **injustice**

Figure 7. Funded research projects where urban studies are involved in the sub-programs H2020. Sources: CORDIS and Open-H2020 observatory, January 2020.

For almost three decades now, the CORDIS database offers information on projects and their results, classifying these by areas and sub-areas: 12 projects are included in the programs. The results always mention two chapters: "deliverables" (reports, pilots, websites) and publications (books, conference proceedings, but mostly peer-reviewed articles). The subjects of smart city, sustainable energy, urban regeneration and social cohesion emerge through these analyses (Fig. 7). One can find in their web sites the impact that each of the projects has had on social contexts: specific actions in the consortium cities, webinars and press releases.

CONCLUSION: WHO DO WE TALK TO WHEN WE RESEARCH THE CITY?

If we were to come up with a headline, we could say that we speak little when we research the city: other knowledge areas are more productive in writing. We do it in diversified forums that do not offer a simple and a global overview because urban studies have a multidisciplinary nature and a contribution might be included in similar categories and under different names. Mostly, our research is not supported with funding –other subject areas are much more financed– and therefore, the issues we address on our own are unlikely to be coincident with our institutions' interests. Besides, we talk 'in a closed circuit' and what we say remains in a very small area, so we may not see much beyond this. Finally, we talk about topics that do not seem to correspond fully with the emerging issues of interest, at least if a comparison is made between the most cited articles and the funded projects entrusted for applied results. This conclusion would support existing studies that warn of the black-boxing of academic communication and its evaluation, thus paraphrasing the black-boxing that Latour coined when referring to the development of scientific research (Bruni and Magaudda 2017). The high-impact journals on urban studies (those that are more relevant for the research evaluation) are less visible to the scientific community. Therefore, the topics discussed in them do not need to be directly linked to real needs. Finally, this study shows that it is not an easy task to monitor the transfer of knowledge. Who do we talk to when we investigate the city? We speak for few, but it has repercussions on many and it is difficult to trace the path because the track is lost. Recipients of the research

results are the general public (citizens), the service providers (transportation, energy), the management decision-makers (community organizations, and private businesses), and the policy decision-makers, but the contact details with this target audience are lost beyond the results reports of a project. The questions about the effectiveness of the knowledge transfer asked in other areas (Lavis et al. 2003) could help to reflect on our urban studies.

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PAPER #7.03

A MODEL FOR COMMUNITY AND CRITICALITY: THE UNIVERSITY URBAN DESIGN AND RESEARCH CENTER

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ABSTRACT

University urban design and research centers link academic pedagogy and research to real world applications. As the rate of urbanization accelerates and universities' missions become increasingly grounded in visible impact and financial self-sufficiency, these centers continue to offer an important and appealing model. These centers have doubled over the last two decades, yet a systematic investigation of their growth, successes, and failures does not exist. From a survey of over fifty centers throughout the United States, a typology is established based on the dominant activity of each center: Advocate, Consultant, Educator, and Scholar. Case studies from each mode are examined at greater depth. Overall, this paper finds continued growth in the number of these centers and a recent broadening of involvement by a diversity of academic and professional disciplines. Given this expansion, this paper is a tool for emerging centers to frame their missions within an established typology and gain best practices. Across all modes, universal challenges include: sustained funding, administrative support, and clarifying student and community roles. These centers are important models for universities to demonstrate visible impact and establish diversified revenue sources.

KEYWORDS

Community design; urban research center; urban lab; service-learning.

INTRODUCTION: THE NEED FOR A FRAMEWORK

This paper examined centers, labs, initiatives, projects, or institutes that formalize a link between universities and the urban planning and design of the communities in which the university sits. For ease, this paper titles these formalized links *university urban design and research centers* or *centers*, but recognizes the great variety under this umbrella. Certainly, each center in the study will continue to evolve and, in the long term, may alter the activities and purpose captured in this paper's assessments. In an attempt to make a broad and thorough study of centers, this paper includes the margins in order to identify emerging approaches and guarantee a complete sampling.

Recent Assessments of Centers

The literature on university urban design and research centers offers discrete analyses of the successes and failures of centers within research and education goals. However, this literature falls short on establishing a cohesive framework to characterize and evaluate centers across multi-dimensional objectives. This paper addresses this existing gap through a systematic study of over fifty centers to provide a relational framework comprised of four modes.

Centers that produce academic research within a community-focused mission face several consistent challenges. The largest issue highlighted by the literature is sustaining funding once it is acquired (Baum, 2000; Peason, 2002; Stahler and Tash, 1994). If the university is not able to offer stability to the center by supporting its annual operating

budget, the center must rely on grants, awards, and professional consulting service fees. Despite these challenges, Gerald Stahler and William Tash (1994) identify research centers as one of the most successful methods by which universities secure outside funding.

University-community partnerships run through educational courses are often challenged to meet initial, community expectations due to limitations in student abilities and the semester timeframe (Baum, 2000). Matching community expectations of professional quality work with student abilities and motivation is underlined as one of the greatest challenges of community-engaged pedagogy (Neuman, 2016; Dorgan, 2008). Real world projects often have timelines that are out of step with academic schedules and faculty have little ability to incentivize students to complete work outside of the structure of grading (Forsyth, 2006). To address these gaps, Howell Baum (2000) emphasizes approaching projects with realism: setting purposes that are clear, specific, and realistic; on matching purposes to resources; making partners accountable to one another; and in continual organization.

Recent Surveys of Centers

In 2002, the National Endowment for the Arts (NEA) published a directory of university-community design partnerships (Pearson, 2002). Rather than a framework, this directory catalogues centers that are a shared university-community enterprise and currently take on projects that use design as a tool to take action. This definition is narrower than the work undertaken by this paper's study. In an assessment of these partnerships, the NEA reports that while the work of these programs is impactful at a local scale, the learning outcomes often fall short of a national impact on community development objectives (Pearson, 2002).

In a 2006 article, Ann Forsyth looked at a broader definition of centers than the NEA directory, more aligned with the scope of this paper. She outlined and critiqued seven approaches to university-community partnerships: research centers, university firms, community advocacy center, extension, studio, clearinghouse, and umbrella organization. This outline provides an overview of types of activities undertaken by centers. Forsyth's article speaks in general terms from observations and experience. This paper provides a systematic examination of existing centers. It builds on the directory by NEA and the characterization of centers by Forsyth to analyze the growth of centers, modes of operation, and specific opportunities and challenges. It ultimately provides a relational framework of the broad diversity of centers that exist today.

1. METHOD: EVALUATING UNIVERSITY URBAN DESIGN AND RESEARCH CENTERS

The methodology of this study involved three stages: survey, framework formulation with the creation of a timeline, and framework testing through case study (see Figure 1). First, a survey of the existing urban design and research centers in the United States was conducted. The list of top twenty-five public universities (US News and World Report, 2016), top twenty-five private universities (US News and World Report, 2016), top 25 graduate urban planning programs (Planetizen, 2016), and top twenty-five schools of architecture (Design Intelligence, 2016) were investigated for the existence of a center. Over fifty centers with an urban, multidisciplinary focus were identified within many of these universities. Data was gathered by reading centers' websites and blogs, related news articles, and social media presence. Additional information was gathered by contacting the directors, administrators, or faculty members involved in each of the organizations through email and phone. During these conversations, the interviewees referenced other centers for inclusion in the survey. Reviewed literatures were also drawn upon for the survey.

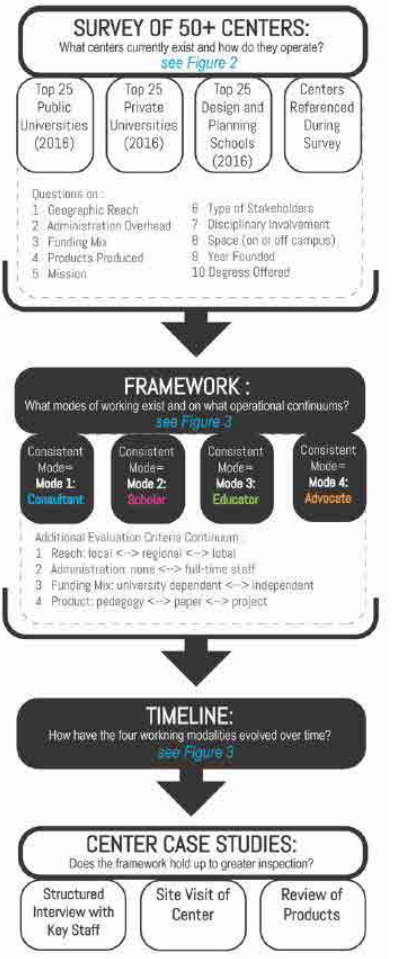

Figure 1. Research Methodology (Author 2020).

1.1. Survey of Centers

A comprehensive spreadsheet was created to document the information generated from the survey process. The spreadsheet recorded detailed information on each center including geographic reach, administrative overhead, funding mix, products produced, mission, type of stakeholders, disciplinary involvement, designated space (on or off campus), year founded, and degrees and classes offered. From this master list, over fifty centers were identified, relationally mapped, and organized chronologically to understand trends and relationships. Figure 2 diagrams the translation from consolidated spreadsheet to relational representation. The centers were charted on two axes: type of product (paper to physical) and type of activity (thinking to doing). Additionally, each center was encircled with the disciplines that were involved from their host university. Although planning, architecture, art, and landscape architecture dominated in involvement, some of the most dynamic products were produced in centers where there was involvement from other fields including sociology, geography, engineering, and political science. In this diagram, centers that have off-site locations are tagged and stakeholder involvement is indicated through color. Most centers broadly engaged with students, community members, and the professional community.

1.2. Categorization: Establishing the Framework and Timeline

The second stage was to interpret the gathered information in the spreadsheet to inform a set of deeper case studies. From an analysis of the activities and voiced purpose of the centers, a framework was developed based on four dominant modalities: Consultant, Scholar, Educator, or Advocate. These are represented by distinct colors in Figure 1 and 3. Although most centers engaged in all four modes, each center was tagged with a primary activity. Two main questions drove the categorization process: (1) who is doing the majority of the work production (e.g. students, faculty, administrators, or community collaborations) and (2) who is paying for the majority of the work (e.g. tuition revenue, research grants, contracts, or mission-driven foundation grants)? If the majority of a center's products were produced

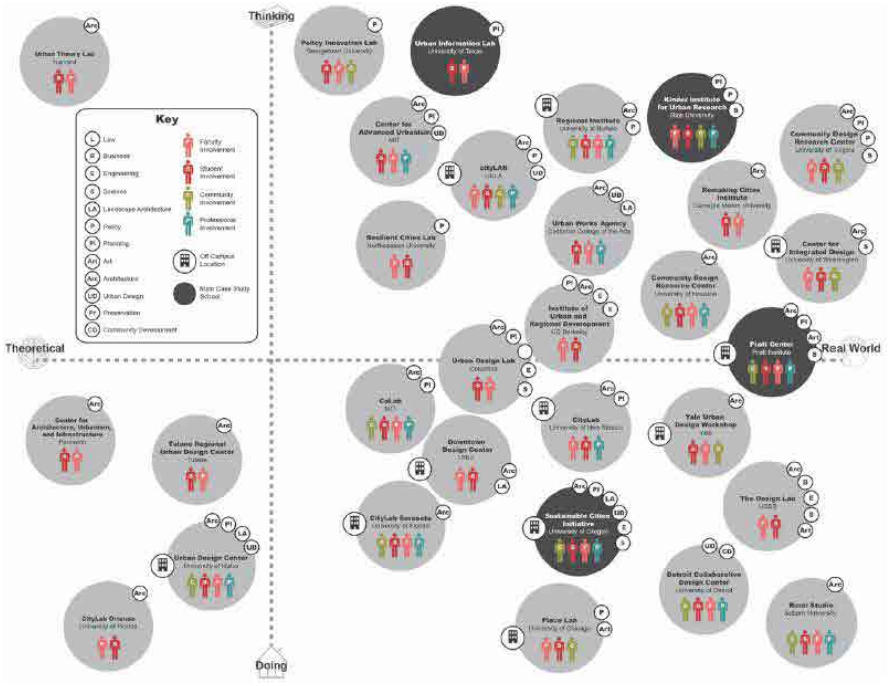

Figure 2. Initial Mapping of University Urban Design and Research Centers (Author 2018, with contribution from research assistants Andrew Marriot and Queston Kwolek).

by students and funded through tuition dollars, it was classified as an Educator. If the majority of work was produced by faculty and funded by grants, it was classified as a Scholar. If the majority of work was produced by a variety of positions with substantive administrative support and funded through contracts, it was a Consultant. If the majority of the work was produced in collaboration with community groups with support from Foundations and mission-driven organizations, it was an Advocate. Additionally, some centers have emphasized different modes over time, but the categorization focused on the current status of the center in the last year. Two graphic tools were created to organize the centers and understand the evolution and current operation of these modalities. A timeline, Figure 3, tracks the creation of these centers against historic trends. Various decades see greater growth or a higher disposition toward certain modalities. A consolidated line diagram, Figure 3, links each center and modality with type of funding, administrative capacity, extent of reach, and product produced. This graphic decodes dominant clustered operational behaviors of different modes.

1.2. Testing the Framework through Case Study

In the third stage, one case study was completed for each of the four modalities to test the framework and understand the great variety within each mode. Additional case

studies were completed to cross examine this main case study. In depth interviews with a set of preset questions with the current director of the center were conducted to gain this deeper picture of operation. Site visits were also conducted by the author to see firsthand the physical location and functioning of the center. A comprehensive review of the center's products, available through the center's website or physically acquired during the site visit, was done. Findings are discussed in the following sections.

2. RESULTS: A FRAMEWORK FOR THE UNIVERSITY URBAN DESIGN AND RESEARCH CENTER

Once this data was gathered from all three methodological stages, results were analyzed. This section shares these results across the strengths and challenges of the four modes. The ultimate aim is to provide guidance for universities seeking to start similar centers or current centers to contextualize their efforts.

2.1. The Consultant Mode

These centers are typically project based and are not focused on theoretical research. Funding usually comes from community and industry partners and grants, but not the university. These centers typically require at least one designated administrator to function (usually to pursue grants and manage multiple incoming monetary streams). They use mainly the professional skills of faculty to assist partners in design or social change work. Overall, these centers were the most financially successful. They had the largest annual budgets and consistently excelled at securing large, multi-year funding sources. The work produced by the Consultant mode often had quick and direct impact as the projects were framed to answer a specific need and were output oriented. However, the Consultant mode often struggled to fit easily within the bounds of the university setting. Challenges included projects driven by client needs rather than intellectual discovery, misalignment between the projects that clients were willing to fund and the specific interests of research faculty, and lack of student learning due to the narrow objectives and strict timelines of client funded projects. Another common issue voiced by the Consultant mode was a perception of the center as taking work from professional partners within their communities. This perception went against the community engagement mission of these centers. Consult mode examples include: Kinder Institute at Rice University and the Yale Urban Design Workshop (mainly supported through contracts for real projects), Columbia University's Urban Lab (garnering funding from internationally commissioned studies and projects), and Colorado States' Institute for the Built Environment (largely executing contract research work). Each of these cases has at least one administrator who oversees development and contract execution. These centers are not formally associated with courses or curriculum within the universities.

2.2. The Scholar Mode

These centers are focused on theoretical and applied research. Funding usually comes from the university or grants. The majority of collaboration tends to happen within the university and its bodies, rather than with the government or community partners. Little to no administration (outside of the typical facilities and administration provided by the university) is needed in this mode. The work products from these centers included journal articles, books, newsletters, and blogs. Oftentimes, impact of the work extends out to other universities or professionals who bring theories to reality or expand on the knowledge-base related to the work. As the output of this mode is mainly publications, it syncs well with a typical university promotion structure that prioritizes academic publications. Additionally, this mode was often a positive mechanism to encourage multi-discipline

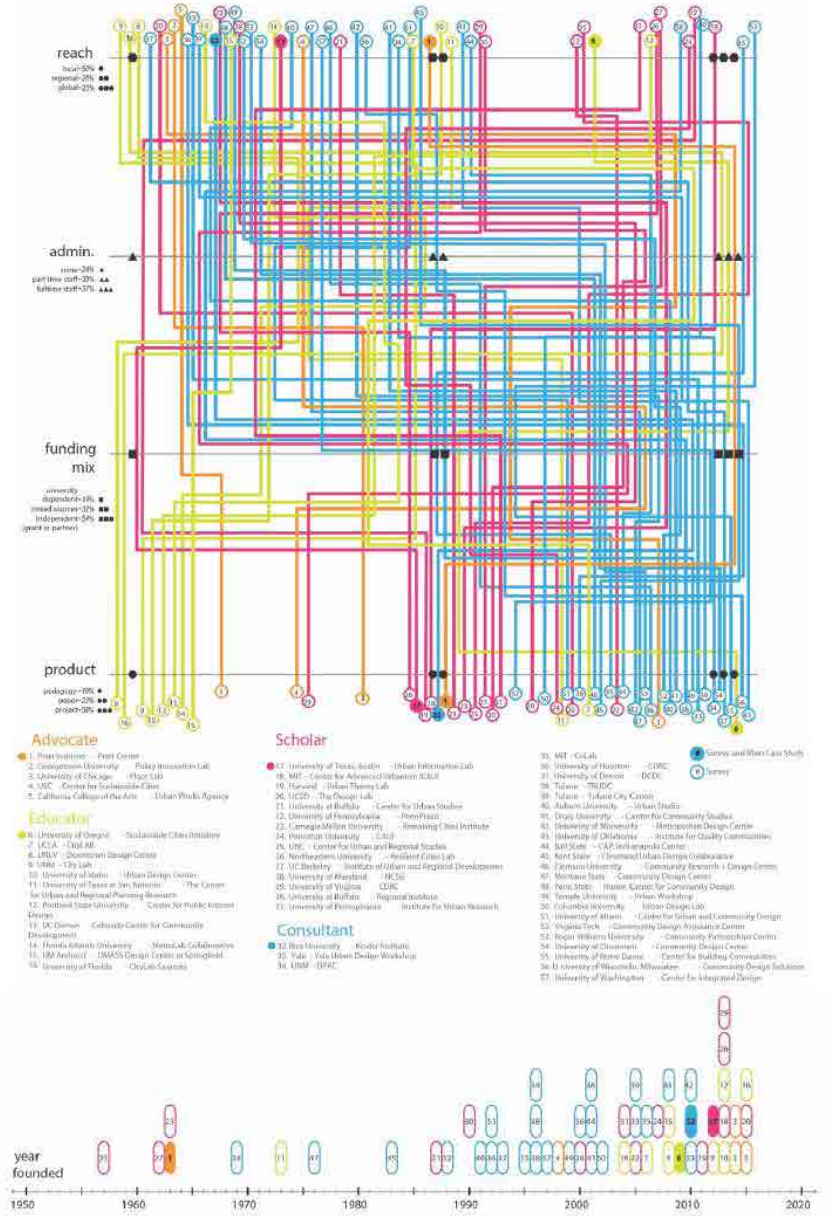

Figure 3. Timeline and Modalities of University Urban Design and Research Centers. (Author 2018, with contribution from research assistants Andrew Marriot and Queston Kwolek).

and multi-sector collaboration and provide graduate and advanced undergraduate research opportunities. One downside was that work from the Scholar mode was often less connected to the community. Academic publication did not always communicated in a way that was accessible and useful to community members. This mode largely relied on faculty to administer the center. Due to limited time, centers led by a faculty administrator were often steered toward the faculty member's own research agenda. Thus, in the Scholar mode, the center's work seemed less agile to new needs or demands of community partners. Scholar mode examples include: University of Texas-Austin's Urban Information Lab, Harvard's Urban Theory Lab, University of Pennsylvania's Institute for Urban Research, Massachusetts Institute of Technology's Center for Advanced Urbanism. All of these centers mainly produce academic publications and are supported largely by grants and the universities in which they sit.

2.3. The Educator Mode

These centers are focused predominantly on teaching the next generation of planning and design professionals. Funding is almost all university (tuition) based. Some centers in this mode hired additional administrators to handle development and dissemination of work (particularly if construction was involved). Service-learning and design-build pedagogies are strategies commonly used by these centers. Positively, the Educator mode supports the core mission of the university to educate. This mode provides real-world project experience to students, particularly aligned with professional schools of planning and architecture that seek to produce practice-ready graduates. This mode also appeared more able to respond to local community needs because the center is funded through a stable stream of tuition revenue rather than beholden to the fluctuating demands and interests of clients or grants. Centers in this mode took on more pro-bono and short-term projects. Challenges faced by this mode included inconsistent quality of products due to the limitations of the academic calendar and student effort and skill and variability in community connection because of a constant turnover of students. Educator mode examples include: University of Florida's CityLab (offering degrees and classes directly through the Lab), Texas A&M's Institute for Sustainable Communities, and Auburn University's Rural Studio (delivering the majority of its work through coursework). These centers are all focused on the dual mission of connecting with their communities and supporting student learning.

2.4. The Advocate Mode

These centers focus largely on policy advocacy and public education for the betterment of communities. Funding comes from those looking to promote change – be it the university, community partners, or national organizations. This typology typically has at least one administrator (such as a director) to clearly guide the mission and fundraise. The impact of the Advocate mode ranges from simply distributing knowledge to changing laws for the public good. Few of the surveyed centers were classified under the Advocate mode, though many hybridized Advocate activities with their dominant mode. This mode strongly focused on community needs and supported long-term community relationships. With the right mission, these centers received sustained, multi-year funding by mission-aligned foundations and organizations. One challenge faced by this mode was a conflict between the political nature of advocacy and the apolitical mission of institutions of higher learning. Additionally, some faculty found it difficult to situate their scholarly publication incentives within the work of these mission-driven centers. Advocate mode examples include: Pratt's Center for Community Development, Georgetown's Policy Innovation Lab (focused on informing and changing

policy) and University of Chicago's Place Lab (emphasizing advocacy for communities surrounding the university).

3. DISCUSSION: VARIATIONS WITHIN AND BETWEEN THE FOUR MODES

During the creation of this framework, three inter and intra mode variations were observed: (1) operations,
(2) hybridization between modes, and (3) transitions of modes over time. The next section discusses these dynamics between the four modes.

3.1. Four Modes: Operations

During categorization, centers were also mapped against four operational continuums: geographical reach, administrative support, funding mix, and type of products produced (Figure 3). Generally, the Consultant mode tended to have a regional to global reach, require greater administration support, secured higher volumes of funding largely from industry, and produced professional products. The Scholar mode tended to have a broad reach, required less administrative support, secured moderate levels of funds largely from grants, and produced academic publications. The Educator mode tended to have a local focus, required little administration, derived funding from existing tuition dollars, and produced semi-professional products. The Advocate mode tended to be locally focus, have greater administrative support, successfully secured larger amounts of funding from mission-driven foundations, and produced products that directly address community identified needs. At the time of the survey, half of the over fifty sampled centers were locally oriented, with only a fourth (25%) with a global mission. The majority of centers (54%) were financially self-sustaining through grants and contracts, with only 14% relying solely on university funding. Projects were the dominant output of 58% of centers, with a balanced divide between pedagogy (19%) and papers (23%) as alternative products. A variety of administrative models either within departments or spanning multiple disciplines exist. More than three quarters of centers (76%) relied on additional part or fulltime employees to operate. Research work overwhelmingly used an applied rather than theoretical methodology (Figure 3).

3.2. Four Modes: Combinations

Within a dominant mode category, there are several hybrids or combinations. Take for example, a center that does the majority of its work in the Consultant mode, but also acts as an Educator and Advocate. Such a center receives the majority of its funding from industry partnerships and paid reports, but also acts as an Educator when it hires undergraduate, graduate, and post-doctorates to carry out the work. Additionally, this same center can play the role of an Advocate for the particular mission of the agency supplying funding. In other cases, centers are Educator-Scholars (primarily tuition revenue focused, run through coursework and occasionally publishing papers from course products) or Scholar-Consultant- Advocates (principally grant focused with additional streams of revenue from contracts, powered by faculty time, demonstrating impact through scholarly publications while advocating for community wellness through progressive urban design). Although each center is classified by its dominant funding source and work product, most centers engage with a community through a myriad of processes.

3.3. Four Modes: Transitions

Additionally, many centers have transitioned from one model to another over time. Transitions are most often spurred by a change in the interests of the center's leadership or funding availability. For example, the Kinder Institute at Rice University initially grew out of a course that produced an annual

comprehensive area survey documenting the changes in Houston over time. It was funded by tuition dollars and powered by student work (fitting the Educator mode). As the survey grew, the center garnered grants and several post-doctorates were hired and enlarged the center's academic publication (fitting the Scholar mode). Most recently, the Kinder Institute has switched from a faculty director to an executive director pulled from industry and government experience. The main source of revenue is now a healthy endowment and contracts with industry partners. A marked decrease in faculty involvement has been replaced by hired research associates to complete the terms of contracts (fitting the Consultant mode) (Klineberg, 2018). This one example is indicative of the journey of many centers across the country over time – endeavoring to stay nimble within changing funding availability and institutional expectations.

CONCLUSIONS: A FUTURE OF ENGAGED WORK, SCHOLARSHIP, EDUCATION, ADVOCACY

University urban design and research centers link academic pedagogy and research to real-world applications. These centers provide an infrastructure for faculty, students, and research staff to complete research, coursework, and projects that engage with urban planning and design practice. Four modalities (Educator, Scholar, Consultant, and Activist) structure a framework to understand the diverse work of these centers. Variations within and between these four modes include operational factors (administrative support, funding sources, geographical reach, and material outputs), hybrids, and transitions. This paper addresses a current gap in a systematic study and relational understanding of these centers.

Overall, this paper is a tool for universities interested in starting a center to develop their own missions and for existing centers to contextualize their efforts within a systematically established framework. The strengths and challenges and analyses of the four modes can be weighed by universities in this position. The Consultant can encounter complaints by the professional community of unfair competition, yet also has demonstrated the greatest capacity to expand university revenue. The Scholar can endure yearly budget uncertainties between grant funding cycles, yet most naturally fits within the skillsets and incentive structure of faculty in a tenure system. The Educator may enjoy a stable university budget, but struggle to meet the expectations of the community partners within the fixed schedule of coursework. Further, the Educator seems to be the easiest center to initiate, as it functions within existing coursework structures and there is little new overhead. Finally, the Advocate may encounter misunderstandings of their role of advocating for a community while staying apolitical, especially if the center sits within a state university. This mode seems to be the best model for targeting specific issues or desired areas of change within a community. All four modalities can demonstrate visible impact and bring diverse sources of revenue for universities. Overall, centers continue to expand in number and mission across the country and involve a widening set of multi-discipline academic and professional interests.

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PAPER #7.04

PEER-REVIEW OR POPULARITY-CONTEST: THE EROSION + IMPLOSION OF INTERNAL ASSESSMENT IN HIGHER EDUCATION

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ABSTRACT

Architectural education historically has an awkward existence in the academy, in part due to strong links to the profession and in part due to subjective dimensions. Universities struggle to understand environmental design fields, reluctantly accepting creative endeavors as valid undertakings yet questioning an absence of empirical rigor, methodological discipline and measurable outcomes. Within this complicated milieu falls the task of faculty performance review. Universities develop guidelines for promotion, tenure and merit that attempt to cover the broad spectrum of fields dwelling in the halls of higher learning. In many instances general solutions are simply inadequate. Within colleges of architecture, unique evaluation policies are established that seek some resolution between discipline-specific circumstances and generally-applicable expectations. It is a rough fit at best. The subjective nature of environmental design has implications on student work, academic research and faculty assessment, to name but a few impacted realms. While external review, such as journal article consideration or conference paper evaluation, is commonly blind, the assessment of faculty on university campuses is never such. Rather than being objective and blind, these evaluations are commonly tainted with politics. Inappropriate aspects, such as a faculty member's popularity, philosophical posturing or pedagogical positioning have undue negative influence on delivery of fairness and execution of justice in determining meritorious performance. The present meta-enquiry argues that within architecture schools such loose and slippery qualities are heightened and amplified, based in large measure on subjective grounds used to evaluate many activities in the ethos, including design. The research examines literature exposing flaws in assessment within the academy and builds arguments for further and more focused study. Design faculty often claim uniqueness and difference as grounds to opt out, in part, from larger university guidelines. However, departing from universally accepted norms opens doors for abuse, arbitrary judgements and inequity. The paper provides a provocation, and opens the door to an emergent field of research, that is proving both urgent and significant. The author paints an initial picture of a complex landscape that is often ignored in higher education, and as such encourages broader and deeper investigation of topics that strike sensitive yet vital cultural, legal, social and cognitive chords.

KEYWORDS

Architecture; higher education; systems; review; performance; equity; justice.

INTRODUCTION

> "Education is about healing and wholeness. It is about empowerment, liberation, transcendence, about renewing the vitality of life. It is about finding and claiming ourselves and our place in the world." Palmer[1] (1999)

[1] Palmer, Parker J. "The Grace of Great Things: Reclaiming the Sacred in Knowing, Teaching and Learning". In The Heart of Learning: Spirituality in Education. Editor: Steven Glazer. Tarcher/Putnam: New York New York. 1999. Pp 18-19.

Universities tend to take great pride in the rigor and discipline required to discover knowledge, search for understanding and solve problems. Without doubt our present world is overflowing with crises and catastrophes that warrant our attention, ingenuity, wisdom and resolve. Within such a demanding milieu many academics rise to the challenge, pushing hard to consider the complexity of dilemma and to chart viable paths forward. Higher education is a unique environment where freedom of thought is supported and unconventional thinking is encouraged. In this ethos, competition runs high and over-achievement is commonplace. Faculty vie for position and fight for the finite rewards, monetary and otherwise, that accompany the conferral of the title 'meritorious'. However, the game is zero-sum, filled with winners and losers and perhaps a few scattered serendipitously in-between. Modern societies increasingly lose sight of the notions of right and wrong, truth and lie, good and bad, and fair and unjust. In times when governments have abandoned moral compasses, and elected officials drool in their pursuit of money and power, it is understandable how ripples reach far and wide. The university, of course, is in no way immune to the plague of politics as it seeks to acknowledge achievement, reward accomplishment and honor those deemed worthy. In fact, the present paper argues that in many ways the academy falls victim to moral decay and 'might makes right' mentality propagated by powerful politicians, corporate leaders and others who routinely abuse position and power – all too often placing self-interest, self-promotion and self-gratification well above qualities of compassion, charity, grace and the support of the community.

1. BACKGROUND

> "Complicating matters are colleagues who in social situations appear collegial, congenial, and supportive to the victim but in private become just the opposite.
> The victims are excluded, disenfranchised, silenced, overlooked, or ignored." Twale + De Luca[2] (2008)

One of the potent tools used within the academy to assess performance and measure impact is peer review. In its purest sense, that is when truly blind in structure and execution, peer review is a powerful vehicle to determine the value and significance of work – whether that be a scholarly paper, a grant application, a request for advancement, etc. In such a scenario the identity of the person or persons whose work or performance is being adjudicated is hidden, rendering said assessment more objective, more fair and in principle without political or personal bias. In some cases where there are numerous stages of assessment, the review can be double blind, or more so, in an effort to proffer even more objective outcomes. In some cases, at some institutions, there are selected processes that do deploy blind review. However, this approach for many internal evaluations, such as promotion of rank or merit assessment, is often anything but blind. In a growing number of cases throughout higher education the evaluative systems in place are corrupted by internal politics, swayed by individual personalities, and skewed by power dynamics that unduly tip the scales of justice. In recent years many researchers have cast light onto dark subjects such as incivility, bullying, mob mentality and incessant individualism within the halls of the academy. Such studies point to a growing climate of toxicity in many units on campuses across the USA and Canada.Fueled by heightened competition, stagnant salaries and a culture of greed,

[2] Twale, Darla J and De Luca, Barbara M. Faculty Incivility: The Rise of the Academic Bully Culture and What to Do About It. Jossey-Bass: San Francisco. 2008. Page 24

it is increasingly common to see brutal political games play out in the colleges and departments of our institutions, and of course, to have them manifest in systems of assessment. The research, concerned with an escalating climate of injustice and incivility, critically reviewed recent literature outlining dysfunction in the academy (see, for example: Twale & De Luca[3], 2008; Coates & Morrison[4], 2011; Bennett[5], 2003; Ginsberg[6], 2011; Hollis[7], 2012). The author, with intense experience in senior administration on both sides of the 49th parallel, has witnessed this escalation in attacks, rise in bias and exercises in prejudice within universities. Of course no one wants to admit that higher education could fall into these traps of incivility and injustice – especially given the lofty status many academics ascribe to themselves by virtue of degree and pedigree. However, as in the society looming beyond the ivory towers, the academy's behavior reflects a broader decline and deterioration that must be admitted, owned and hopefully rectified.

2. PEER REVIEW - FAIR OR FRAUD

> "Professors, taken as a group, are far from perfect. They can be petty, foolish, venal, lazy and quarrelsome. Nevertheless, at its best, the university is a remarkable institution. It is a place where ideas are taken seriously; where notions that are taken as givens elsewhere are problematized; where what has seemed to be reality can be bent and reshaped by the power of the mind." Ginsberg[8] (2011)

The concept of peer review is robust and fair when executed with professionalism, mindfulness and care. Key aspects of fairness include impartial review, to minimize politics and favoritism, and deployment of accepted standards, to ensure reasonable enforcement and similar comparison. When peer review is handled in this manner academics, administrators and the public enjoy confidence in the system. Academics understand the nature of assessment, knowing what is deemed meritorious and feeling comfortable that adjudication is being delivered in a balanced and transparent fashion. Even when the game is zero sum, at least there is comfort in knowing the mechanisms for evaluation are rational, consistent and even-handed. In many cases at many institutions the peer-review systems in place operate with fair play front of mind.

In many cases, however, and especially in the current climate of turbulence and distrust, the peer-review process slides south, rendering decisions in ways that delegitimize the system and divide up cohorts into opaque pools of winners and losers. Rather than ensuring blind review, whereby the assessors hold an arm's length to those under assessment, many contemporary approaches are exposed to the dark sides of the academy where popularity is preferenced over performance, where favoritism trumps fairness, and where who you know can matter more than what you achieve. In such scenarios certain groups of faculty stand exposed to far greater risk – for example tenure-track members who are in vulnerable positions and who are subject to serious power differentials. Rather than standing securely on objective review of the merits of their work, as measured by impact factors or awards or funding, they can face subjective judgements based on perceived collegiality, arbitrary assessments of research value, or selective screening of

[3] Twale, Darla J. and De Luca, Barbara M. Faculty Incivility: The Rise of the Academic Bully Culture and What to Do About It. Jossey-Bass: San Francisco, CA. 2008.
[4] Coates, Ken S. and Morrison, Bill. Campus Confidential. James Lorimer & Company: Toronto. 2011
[5] Bennett, John B. Academic Life: Hospitality, Ethics, and Spirituality. Anker Publishing: Bolton, MA. 2003
[6] Ginsberg, Benjamin. The Fall of the Faculty: The Rise of the All-Administrative University and Why It Matters. Oxford University Press: NY, NY. 2011
[7] Hollis, Leah P. Bully in the Ivory Tower: How Aggression & Incivility Erode American Higher Education. PatriciaBerkly: San Bernardino, CA. 2012
[8] Ginsberg, Benjamin. The Fall of the Faculty: The Rise of the All-Administrative University and Why It Matters. Oxford University Press: New York, New York. 2011. Page 201.

teaching evaluation commentary. In these cases the direction of the assessment can be predetermined based on goals of sending a message, curtailing freedom, suppressing ascension, or simply engaging in bullying and incivility.

3. ESCALATING DYSFUNCTION

> "We see that there are proclivities toward individualism across the higher education world. The disposition to behave in self-absorbed and self-protecting ways and to put narrow self-interest ahead of the welfare of others or a broader common good is widespread. Individual and institutional identity, worth and fulfilment are understood in terms of power to shape and control others, and to resist their power." - Bennett[9] (2003)

Higher education is a remarkable, potent and positive vehicle within our societies. Critical missions that embrace the power of teaching, the shaping of minds, the building of character, the discovery of knowledge, and service to community, to name but a few attributes of the academy, serve as vital forces to keep society in check and our progress on track. This is not to imply that the academy is ideal, but rather that its many roles however flawed are important and meaningful. In recent decades, as society has confronted growing separation, fragmentation, angst and anger, the university milieu has also encountered its share of trials and tribulations. Some of these challenges are merely reflections of obstacles facing society writ large. Some of these challenges, however, are somewhat unique to the institution, or at least assume a unique character and condition due to the peculiarities, parameters, qualities and quirks of place. The array of novel negative features that have been building in the academy is broad. For the purposes of the present paper, intending to catalyze future research, the author has identified, and will elaborate upon, five features: Relentless Individualism, Mob Mentality, Power Differential, Popularity Contest and Barefaced Discrimination. Relentless Individualism: The systems in place in higher education promote competition before community, and generally both within the ranks of the professoriate and in student populations. Coates & Morrison[10] (2011), for example, highlight that: "Faculty members compete for research grants and academic prestige; they compete for tenure and promotion, and often for an annual merit bonus; and they work in a complex professional environment, where evaluation is constant, real approval rare, and criticism routine and intense." The milieu, for all stakeholders, can be aggressive with high stakes. Grading scales, pay scales, performance curves, merit assessment, chasing points, pursuing papers, seeking attention, demanding accolades, and the like all tend to foster a milieu of winners and losers. And while, without question there must be means to differentiate levels of success, and to acknowledge progress, such focus on individual advancement should not come at the expense of building community, of cultivating civility and of propagating a culture of caring. In reaction to many institutional developments, including reduced operating budgets, eroding salaries (taken to irrational levels where institutions refer to oxymoronic 'zero percent' increases), and misguided efforts to encourage rivalry, faculty double-down on self-preservation, escalate self-interest and slide into survival of the fittest modes. Relentless individualism is concerned about winning at all costs, aggressively displaying the peacock feathers and assertively keeping others in their place. Mob Mentality: While the concept of mob mentality seems on first glance to oppose relentless individualism, they are in fact mutually supportive. Often individuals fear for their success and progress in a climate

[9] Bennett, John B. Academic Life: Hospitality, Ethics and Spirituality. Anker Publishing: Bolton, MA. 2003. Page 21.
[10] Coates, Ken S. and Morrison, Bill. Campus Confidential. James Lorimer & Company: Toronto. 2011. Page 146

plagued with power plays, where senior faculty with authority can make or break the careers of junior members. Often less outgoing faculty dwell in the shadows of those with voice and influence, being easily swayed to take a side or move with the mob. In academic environments there tend to be very few checks and balances on mis-behavior, and this is especially true as one climbs the ladder in power and position. In many cases there are systems through which to raise grievances, or to appeal decisions, or to express concern – however in many cases these same systems lack substance, enforcement and impact. In many cases the rewards of travelling down a path of complaint are few and far between. In some cases merely raising a matter places a target on one's back – whereby the group is clearly able to rally against the whistle-blower, marginalize the outlier or sideline the opposition. Power Differential: University environments, while frequently taking pride in claims of independence and horizontal structure (e.g., difficulties in herding cats or raking water uphill), tend in fact to be very vertically structured. In many cases the lines of authority are clearly defined, delineated, apparent and applied. In such cases positions and position descriptions, including job responsibilities, are well cast with manifest accountability. However, and far more disconcerting, are the power differentials and power games that exist in informal ways. For example, senior tenured faculty members that have sights set on controlling the behaviors, interests and agendas of junior tenure-track academics. At times the biases play out in the open, at faculty meetings or committee sessions, where intentions may be vehemently verbalized and loyalty expectations explicitly expressed. In a dark observation around power differentials Hollis[11] quotes a junior faculty member: "Untenured faculty are very susceptible to being bullied by their tenured colleagues; the whole system is set up to support that." Far more problematic are passive-aggressive actions whereby confusion and chaos are sown, wherein junior faculty sense they are being judged, or their work is in question, or they are slipping, all without the benefit of overt & objective guidance. In many instances the power differential rears its ugly head in committee deliberations considering tenure, promotion, merit, leave requests, internal seed funding applications, or similar entreaties. In such committees senior faculty tend to wield extraordinary influence by virtue of experience, rank, seniority or connections. They are often leading these adjudications, expressing views, often personal, about the virtues of an academic, an application, an argument, or an advancement. Due to the authority and power (might makes right) imbalance more junior members are often reserved, intimidated and/or acquiescent. While questions about right or wrong may be in mind, it is difficult to challenge those in power and especially if there are demonstrably bad consequences for running against the current. Twale & De Luca[12] underscore: "To acknowledge the power and authority differential is to begin to redefine and redistribute power with an aim to neutralizing a bully and a bully culture." Popularity Contest: Human beings have a natural craving to belong. Our identities are, in part, derived from those we associate with, from those we resonate with, and from those we feel most alike. To be popular is to have a sense of belonging – to feel comfortable and to know we fit in. On the contrary, to reside outside of a social group, to be alone and to be out of place is challenging and discomforting. In the halls of academia there are many cliques, groups and gangs based on common views, shared values and similar posturing. When an academic strays too far from the party line they face risks of alienation, marginalization and ostracization. Such party lines may not be

[11] Hollis, Leah P. Bully in the Ivory Tower. Patricia Berkly: San Bernardino, CA. 2015. Page71.
[12] Twale, Darla J. and De Luca, Barbara M. Faculty Incivility: The Rise of the Academic Bully Culture and What to Do About It. Jossey-Bass: San Francisco, CA. 2008. Page 167

explicitly delineated yet are tacitly understood – for example, subscription to a given view on pedagogy, or particular research methods, or an in-vogue style, or certain internal politics, and the like. When it comes to evaluation, whether for merit, promotion, awards and so on, one's popularity can factor large in decision-making. If professors are outliers, with views that are contrarian, they can be harshly assessed and even punished. Even with the guardrails of tenure, those in power (whether administrative, committee, jury, etc.) can inflict pain and suffering upon those deemed to be assuming unpopular positions. Barefaced Discrimination: Perhaps the most egregious of tactics at play in the academy is blatant, open, unvarnished discrimination. Certainly the academy, as a cultural institution and at the highest levels of aspiration and action, is a champion for fairness, justice and equity. In general, and in many ways, the academy subscribes to and achieves elevated positions around morality and ethics. That said, at lower levels, including internal peer review mechanisms, there are many instances of abuse of power, abandonment of values and simply bad behavior. Of course the academy frowns upon discrimination of all types, opting instead to champion the rights of all members, and all students, in a climate of equality and acceptance. However, when committees need to render decisions, or individual administrators are called upon to take a stance, undue considerations such as gender, age, race, income and other factors can surface. In many cases when infractions are brought to light, by whistle-blowers for example, the system struggles to react in positive ways. Often the legal experts in the system, on both faculty and administrative sides, suggest cases of discrimination are exceedingly hard to prove. Again with almost no means to discipline belligerent behavior, such as demonstrations of overt discrimination, the issues are downplayed or swept under the carpet. The toll of fighting the system, in the case of victimized faculty members, is commonly significant. In the end the odds of winning are slim and the potential risks of precipitating retribution and escalating abuse are many. To sum up … These negative forces, and damaging actions, within the academy are not of course omnipresent but are evident enough to warrant our attention and demand our concern. Shrinking university budgets and growing obsession with things quantitative have tended to translate into growing aggression in the ivory towers, with voracious academics clamouring for anything of substance in the zero sum game. Notions of rating, or ranking, or sorting or sifting, are totally understandable but that said, must be informed by evidence, must be executed with fairness, and must be grounded in justice. Unfortunately in many instances these qualitative judgements are frequently rendered in less than pristine ways, and often without the benefit of unbiased means, metrics or methods.

4. MEANS, METRICS + METHODS

> Peer-Review[13]
> "process by which a scholarly work (a paper or a research proposal) is checked by a group of experts in the same field to make sure it meets the necessary standards before it is published or accepted."

While many of the identified concerns are discoverable in all corners and crannies of the university, some colleges and departments are arguably more susceptible to various forms of bias and discrimination. The design professions, including Architecture, are especially prone to abuse due to the unique nature of the disciplines. Architecture, for example, is a complex melange of art and science, humanities and technologies. Due to the highly subjective dimensions of the

[13] http://www.merriam-webster.com/dictionary/peer-review

profession, judgements around right and wrong, good and bad, strong and weak, often degrade into realms of intuition, opinion, flavor and favor. Unlike more empirically based fields, where measurement and quantification are intensely standardized, architecture endorses and encourages very subjective ways of interpreting, understanding and judging. In architectural design many facets of the equation are more about 'appropriateness' than about right or wrong. A dozen architects working on the exact same problem would arrive at a dozen largely unique solutions – all with greater or lesser levels of appropriateness and suitability to the challenges at hand. One might argue that in the creation and construction of a building this level of tolerance or latitude is acceptable if not desirable. However, in the academy, when decisions are being made that have demonstrable impacts on one's career advancement, research progress, teaching efficacy and so on, the need for fairness, integrity and transparency looms especially large. Promotion of rank or judgements around meritorious performance should not be a moving target based on whim, personalities and politics. Rather, all faculty members should know the rules of engagement and should have confidence that the scales of justice, and modes of judgement, will be fair. The present paper wades into some difficult and turbulent waters. A key goal is to explore some dark corners of the academy – at this point in a preliminary manner that paves the way for more fulsome study. It is worthwhile to briefly review some of the typical approaches to internal assessment of faculty, including the areas normally considered for evaluation. As an initial examination the research aims to be exploratory – in many ways more speculative than definitive. The author acknowledges and accepts that further study will be required, especially in a comparative sense, both within and between institutions. While the evaluative strategies of institutions vary widely (and, of course, differ widely between various countries), and the author is quick to support said nuance, the overall tactics and techniques for review are relatively common within the academy. For example, most universities globally attend to the triad of teaching, research and service, albeit with percentage weighting at times shifting from school to school. The following section of the paper is intended to provide a very general understanding of forces and factors under consideration. Narrative Assessment + Committee Review: In many schools the process of internal assessment, whether for advancement in rank, acknowledgement of performance, or conferring of awards, involves two components. On one hand the administrator closest to the academic in question prepares a narrative summarizing performance and underscoring high and low moments in that performance. This often involves a rather subjective read of an application prepared by the academic under review, which in and of itself is often quite subjective. In Architecture there are few definitive standards that are set with respect to impact factors of journals, weighting of publications, value of research outputs, etc. So to reiterate, a rather comprehensive yet ill-categorized listing of accomplishments by an academic is then interpreted, again in an often loose manner, by an administrator deemed to be the closest supervisor in the hierarchy. The language of such interpretive narratives is often colorful, highlighting the poetic posturing of the discipline rather than underscoring a more fair and objective evidence-based adjudication. This narrative, a summary of an academic's performance as interpreted by an administrator, is then used as a starting point for a committee review. The tone of said narrative often leads the witness – that is, the position of the administrator may unduly influence the committee that is charged with being fair and honest judges of a faculty member's performance. This aspect alone is enough to call into question

or even discredit the system, as it is highly influential and anything but blind. Review committees, often elected by fellow faculty members from the field, sometimes with additional academics drawn from outside, then consider the narrative as a starting point with judgments then strengthened or weakened by review of the candidate's application (e.g., portfolio of performance). These committees are commonly highly politicized, with junior members deferring to senior members and with extroverts dominating deliberations. While these committees are often intentionally composed of tenured and tenure-track professors, the power differential is obvious and difficult. Few tenure-track faculty are willing to confront senior professors, knowing that soon enough the junior members' fate will be in the hands of their senior colleagues. After a decision departs a review committee it is commonly screened again by the next administrator above, typically a dean, who judges that the committee's assessment can be upheld or modified – upwards or downwards. This point in the process demands tremendous strength, integrity and openness by the administrator – or else another point of exploitation can be introduced. The internal systems of adjudication, in general, are often far too tight, intertwined and incestuous for comfort and confidence to prevail. In many cases such committees deliver a judgement on the applicant, meritorious or not, worthy of tenure or not, deserving of promotion or not. While some universities strive to inject as much balance as possible into such systems, in the end the ensuing determinations are often colored negatively by the many flaws inherent in such closed, internal arrangements. The university typically structures review of faculty around a very traditional trilogy of teaching, research and service. It is helpful to briefly consider these realms, and in particular with respect to weaknesses and faults inherent in prevailing methods of assessment.

Teaching: Teaching is a hallmark of higher education and as such weighs heavily under any schemes for assessment of faculty. There are many means to assess effectiveness in teaching. Unfortunately many institutions rely too heavily on only one or two approaches, and most commonly just student executed evaluations (also called course and instructor surveys). There are myriad problems with reliance on a single instrument, and even when they are executed with care and professionalism the results can be misinterpreted and even abused to ill ends. For example, most course & instructor evaluations include scales for questions but also include written anecdotal comments. In reviews, such as faculty performance, individual comments can be extracted without context and without a complete picture. In other words, negative comments can be extracted for the purposes of building a case, even if the evidence points elsewhere. Also, if anecdotal comments are 'cherry-picked' without the inclusion of the full statistics around the survey then the conclusions can be misguided and even malicious. A better approach is to deploy an array of tools to more robustly measure teaching effectiveness – and there are many from which to draw.
Research: Research is a vital activity of the university, with the pursuit of new discoveries and the application of existing knowledge fundamental to equations of success. In so many ways the contributions of the academy, in terms of the advancement of society, the alleviation of suffering, the improvement to quality of life, and other positive actions, are outstanding. Measures of research achievement are many, and in general are fair and appropriate. Impact factors, funding levels, external awards, patents secured and other metrics aim to objectively assess the benefits of scholarly exploration and scientific experimentation. In terms of internal systems of assessment for faculty, at times the consideration of research accomplishments

is reasonable yet at times it is skewed. To expand on the latter, in some cases a faculty member's research area can be viewed negatively by assessment committees or administrators, based on personal opinions or group tendencies.While there are good reasons for the concept of academic freedom, the principle and the practice are commonly out of resonance. Pressures to chase funding – that is opportunistic research – or to conduct research in line with donor interests, can unduly alter any aspirations around fairness and freedom. Also, while strategic areas for an institution and/or a school are important in many regards, they should not be paralytic in terms of faculty who stray from the party line. Judging the worth, impact and importance of scholarly work should be executed at arm's length – without the influence of politics, personalities & popularity.
Service: The final leg of the trilogy is service, with this activity assuming many forms and touching many communities. In some cases the service efforts are internal to a faculty or to an institution, such as a curriculum committee or a university appeals process, but in other instances are dedicated to professional organizations or toward the public sphere. This work can be quite difficult to measure, as in many cases the outputs are less tangible and quantifiable compared with what might be seen in teaching and research endeavors. However difficult to empirically judge, service pursuits are nonetheless a critical part of an academic's contributions. In many schools this work is weighted less than teaching and research, with a common breakdown of 40% teaching, 40% research and 20% service. With regard to internal evaluation perhaps the greatest risk is an overlay of politics into the mix – for example, a faculty member donating time to address human rights, a sustainability agenda, indigenous affairs, or working to lessen homelessness, may be judged negatively if the culture of the school or university runs in counter directions. In some schools such hot topics are seen as irrelevant, or niche, or marginal which then colors assessment of faculty performance.
Conflicts of Interest and Conflicts of Commitment: An area of unease that warrants mention is conflict of interest and conflict of commitment, both of which can negatively shape decision making within internal evaluation schemes. For example, a member on a merit assessment committee could have previously been evaluated for tenure, or promotion, or a teaching award, by the same individual they are now charged with assessing. Such blatant conflicts commonly arise within the academy – again the lack of blind assessment subjects the process to corruption in serious ways. A frequent response by administrators, and legal folks, within the university points to the smallness of the pool and the fact that academics need to simply get along and trust each other. Unfortunately such posturing is foolishly naïve and simply unrealistic. Various forms of conflict are the reality and must be understood and managed as such – the internal processes of assessment need to fairly and objectively consider such conflicts and, in response, demand conflicted faculty to resign from committees or recuse themselves from evident problems. While many schools do have policies and language around such conflicts, the actual discharge of the policy is another beast altogether.

5. AN ALTERNATIVE NIEW | FIT

> "Faculty and administrators with tenured faculty appointments are untouchables and they continuously get away with bullying because it isn't looked at as a termination worthy cause. … The norm is bullies running unchecked devouring the meek and weak in an organizational structure. The bullies pick on those they believe they can bully but won't stand up against someone on equal footing. It is sad to watch." Hollis[14] (2015)

[14] Hollis, Leah P. Bully in the Ivory Tower. Patricia Berkly: San Bernardino, CA. 2015. Page 70.

In light of some of the serious challenges to peer-review internal to our institutions, the author proposes a much more mindful, and disciplined, approach to the processes, policies and procedures deployed. In particular, the individuals and especially the leaders responsible for the conduct and oversight of peer-review need to be vigilant to ensure peer-review is honorable and just. Of course the words are easy to write or say while the actions and operations are difficult and demanding. In the academy we profess to students the need for our societies to be balanced, compassionate, respectful and reasonable. In our classrooms we endeavor to model good behavior and to espouse the worth of a life well lived. We teach theories and principles, and explore application and implications, with care and attention to detail. In terms of our evaluation of our peers, some of these same strategies and objectives seem apropos. For certain the systems of evaluation we enact must be evident, must be consistent, and must be justifiable. Too often decisions are rendered behind closed doors, with directions determined by preference and personality versus by policy and principle. In our research we aim at rigor, validity, certainty and clarity. The author argues that this same set of guideposts should inform our peer-review systems. Exercising narrow agendas, limiting academic freedom, playing politics, abusing power, deferring to the mob, and preferring popularity over performance all have no credibility within the seriousness of internal peer-review. The present paper advances a framework for peer-review that acknowledges the system complexity and recommends careful attention to the triad of Fairness, Integrity and Transparency. Considered together, and if applied with an understanding of their inter-relatedness, significance and vitality, these three dimensions of peer-review have potential to reform and redesign the policies and processes in meaningful ways. Given the tremendous responsibilities we, in the academy, are charged with by society, and considering the great privilege we hold within the education and research realms, we need to get the assessment equations right. Based on explorations of the literature, as well as several decades of direct experience in the academy and senior administration, the author proposes a system for internal peer-review that demands three interdependent qualities. **Fairness; Integrity; Transparency**. These three dimensions (FIT) need to be diligently addressed when formulating principles then developing and executing policy for peer-review.

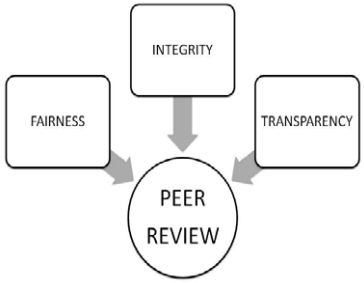

Figure 1. Integrated Framework for Enhanced Peer Review

5.1. Fairness

Fair[15]

- *marked by impartiality and honesty: free from self-interest, prejudice, or favoritism <a very fair person to do business with>*
- *(a) conforming with the established rules : allowed (b) consonant with merit or importance: due <a fair share>*
- *open to legitimate pursuit, attack, or ridicule <fair game>*

The idea of being truly impartial lies at the heart of any peer-review approach. To be 'fair' necessitates some shared understanding of the conventions enacted – in other words, going into an internal peer-review process

[15] http://www.merriam-webster.com/dictionary/fair

both the reviewers and the individual under assessment must clearly grasp the regulations, policies and, most critically, the criteria being used. The focus should be on explicit criteria that can be in some ways measured – it does not necessarily mean that every aspect of the review should bequantifiable, but rather that every aspect should be explainable. The processes and methods should also be consistently applied across those being reviewed. In this case, one size does fit all. When the rules and regulations morph based on personality, preference or politics, the system cannot be fair.

5.2. Integrity

Integrity[16]
- *firm adherence to a code of especially moral or artistic values: incorruptibility*
- *an unimpaired condition: soundness*
- *the quality or state of being complete or undivided: completeness*

The academy is a very special place, comprised of people who largely aspire to do meaningful work with positive impact. In doing this work there needs to be values in place – which, while both implicit (tacit) and explicit (say-able), need to resonate within and across the larger community. Ethics need to underpin the enterprise, including attention to not only the well-being of individual members but also to the fitness of the whole. The notion of a moral compass is appropriate, where each of us can ensure our actions are mindful and our intentions are good. The health of the academy rests, in significant part, on the clarity, relevance of and subscription to such a moral code. Following the code has implications for all of our activities, from teaching and research to community volunteerism and public outreach. It also, of course, holds undeniable connections to and correlations with peer-review. If a faculty member treasures the code and watches the compass, then ill-behaviour within internal peer-review processes should be kept in check. If the code is ignored, and the compass broken, then a trail of damage and destruction is inevitable. Unfortunately there is always tremendous collateral damage in such cases – it is never just the individual under review that bears consequences. The system, as a whole, is assaulted and undermined.

5.3. Transparency

Transparent[17]
- *free from pretense or deceit: frank*
- *easily detected or seen through: obvious*
- *readily understood*
- *characterized by visibility or accessibility of information especially concerning business practices*

As the saying goes, 'The sun disinfects all it touches'. Douglass[18] (1986) noted "Institutions create shadowed places in which nothing can be seen and no questions asked." Internal peer-review, considering its essential place within the academy, must be fully transparent. Not only do the policy and criteria need to be explicit and shared, but critically the processes and procedures therein must be fully understood and visible. The notion of being 'free from deceit' is fundamental. Based on the experience of the author, in many instances decisions around peer-review within institutions are rendered in a black box – rather like the great Wizard of Oz performing his magic behind the curtain. Internal peer-review, whether addressing merit pay, performance assessment, promotion and tenure, or grant money, cannot be a mystery. The rules need to be readily understood and without fail, followed. In many cases the metrics for success, for example in teaching or in scholarship, are

[16] http://www.merriam-webster.com/dictionary/integrity
[17] http://www.merriam-webster.com/dictionary/transparent
[18] Douglass, M. How Institutions Think. Syracuse University Press: Syracuse, New York. 1986.

loosely defined then more loosely interpreted. The value of a teaching assessment, or the worth of a journal publication, should not be determined 'willy-nilly' by any one academic or even by a committee of academics. In the experience of the author, the outcomes of annual peer-review processes within institutions can swing dramatically based solely on the composition of the committee. This is entirely inappropriate. As with any complex system, peer-review is multi-faceted and influenced by a plethora of forces. The aforesaid framework is intended as a guide to direct thinking around peer-review policies and procedures. The value of peer-review within the academy and, by extension and implication, beyond, is unquestionable. We need to be very disciplined, conscientious and decent in the development and execution of rules, processes and outcomes of peer-review. We need to develop peer-review systems that treat all with equality, respect and dignity, and that fosters not only the well-being of our faculty but also furthers the civility and worth of our institutions. academy

CONCLUSION

> "Despite their public representations – and perhaps their inner intentions – these institutions offer a philosophy of atomism, and ethics of opportunism, and a spirituality of self-preoccupation." Bennett[19] (2003)

> "Professors, taken as a group, are far from perfect. They can be petty, foolish, venal, lazy and quarrelsome. Nevertheless, at its best, the university is a remarkable institution. It is a place where ideas are taken seriously; where notions that are taken as givens elsewhere are problematized; where what has seemed to be reality can be bent and reshaped by the power of the mind." Ginsberg[20] (2011)

Peer-review remains a vital and valued aspect of higher education – when it works it ushers in many positive outcomes including the potential to demonstrably raise the quality of teaching, research and service. However, as the present paper delineates, in many instances the system is in disrepair and/or dysfunction. Such problems are, of course, part and parcel of greater challenges facing the academy and society beyond. That said, the academy, and its members, have a responsibility to act at more elevated ethics levels and to behave in ways that inspire and influence our students. There needs to be a fundamental shift away from relentless individualism, abuse of power, and a culture of greed. In its place we need to cultivate a milieu of respect, of caring, of fairness, of civility and of community. Bennett[21] (1998) calls for a move from 'academic professionalism to collegial professionalism. He explains the latter noting "professionalism is converted from credentialism and exclusivity, protectionism, and isolation from others, and it moves to an emphasis upon connectivity and imaginative empathy, competence and dedication to the learning needs of others." There is little doubt that the arrival of negative dimensions of internal peer-review is a product of the greater ethos that rewards and encourages competition before collaboration and presents a 'zero-sum' scenario as the only game in town. The author seeks to open eyes, minds & hearts, including his own, in an attempt to encourage more investigation into very complex and disconcerting aspects of the academy (see also, for example, Sinclair[22] 2019 "The

[19] Bennett, John B. Academic Life: Hospitality, Ethics and Spirituality. Anker Publishing: Bolton, MA. 2003. Page 38.
[20] Ginsberg, Benjamin. The Fall of the Faculty: The Rise of the All-Administrative University and Why It Matters. Oxford University Press: NY, NY. 2011. Page 201
[21] Bennett, John B. Collegial Professionalism: The academy, individualism, and the common good. Oryx Press – American Council on Education: Phoenix, AZ. 1998. Page 52
[22] Sinclair, Brian R. The Devil's Crop: Rightness, Wrongness & Appropriateness in an Upside-Down Abyss. Keynote Address, 31st International Conference on Systems Research, Informatics and Cybernetics, Germany, 2019. https://ucalgary.academia.edu/DrBrianRSinclair

Devil's Crop). The current explorations are admittedly preliminary and perhaps provocative, with a goal to reveal both obstacles, and opportunities, concerning the realization of a more equitable ethos. The researcher is optimistic that the academy can find its bearings, not only pertaining to the matter of peer-review but more generally regarding its discharge of duty and owning of accountability. To recalibrate the compass requires a concerted effort by academics to be far more mindful of their actions, far more generous with their care, far more reasonable with their demands and far fairer in their deliberations. It also relies on valuable and indispensable players within our institutions, such as faculty associations, ombudspersons, centers for teaching + learning, research services, institutional assessment offices, and units for protected disclosure, to help us stay true and on track. At the end of the day the system, and its constituent members, needs to be more honorable and more just. The present paper outlines concerns with the structure and conduct of internal peer-review and, in response proffers an integrated framework for reform and redesign. This work necessitates risk, courage and openness. Glazer[23] (1999) stressed: "While openness begins as an inner, personal discipline, it very quickly evolves into a dynamic, interactive experience. Our own openness actually collapses boundaries between ourselves and others and the world."

[23] Glazer, Steven. The Heart of Learning: Spirituality in Education. Tarcher/Putnam: New York, New York. 1999. Pages 247.

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PAPER #7.05

ARCHITECTURAL EXPERIENCED MACHINES: THE ACTIVATION OF TIME

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ABSTRACT

The optical and kinetic art of the 1960s converged on the architecture of the 1970s with a sensitive and poetic style, with its sensorial imprint making it phenomenological. The semiotic contributions of the same period raised from the theory of reception, the open work of Umberto Eco, the debates on the interpretation between J. Derrida and H. G. Gadamer channeled through the critical work of Manfredo Tafuri, culminated in the hermeneutical contamination of this discipline. The mutations from 'art as activism' to 'activism as art', 'the personal is political' in 'everything is political', the postcolonial theory transferred to 'all minorities', added to the above, provides a scenario of transformation, where activism, participation and politics converge in conceptual art. The architecture unfolds under these signs and the post-conceptual at the end of the 20th century and the direction changes from the search for meaning to the search for experience and in its excess, it is sometimes constituted as experiential devices for activating time. Some works by Miralles and Pinós, Diller Scofidio, Olafur Eliasson, Turrell and Neón Artist, Libeskind, Eisenman, SANAA, Carlo Scarpa, sculptures by D. Bestué, J. Plensa or R. Serra, among others, will allow us to identify the temporal prevalence in the space-time relationship so characteristic of our discipline, and in it to recognize the strategies of temporary mobilization.

KEYWORDS

Space; time; machines; conceptual; post-conceptual.

INTRODUCTION

I see an advertisement on a poster for the facial cream InstaMoisture from the cosmetic brand KIKO, which promotes a virtual investment: that the new look is like the virtual one in Instagram (fig. 1). Here, the virtuality is taken as a simulation of reality (our first photo was already fictitious since it was edited), mobilizes the disintegration of the little reality that remained. A third order virtuality. An activating image of time "How did we come to this? Does the same thing in architecture?" In the extensive bibliography produced (Giddens 1994), we look for indicators to clarify the imprecise transition towards post-metaphysics of architecture, where we appreciate its indistinct implementation in a short, aporetic period, in which these "experiential machines" emerge.
Jürgen Habermas (1980) In view of the preceding (postmodernity), had to remind himself of the establishing of the project of modernity through Max Weber's idea:

> Cultural modernity is defined by the separation of the substantive reason expressed by religion and metaphysics in three autonomous spheres those being science, morality and art that are distinguishable because the unified world views of religion and metaphysics are separated.

Tiempo	características	dispositivos
Refigurado (1980-95) Desde el configurado se resignifica	Imagen Relato Narración Temáticas adicionales Giro hermenéutico Fantasmas y síntomas	Narración material Estético Hermenéutico Acontecimental
Resignificado (1995-2010) Refigurado por su representación	Liquido Desestructurado Des contextual Desconexas Acción por la acción Disolución de limites Hiperestetización	Acontecimental Psicológico Narrativo material Estético Semiótico Hermenéutico
Recodificado	Neoformalísmo Reacio a experiencia Poéticas personales Racional instrumental Neo estructuralista Tecno arte Compromiso social Materialismo social Anticapitalista	Fenomenológico Memoria Narrativa material Hermenéutico Tiempo social Psicológico Hermenéutico
Refracción (2010-20)	Cansancio, insatisfacción Perdida autenticidad Imágenes mnémicas Efectos alucinatorios	Virtuales Narrativa Material Psicológicos Hermenéuticos
Reaccionario	Reactivo Experiencialidad Nueva figuración kitsch Imágenes hibridas Heterodoxas Pret a porter Postconceptual	Virtual Narrativa Material Hermenéutico

Figure 1. Image as a temporary device. Summary table of devices and time modalities. Source: image from https://www.kikocosmetics.com/es-es/novedad/instamoisture-foundation.html and table provided by author.

In this "false autonomy" of art lays a certain complexity. This agitated debate on postmodernity presented different approaches. For Jürgen Habermas (supporter of the "critical appropriation of the modern project") modernity was a challenge against the cultural order of the bourgeoisie and the "false regulations" of its history. Today it is considered as the official culture to transgress; "It is dominant but dead" as long as it does not practice its unfolding, warning in turn about the "false denials" that happen to it. Facing a new culture portrayed in the 70s by: (1) configuring a new representation scene, (2) employing supreme fictions derived from thinking about difference from a sensible perspective, (3) by its populist masking, (4) with stylistic "avant-garde" that falls on kitsch, (5) embroiled in hermetic codes, with as many models as there are works, (6) without affiliations and easily assignable to apparent relativism. A set of adhesions that caused skepticism towards the autonomous spheres of culture, without being recognized by experts, navigating formal affiliations that led to social affiliations, to finally delve into the political-cultural nexus that in practice formed an activism as art (Felshin 1995, 9-29) (hardcore, which transforms the physical and social environment) and enhances the political reaction. A liberating effect through an aesthetic anarchy, or "utopian dream of a time of pure presence" and a space beyond representation. This display was influential based on conceptual art that tried to "find art in social energies"; a possibility that would allow the expansion of social.[1]

[1] Helen and Newton Harrison–environmental art; Suzane Lacy–feminists performance; Judy Chicago in The dinner party (1979); Mierle Laderman Ukeles–kinectic art; Carol Condé and Karl Beveridge–political activism (1969, 1976).

1. DISCUSSIONS AND ANALYSIS

This trend is possible due to several previous transgressive ideas: a) the historical concept of culture made up of the representational and performing arts, mutates due to the effect of mass culture to approach how the lifestyle is organized and carried out (Bell 1979); b) simultaneously from feminism it is coined that "the personal is political" (Hanisch, 1969). Ideas that in their extensive implementation led to enhance non-cohesive individualism with social structures and with it their segregation that led to dystopia and diachrony. At the time, neo-conservative critics (Shils 1969; 1967) the majority in the Atlantic sphere maintained that this emerging culture "took the form of a struggle from an *oppositional* mindset to discover a new logic" and with it ties the revised concepts to different forms of extremism. Those empty criticisms did nothing but provoke the forcibly autonomous emancipation of art that led to activism, performance, participation, *virtuality* and *kinesic staging*, which in its evolution was seized by the new politics in the construction of new pseudo-cultural identities.

Hal Foster's (1988) gathers a larger sample of critics who announce a "break with the aesthetic field, changing the very object of representation". Or they emphasize postmodernity as the object of post-criticism and the politics of interpretation. Specifically as a new, "schizophrenic manner of space and time, which declares the "death of the subject". From literary criticism Paul de Man points out that each period goes through a modern moment, which is followed by a period of "the transgression of the ideology of the transgressive", to turn it into mutating purposes and thus autonomy into identity. Roland Barthes cites the relevance of continental culture in the transition from structuralism to post-structuralism, where he reflects on "culture as a corpus of codes or myths", as a set of imaginary solutions of real contradictions. The following gathers some common features that define the operational plexus of this postmodernity: c) it follows a textual, narrative, allegorical but contingent model; d) it deconstructs itself to open up to other images, other heterogeneities, rewriting its contradictions, challenging the dominant narratives with the "discourse of others". And so it distinguishes between two directions: (I) the postmodernism of "resistance" and (II) that of "reaction"; the first is of action, the second of diction through rejection and praise, dominated by neo-conservative messengers (Connor 1996; Lyon 1996; Rorty 1996; Rorty 1986; Jencks 1982; Jencks 1981; Bell 1977); e) it will be Jürgen Habermas who points out the common aspect; those factors act strategically, separating the cultural from the social, and then blaming modern problems for social problems; that is, they confuse cause with effect while reaffirming an economic and political status of a new "affirmative" culture. Along these lines, Kenneth Frampton had already warned that historically culture was a force above all of social control that mutated towards a "free image drawn on the face of instrumentality". No wonder, therefore, that the new policy eliminates the control that culture exercises if its intention is to break with the future, history and the past. On the contrary, the resistance groups are interested in implementing post-metaphysical in two ways; (II.1) with a reconstructive bias (as in *dismantling*) and (II.2) (as *disassembly*) the critical deconstruction acting on the traditions that question without presenting cultural codes since it explores them without hiding social and political affiliations. Rosalind Krauss (2013; 2006) points out an important aspect in this position; it is a rebellion of external cultures (to the art in question, painting, sculpture, architecture through politics, feminism, gender, sociology, psychoanalysis, etc.), against the breakdown of internal culture, even in its most exclusive domains (utility, strength and beauty, or

[2] The Marxist left in the 70s revises modernity: Victor Burgin, Jo Spencer, Mitra Tabrizian, Henry Bond, Liam Gillick. Tainted the Next Left. In 1993, "Whitney Biennials" makes official activism.

the equation form + function + meaning in architecture). Gregory Ulmer details that this crisis of representation has led to new cultural forms: a) through collage and montage the conventions of modernity are questioned; b) deconstruction as a critique of mimesis and the sign (Derrida); c) allegory, as a thought *in progress* linked to action, participation, kinesthetic art, etc. (Benjamin); f) other authors (Sánchez 2006) introduce us to a hermeneutical problem (Gadamer and Derrida) derived from participation: if the work is clarified with this mediation or intervention, the personal expectations of the receiver are integrated. For this reason aesthetics becomes a weapon, by extending to all areas "the personal is political", and since personal expectations are integrated in such a way that collective interest is declined. g) For his part, Simón Marchan (2006) introduces us to the duality between *real and virtual* in the rise of techno aesthetics or aesthetics of digital appearance, where references to reality are diluted "in the random games of the signifiers", a hyper-textuality derived from the implosion of signs, which produces a *divide between the material and the immaterial*; or the rise of new antinomies through dematerialization and de-realization. All these shelled factors form the basis of an architecture that converges towards "experiential machines".

2. THE CRITIQUES

Regarding both lines, Fredric Jameson (1996; 1991; 1989) (like Terry Eagleton, I. Hasan, J. Baudrillard) point out that this new cultural form is a guise to avoid our complex present (present-present or eternal present according to the authors). That is, the heart of the problem is focused on temporality. Other discourses cite the transit of intentional time to mere temporality. It is through the *pastiche* "where we swim in a sea of private languages", that satisfy the desire to return to less problematic times. For Jean Baudrillard we are witnessing the dissolution of space and time, because simulation loses cause; and without it there is no unmasking of reality, "the object no longer serves as a mirror for the subject and there is no private and public scene, only information". Such an excess of information is not accidental but opportunist. Edward Said points to a purpose: to establish a "doctrine of non-interference", by which humanism and politics are kept at a distance that allow the second to re-establish a new order that, not being global with the humanistic parameters linked to art, they must be of a different nature; propagandistic, informational, fast-paced and populist. For this reason, the illustrated project is uncomfortable for these groups that question it, seeking to serve other purposes among followers of multiple circles of political-identity. And thus he suggests that contaminations and interference practices are necessary to deconstruct this perverse dynamic through artistic and cultural criteria. Along the same line, Umberto Eco (1968) will express himself, in relation to anti-critical programs in mass culture, where opinion-makers, routines, outsiders, ragmen and scavengers, interview each other, objectifying and constructing virtual anti-social themes. With all this came the displacement of spatiality by temporality.

Thus, through the configuration of a parallel (*unsightly*) network of ideas, meaning is ignored and aesthetic *experience* is shaped, derived from post-colonialist trends (Fanon 2007; 1962; Césaire 2006): ethnic arts, ethnographic twist, multiculturalism, social heterogeneity, whose existence is separate, without object and beyond history (as shown by the new urban contextualism or the landscapes of action born from Land Art as restorations that generate an ecological aesthetic). For this reason, art can produce interactions, inter-subjective relationships of identity and a symbolic totality, which by its separation (also externality to the being of the subject), keeps the subject anchored in the "eternal present", but vested with a new

plexus of alienating political formulations that are presented as new independent stories with supplementary language (as occurs with those abducted). It is what Habermas calls "aestheticization of politics", that occurred with futurism and constructivism prior to the Second World War, and which transformed the enunciated autonomy (*logos*) of modernity into stylistic identity (pathos). A change in the re-appropriation of art or the process of altering meaning through the *aesthetic experience* - so typical of today's virtual world. Because:

> When such an experience is used to ished light on a life history situation and is related to life problems, it delves into a language game that is no longer that of aesthetic criticism. So the aesthetic experience not only renews the interpretation of our needs in whose light we perceive the world. It also permeates our cognitive meanings and our normative expectations and changes the way all these moments relate to each other".

This process has been gaining strength with the modernizing of computers, until defining the time of virtual dominance, described by Slavoj Zizeq (2011). A process that Marchán (2006, 42) attaches to rampant *sociologism,* "which invokes micro-politics of power that tend to postpone the goals of a social transformation for the sake of the exploration of *Myself* where all the personal is placed in the category of the political". However, Derrida is opposed to part of this analysis: because he points out its opportunity as the aesthetic experience allows complete alterity and a hermeneutic of the event, opposing the errors that prevent temporal disruption.

3. THE TEMPORARY TURN

But also, in those years, a conceptual implementation forging transversality was conceived, which, being carried out from that distance of society and history, was the underlying layer of its later problematic situation; (1) from the incorporation of subjectivity it contributes: participation, multiculturalism or acceptance of other logic of meaning, transforming the approaches based on self-awareness (Kant, Hegel), towards positions on moral will (Fichte), genius aesthetics (Schelling); but finally mutating towards subjectivism (misreading Saussure or Derrida) ethically understood as the predominance of the Other, here as pseudo alterity that ends up being aestheticized. (2) "Complex" thinking (Edgar Morin) and lateral thinking (Edward de Bono from cognitive development) were applied to the "processes" of work, discriminating the repertoire (superstructures) that mutates towards the acceptance of multiple logics of meaning. But instead of approaching infinity in a qualitative way, it is replaced by free will: with a possibility of the structural side and alterity on the post-structural side. It was when the cognitive cartographies, the maps of forces, energies and tensions, and diagrams emerged in their two readings; quantitative and qualitative. (3) The theory of processes, (in relation to situationism), through its particular conceptualizations in literary, creative and architectural dynamics, also converge in the incorporation of *significant topologies*, which allow the receiver to act as co-author when participating in the hermeneutic discovery, as well as its desire-driven *invention*. (4) Such a hermeneutical dimension of architecture lends itself to testing the duality between open work and deconstruction, through existentialism and phenomenology. Where the lack of understanding of the deconstructive work resulted in relativistic with no more reach than the synecdoche or the pseudonym. But in any case, the predominance of time over space, known as the *temporary turn* (Brandt 2015), was imposed. Umberto Eco (1975) gives as an example at the Faculty of Caracas of Carlos Raúl Villanueva, 1960; Colin Rowe (1963) approaches as a key element

the "dissolution of limits", through glass, as a temporary device; Superstudio (1967) appeals to "ideas as objects", because these can change time; Paul Virilio, points it out *in Architecture, virtuality and disappearance*; Bernard Tschumi develops it in the Glass Pavilion from 1994-96, challenging instability in a sloping glass box, reflecting the data codes of interior computers. Enric Miralles calls *imaginary machines*, for whom the viewer's gaze reconstructs the time of the project, such as the *Casa Garau Agistí*, the Kolonihaven cabin or the Igualada Cemetery; Josep Quetglas says "as if inhabiting were nothing more than moving between the time of a place" (Miralles 2004, 34); Curtis, indicates his maps of forces and energies, which converge to modify time; Robert Brufau, highlights his *archeology of time* and Zabalbeascoa (2013), calls it *architecture of time*. The objective of this temporary primacy in architecture is to overcome the *prefigured time* through its operation and perhaps the recurring *invention* is possible, not only of the initial author, but of the participating subject successively. Every time we contribute a new signifier to the work it is renewed and updated, able to configure a different future. As Derrida (1998, 347-372) points out for the work as a text,

> Writing is a kind of brand that will constitute in turn a kind of *producing machine*, that my future disappearance will not prevent it from continuing to work and giving, to reading and rewriting"

4. ITS DEVELOPMENT

Since the mid-1980s other factors converge in that initial dissent, which only augment this *temporal diachrony*: the excess of information, the speed that prevents successive adaptation, the high level of alienating demand, the predominance of the video sphere or interactive virtual reality. In other words, "second degree simulations" (like our advertisement) that produce "transitions from traditional spaces of optical illusion to current ones of immersion" (Marchán 2006, 43), *virtual environments, multisensory* works, which generate their own reproductions mimetics. For this reason, these excrescences are overflowing with digital narratives, mediated communication, substituting inter-subjectivity for interaction and subjectivist sensitivity that hinder their real socialization, being replaced by the pseudo-artistic communal experience of a marked sign of private politics; that is, the complete overcoming of the simulation reached by Real (Barrera 2019). Where the marks of space-time "are transformed into virtual figures, things or events" that generate a universalist semiosis —sometimes of impersonation—, whose answer is: "despite the facts, I feel that way." Here, time results from iconic transformation and post semiotic response (transformation of signs). With this, an explosion of referentialities occurs, where the similarity within the virtual field becomes iconic correspondence, which, being a mirror image of itself, passes towards the *hyper-aestheticization of the virtual*. Where we can neither allege the theory of experiential expression, but only "the production of meaning that is altered by metamorphosing itself into the reworking of the stored data" randomly. The works of *techno art* are therefore floating, evolving, interactive, in permanent dissolution, capable of "manipulating the synesthetic system by controlling environmental stimuli" (Marchán 2006, 48). Having overcome hyper-reality, we enter the Lacanian Real (Lacan 1999), which does not belong to either the imaginary or the symbolic order, but which has its own presence and existence, although it is not representable. It is the place where the signifiers of foreclosure reappear or return in the form of hallucinations or delusions.

5. EXPERIENCED TIME ACTIVATION DEVICES

They are parts of the project, encounters, forms, sequences or routes, materials, optical, haptic, or sound supporting the multiplicity of experiences leading to the questioning about time. They unfold on the basis of an activist architecture, symbolically, socially and politically, or in their encounter with space; endowed with participation, inter-subjectivity, with a predominance of paradoxes and antinomies or resources that in its interpretive reading allows multiple annexations and grafts; they form significant concepts. We recognize the architecture that displays the diversity of these devices as *experiential machines, virtual environments,* imaginary machines or producers. The devices created serve ten modalities; social time, phenomenological, aesthetic, material narrative, psychological, hermeneutic, eventual, semiotic, memory and virtual time. We acknowledge the following trends:

5.1. Re-figured time

The fifth generation of Modernity (second to postmodern time, 2nd PMT) emerges and is set between 1980-1995. It stands out for the empowerment of the discourses described through two transitions; the specific importance that *the image* and *the story* acquires, in the terms that Ricoeur (2008, 148) quotes while "the story or the plot… refigure an action in time" because, "we continue, then, the passage from a prefigured time to a refigured one through the mediation of a configured one" (the one that we imagine could be subject for debate). Those two transitions will destroy the inherent space-time relationship of the architecture, to turn to the temporal primacy, the *refigured* time. Introspective glances seek inner clarification by extracting unsuspected, invisible relationships in a substantially transformative creativity. Through significant transversality, investigative themes are introduced, such as the fold, plateaus, rhizome, the fractal, etc., which allow the participative, activist, integrated, collaborative praxis of the subject in the work experience. With it, a hermeneutical turn, between narrative and poetic; because "what is interpreted in a text is the proposal of a world in which I could live and project my own powers" (Ricoeur 2008, 153); that is, making it narrative *re-signifies* the world in its temporary dimension. Because dynamism, activity and participation transform aesthetic experiences into life experiences. Faced with this "poetry, by its *mythos*, *re-describes* the world" (Ricoeur 2001). In this the communicative scope of the image is explained, in the fight against the surviving image (pathos) that Didi Huberman (1990) exposes, as the structure that appears through form, or "invisible tension that confronts visibility"; latent forces of the past that are presented; Aalto (Schildt 2000) already pointed out that "what has ever existed, always reappears in a new form". This overvaluation of memory, like its disconnection between image and story, allows old ghosts to emerge, which in Derridian terms, would be the *symptom*: "falling together", a word that means first the sinking, the collapse, then coincidence, the fortuitous event, the encounter, "the other way than being" (Derrida 2003; 1987). Its impossibility of re-allocation lies in the mixture of polarities or antinomies, and its overlapping in movement tending towards the activation of temporality. Álvaro Siza (1995) will call it "a fusion agent", the cause of transformation or *union*, in the ambivalent transition from synchronic to diachronic. And this despite the fact that the priority option of poetics is autonomy, autarky, loss of hierarchy, break with conventions or the discovery of possibilities, which nevertheless end up in new alienating identities; Also called "inversion of motive" (Baseliz, 1984), *simulated savagery* by Dahn (Marchán 1984, 446) or as Jean Baudrillard (1978), "simulating is pretending to have what one does not have". This transformation will successively establish a supposed new

iconographic modernity, autistic and devoid of a story (neither social nor personal), which apparently will have the signs of that one but which pretends to have what it does not have. Its devices are, time and narration, aesthetic time, hermeneutic, eventual.

5.2. Re-signified time

At the turn of the century and the first decade of the 21st century, together with the growth of provocative post-structural responses, (mistakenly disclosed under the shadow of deconstruction and formed through the implosion of the object, the multiplication of volumes or the plastic decomposition[3]) is configured by the sixth generation of modernity (6th gM) between 1995-2010 (3rd PMT), various alternatives to these drifts within the same; through *liquid* architecture and the will to formalize the *destructuring* in proposals constituted in temporary activators or *disconnected* experiential machines ', all of them through action. The architecture of Miralles had rehearsed multi-temporality, as Gordon Matta Clark did, in its cuts and holes in obsolete dwellings, the re-activation of time, giving them an opportunity to show their hidden reasons for their foundation; Olafur Eliasson, reproduces time in overlapping narratives that look mirrored. Diller Scofidio raises the evanescence of time through the blurring of form in steam; and SANAA, from their poetic *dissolution of limits*, allows the work to be circularly changing like its concern. The 'representation of time' by the sculptor David Bestué, in his exhibition 'Rosi Amor' (2017), aims through the accumulation of objects that make up a disorganized memory - fragments of ruins and remains - to represent linear and the centrifuged time, "as if time were just another substance and could also change shape and turn to dust". All this in a work of internal symbolization to action, since according to Ricoeur (2008, 156),

> it is re-symbolized or de-symbolized —or re-symbolized by de-symbolization— thanks to the schematism sometimes turned into tradition and others subverted by the historicity of paradigms. Ultimately, it is the time of action that is truly refigured by its representation.

Its devices are: eventual, psychological, narrative, aesthetic, semiotic and hermeneutical time.

5.3. Recoded time

But another more structural line is needed that longs for a certain return to those foundations of modernity, exhausted from the osmotic ideologization of the marginal contents that had politicized all creative displays through their narratives. Thus, two routes emerge with a certain importance and in parallel; I) on the one hand, a *neo-formalism*, (opposed to experiential machines) that, as in post-conceptual painting (Marchán 1972), evokes a certain satiety with the previous excesses so belligerent: the expressionist tectonic (even technical brutalism) as a priority response of the previous generation: Foster, Piano, Rogers, Ito, Sou Fujimoto, among others within the structural line. Such neo-formalism addresses some common variables, such as a certain synthetic formal expressionism, vernacular features interspersed with a geometric, compositional and monochromatic reductionism, an instrumental and practical rationality, which is based on the power of hidden structural solutions, arranged as if it were nothing. This formalism recovers previous personal poetics in the shadow of the last masters such as Louis Kahn, or that shown by Siza Vieira, Lina Bo Bardi, Adalberto Libera, José Antonio Coderch, recovering that spirit of Gastón Bachelar (1957). It is in the form of phenomenological dialectics, "as a study of the phenomenon of the poetic image" recalled by the architectural space. We do not say represents, simulates, mimics, seems, recomposes, but its scope is established in

[3] David Bestué (2016) anticipate the keys.

the *recalling* of mnemonic memories, and with them the virtual ones. Its devices are: phenomenological time, memory, material narrative, and hermeneutics. On the other hand, II) with certain structuralist doses the continuous line of social *commitment* is developed (reluctant to let the experiential machine denote different signs of materialism),

> taking a position and real commitment to all forms of connection with the problems of social environment, the only way out of the quality of the marginalized, imposed by the superstructures of the system.[4]

It is a line that sacrifices capitalist evocation and the liberal discourse implicit in technical-functional benefits, for the discourse of technical sustainability, as a giver of quality or human value. Thus they recall the most radical positions of Radical Architecture, 1965-75. To do this, they must do so without the usual means of production, or with the standard channels of communication, but through their tactical use.

This line will strive to create new information channels, and new forms, according to their recipients. All displays will be produced by *occupation* (ideological-political act of the medium) of the space, showing its contradictions. Their responses are not merchandise, but work, *co-creation* and materials, provision of services, disarticulating the economic-cultural relationship even for their part-time work and alleging the lack of work to their fellow believers. Like Santiago Cirugeda (2020) of an anti-system character. From ideological marginalization they oppose the system: he is a worker-intellectual-artist linked to a process of transformation of the relations of artistic-cultural production -their tools of resistance, direct interaction and non-verbal communication. Faced with the metaphors, or *"informal translations"*[5] of the previous line, the "blockade between different symbolic universes" is considered '. Or in another way, without mediation, producing messages for no one in particular, latent in the video sphere. In this line the new millennial generation or Gen Y: with late works by Lacaton and Vassal, and the young Izaskun Chinchilla, Uriel Fogueé, Andres Jaque, Ecosistema Urbano, Zuloark etc. Its structuralist underlay comes in this case from its political appeal, as visible as it is prone to the "pro-common", with proposals such as *urban endodontics*. Its temporary devices generate psycho-political experiential machines. The following temporary devices are used; social time, psychological time and hermeneutic.

5.4. Refraction time

In the second decade of the 21st century, with generation Z (7th gM and 4th PMT), all open lines are maintained, but under two transformative effects; the complete unfolding of the *video sphere* and the tiredness and *dissatisfaction* that traditional and reinvented sociopolitical discourses generate. Applying these two factors assumes that their *authenticity* fades because instead of making conscious proposals of their full scope, they are mediated not by their experience or the author's experience, but by the virtuality of such borrowed experience. Thus, the eventual autonomy germinates in an inexorable identity. They do not intend to establish spaces and times of their own experience, but to offer a reflection of virtualities that in turn mirror mnemonic images of other people's experiences, impossible to make their own. This leads to design *refraction* (the action is refigured by the representation, Ricoeur said); It is designed following apparent images of force, which in reality exhibit the remains of other things than those pursued, from an unconscious consciousness. In it, time

[4] Response from Marchán (1972) to Tapies' article
[5] Joseph Kosuth in "One and Three Chairs" (1965): "The art I call conceptual is such because it is based on an inquiry into the nature of art".

disappears, anchoring itself in the *eternal present*. Hence the invasion of simulations, impersonations, *freaks*, or the distorting mirrors of Eco (2012, 34), "semiotic projects through strange prostheses that generate hallucinatory functions". Such hallucinatory effects are more evident; the more political idealism underlies the structure. Its devices are mainly virtual, material, psychological and hermeneutical.

5.5. Reactionary time

The most *reactive* line against that unfolding is manifested in the "alienating neo-formalist poetics" that emerged earlier, but that is now deformed by nonsense. And this, because it escapes from the previous prefigured assignments; It is not completely structuralist, nor is it post-structuralist. It is basically reactionary with everything, but it is comforted in this *hallucinatory-experiential* drift to which subordinates or personal stories lead, seeking a return to the essential and contained. Here the activation of time is no longer relevant. This pseudo-poetic line supported by the sensitive and defined by images indebted to its power, extracted from the force and formal energy that material plastics have, contains certain mutations like most of the video sphere's time architecture towards *experientiality* different from *experience*; its ideality. This means suffocating the project to a lesser repertoire of signs that make the personal pseudo-poetic visible in an apodictic way, which leads to *figuration*. This is the reason why an eclectic or *prêt-à-porter* reading period is presented, where a wide sector of professionals wanting to occupy a space, with cloned images of variants on the same and with few nuances that extends like a new *international panorama*. Heterodox group that articulates the so-called post-conceptual art, known in Spain as the "new Madrid figuration" or neo-metaphysical art. Defined as post-abstract and anti-realistic, it is driven by *hybrid and unorthodox images*. The exhibition "Painted Architectures" (2017-18), curated by Juan Cuellar and Roberto Mollá, testifies the *dissolution of time* to this creative line. It participates in that melancholy and historical exceptionalism that Gerhard Richter highlighted, when he describes this aesthetic as one that retains the material form of an object whose previous historical function indicates other functions and another context of scope as irremediable; thereby revealing the *"representations of representation"*.

CONCLUSION

The temporary turn of the 80s brings to architecture an entire display of formal, material, haptic, optical, and phonic constructs that, in the manner of semantic tropes, inoculate projects, mobilizing time. According to its development, it incurs one of the five described modalities. The re-signified time and the re-figured time allow ideological neutrality, the displacement of the subject with its personalities and it resembles the poetic unfolding from a semiotic perspective. The rest contain transgressions of some order: imaginary, real or symbolic. Especially highlighted is an ideological contamination towards two trends: recuperate the neo-Marxist materialism at all costs and on the other hand, the liberal current, fed up with such impositions implored by ideology, allowing for contamination of the market. Both unfold to the virtualities that present a desired world.

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PAPER #7.06

AWOL: PSYCHOLOGY, BUSINESS + RESEARCH IN CONTEMPORARY ARCHITECTURAL EDUCATION

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ABSTRACT

Architectural design today is a wickedly complex and dauntingly difficult undertaking. The ethos for design activity has grown more complicated, with building and urban projects mired in legal considerations, political expectations, cultural dimensions, environmental demands and financial limitations. Architectural education desperately attempts to keep pace with the present milieu and, under ideal circumstances, to predict future circumstances. The pedagogy required to adequately prepare tomorrow's architects must, by necessity, be agile, resilient and potent. Students must not only learn technical competencies, but must be conferred the abilities to think critically, to anticipate change, to be culturally sensitive, and to be environmentally responsible. Such a deep and broad set of aspirations is not for the faint of heart. The present research, in many ways a first step forward within a broader research agenda, critically examines architectural curricula from a vantage point of societal preparedness. The paper provokes both a broader and deeper understanding of the complex landscapes of design education, with a focus on North American systems. An argument is made, based on meta-analyses and literature reviews, that present-day architectural education is deficient in three major ways. Absent without leave in modern design education & training is understanding concerning human-environment interaction (e.g., environmental psychology), business acumen (including financial awareness & fiduciary responsibility) and research skills (including both quantitative/qualitative methods as well as the need for a knowledge base to advance and apprise practice). While concerns around the subjective nature of architectural production are longstanding, patience is growing thin concerning lack of empirical grounding in design decision-making, irresponsibility in budget management of projects and arbitrary judgement around suitability, quality and appropriateness of design solutions. The author argues that psychology, business and research are key missing ingredients that must be meaningfully introduced into the curriculum. While the paper uses North American higher education as a case, relevance & implications reach out to international jurisdictions beyond. Given urgencies around climate change, health crises, global conflicts, racial injustice, resource depletion and political decay, it is essential for future architects, regardless of geography, to be educated in more meaningful, appropriate and effective ways.

KEYWORDS

Architecture; education; systems thinking; culture; complexity

INTRODUCTION

> "We must take on the work of facing our fears, opening to intimacy and vulnerability, and opening to the unknown, to surprise. We can learn to open to situations simply, without aggression or defensiveness; and open to the inside as well; the depths beyond the surfaces of all life." Glazer[1], 1999

[1] Glazer, Steven (Editor). The Heart of Learning: Spirituality in Education. Penguin Putnam Inc.: New York, 1999. Page 247

Over the past several decades we have witnessed, as global societies, a rapid increase in the severity of calamities and an exponential escalade in the complexity of our world. There are many reasons for these dramatic shifts, including the prevalence of information technology, the ease of mobility and heightened confusion around ethics. While it is undeniable that our world has always been a melange of good and bad, right and wrong, and fair and unjust, recent developments arguably put the equations off kilter and place crises on steroids. From rising conflict and erosion of human rights to climate change and pandemics we confront many unprecedented problems that challenge our conventions and threaten our existence. In earlier days many problems were grounded in local conditions and manageable both in terms of our understanding and our solutions. However, in contemporary times problems become catastrophes with increasing frequency, and often reside beyond our comprehension and outside our ability to act. Historically, universities have played important roles in society, including educating future citizens, discovering new knowledge, and serving as a sounding board & informed critic considering the past, the present and the future. Freedom of thought and freedom of expression provided academics, and by extension students, with a milieu in which to critically consider our many paths and manifold possibilities. The autonomy of the institutions translated into abilities to question the status quo, to develop alternative ways, and to imagine a different tomorrow. Within this unique environment, academics and students have been able to develop novel ways of seeing, thinking and acting that have, over time, ushered in many advancements for our people, our communities, our companies, our governments and our nations. In earlier iterations of the academy, and its curricula, the formulas and the factors seemed simpler and more straightforward. However, in our modern times burgeoning data, information and knowledge engulfs us and commonly overwhelms us. In an effort to fast-track learning and manage growth we have seen increasing specialization, departmentalization and fragmentation. The notion of a well-rounded liberal arts grounding has been dissolving, with many students now channelled quickly from high school into disciplines via direct entry programs. The value of a common core within undergraduate education has diminished, with many students locked within the walls of their baccalaureate degree for their full time at university. In many ways this pigeon-holing makes management sense given the complicated nature of higher education. However, the author argues it makes limited sense with respect to preparing future citizens to grapple with the wicked problems they stand to inherit. We need to be broadening and deepening understanding, versus being overly obsessed with narrow training and pursuing job-readiness. The present paper considers architectural education within the shifting conditions of society and given the context of new demands on higher education. It errs on the side of provocation and speculation, understanding that doors need to be open to tackle pedagogical and curricular reform. The author accepts that such preliminary posturing, by both necessity and invention, is exploratory and challenging as opposed to proving definitive and set.

1. BACKGROUND

> "The longer one listened to him, the more obvious it became that his inability to speak was closely connected with the inability to think, namely, to think from the standpoint of somebody else. No communication was possible with him, not because he lied but because he was surrounded by the most reliable of all safeguards against the world

and the presence of others, and hence against reality as such."[2] (Hannah Arendt 1977)

In the bigger picture, architecture as a discipline and profession is a relative latecomer to the academy. With roots in the guild system of Europe, with the architect positioned as a informed craftsman, knowledge was held tightly and wielded with cautiousness. In time, with the formalizing of knowledge, the role of the master builder was separated into two distinct yet complementary realms – that of the engineer (Ecole Polytechnique) and the architect (Ecole de Beaux Arts). Polarization of positions was a natural tendency. On one hand the engineer was concerned with function, pragmatics, science and technology. On the other hand the architect was focused on form, poetics, art and humanity. The means and methods of these two divisions evolved in unique directions, as did their status and standing in society.

Clearly many of the distinctions drawn between engineering and architecture are stereotyped, with caricatures developed to simply describe the roles and responsibilities of each. That said, there are real differences in the ways these groups are educated, in the values they hold and in the manner in which they problem solve. The present paper addresses the path of the architect within the academy and within broader society with an eye to understand the present circumstances and to chart some directions forward that are productive and worthwhile. The paper is most concerned with serious curricular deficiencies in place that arguably limit the architect's ability to make a profound impact and a positive difference to a world in dire need.

2. ARCHITECTURAL EDUCATION - COMPLEX + WICKED

"In that context, and in practice, the process of individual creativity was imbued with a certain utopian potential and intrinsic positive value and universal social dimensions. Today, however, that 'creativity' is reduced to a caricature of aesthetic forms, expressionistic objects or sculpture –
and is mobilized in the service of the dominant power structures."[3] (MacDonald, 2014)

Architectural education arrived late into the university compared to other fields such as theology, the humanities and the sciences. Coming from a guild and then atelier tradition, the discipline of architecture was at times difficult to understand and place within the accepted structures of the institution. Sometimes placed in art departments and sometimes housed in engineering colleges, architecture programs tended to be seen as niche and quirky. When located in art schools, the architects were viewed as objective and disciplined. When embedded in engineering faculties the architects were seen as subjective and unbridled. Perspective, of course, matters. With the increasing demands of accreditation imposed on the education of architects came heightened uniformity in the substance of the curricula and in the training of future professionals. Accreditation sought to set standards and improve quality control within the educational preparation of architects. Accreditation organizations, such as the National Architectural Accrediting Board (NAAB) in the USA and the Canadian Architectural Certification Board (CACB) in Canada, endeavored to develop guidelines to ensure consistency of content and parallel education of architects regardless of state, school and situation. A key goal was ensuring the competency of individuals while

[2] Arendt, Hannah. Eichmann in Jerusalem: A Report on the Banality of Evil. English version of the 1965 edition. Penguin: Harmondsworth. 1977. Pages 48-49.
[3] MacDonald, Robert. Foreword. In: Design for a Complex World: Challenges in Practice and Education. Graham Cairns – Editor. Libri Publishing: Oxfordshire. 2014. Page vii.

acknowledging the diversity of schools and permitting some freedom of expression.

Architecture, as a pursuit and profession, has increased dramatically in complexity. This heightened complexity ironically has been accompanied with narrowing limits to the scope of practice and a proliferation of allied disciplines within the building industry. Post-WWII architects had a relatively wide role and an impressive range of responsibilities, including in many cases work covered today by engineering disciplines. Over time, with the tendencies of society towards greater specialization, architects relinquished many activities, choosing to focus more narrowly on the 'art' of architecture. Today the scope of the architect in North America has been greatly reduced, with some government legislative bodies arguing they should not be in the business of 'licensing artists'.

3. ABSENT WITHOUT LEAVE

> "A connected curriculum would encourage the integration, application and discovery of knowledge within and outside the architecture discipline, while effectively making the connections between architectural knowledge and the changing needs of the profession, clients, communities and society as a whole."[4] (Boyer, 1996)

Without question, the education of an architect is a long, complex and demanding exercise. Architecture is a unique field in that it resides in the nexus between art and science. While a profession in its own right, Architecture is a complex melange of other disciplines, borrowing principles and practices, theories and actions from allied realms. Invoking the rigor and empiricism of science on one hand, including structures and strengths of materials, while straying into the poetics and subjectivity of art on the other hand, including aesthetics and a quest for beauty. Engineers and scientists view architects with suspicion due to the indeterminate aspects and relative subjectivity of the field. Artists perceive architects with equal misgivings, driven by a sense of the architect's finite approach and overly objective manner. Architects then dwell in this space of the in-between – neither hard science nor fine art, but perhaps a touch of both. As relative newcomers to the academy, architecture programs continue to find a forced fit in many ways. With a limited knowledge base, or at least one that is poorly delineated and infrequently acted upon, architecture is seen by some as more vocational than scholarly. While the education of architects has been refined over decades and perhaps centuries, the methods of teaching, the core of knowledge and the nature of the fit within the university remains controversial. In looking between schools of architecture in North America one is struck by commonalities, informed in large part by somewhat prescriptive accreditation standards and regimes. Whether at the undergraduate or graduate level, the diet of courses and studios is quite similar. At the heart of the teaching model is the studio, an intensive small group teaching method that relies on a master-disciple relationship and the instilling of tacit knowing. Rather than being formulaic, in a glass box sense, the studio is often an ethos of exploration, iteration, creation and testing, that is at once praised for its effectiveness and criticized for its inefficiencies. University administrators often lament the resource intensive quality of the studio, in many cases categorizing it as a lab versus a class. Surrounding the studio is a rich array of courses, in some instances referred to as 'support' courses, which serve to buttress design thinking and ground creative endeavor. These courses tend to be both stand alone ventures as well as offerings more meaningfully integrated into studio. The author has written widely about studio education, including studios that are evidence-based, culturally-focused and also comprehensive.

[4] Boyer, Ernest L and Mitgang, Lee D. Building Community: A New Future for Architectural Education and Practice. Princeton: Carnegie Institute for the Advancement of Teaching. 1996.

While the precise composition of curricula varies in some ways from school to school, the basic foundation of the education proves remarkably alike. Within accreditation there is some latitude provided for schools to celebrate their own DNA, and to express the school's character, perhaps most notably through the spectrum of electives offered. Some schools take pride in a digital focus, some in a design focus, some in a cultural focus, etc. Even with this ability to express uniqueness, accreditation demands ensure that no school deviates too far from the party line. In some ways this is understandable and positive – that is, in the assurance of quality, competencyand consistency. In other ways the accreditation overlay serves to limit experimentation, suppress identity, and restrict agility + adaptability. In reviewing the curriculum of schools at a meta-level, and considering both USA and Canadian accreditation systems, the author contends, albeit and admittedly in a preliminary and speculative sense, there are three serious and arguably debilitating omissions: psychology, business and research. In the view of the author these three areas of study are urgently needed as architects enter the workforce to confront unprecedented problems and cope with an ethos of upheaval, uncertainty and unrest. Each of these three curricular realms will be examined in detail, including some speculation on impacts through exclusion.

3.1. Psychology

Architecture is neither a fine art nor a hard science. It is, however and arguably, a social art that is first and foremost human-centric. A building is not a pure piece of sculpture – it is, to the contrary, a container for dwelling, working, playing, living, etc. Architecture exists for use by people and as such demands of the architect a solid understanding of people – their needs, their desires, their concerns, their aspirations, etc. Evidence shows that buildings, spaces and places influence, impact and inspire people. Churchill once stated that "We shape our environments and they in turn shape us". The directions of such influence can be subtle or glaring, and positive or less so, including architecture's ability to help us to heal, to improve our productivity, to amplify our learning, to heighten our happiness or to repress us. Studies have looked at notions of place, including place-making, place-attachment and place-identity. The places we live in, that we grow up in and that we have affinity for, play significant roles in the ways we view ourselves and our world. Architects have great responsibility to get design as correct as possible when it comes to human comfort in the built environment. In order to achieve such goals, the education of architects must include curriculum addressing environment-behavior studies, environmental psychology, urban sociology, cultural anthropology, etc. Many opponents to inclusion of such content in architectural curricula point to an already overcrowded array of courses on the student's plate. However, to keep such human-centric knowledge out of the education of architects is to deny the true nature of architecture as an ethos of inhabitation. It is simply irresponsible to graduate an architecture student without a solid understanding of how people react to and behave in buildings. It is neglect of duty to send students out without deep awareness of design's capacity to impact lives for better or for worse. Some schools claim this content is captured in architectural programming courses or curricular modules, which has some aspects of reality but which alone proves woefully inadequate. All schools of architecture should have dedicated courses addressing human behavior in the built environment. And in the same way that structures are often integrated into studio, environmental psychology should be a mandatory dimension of studio education. Architecture schools do not need to go it alone – they can and should collaborate with programs in psychology, sociology and anthropology. Such collaboration is both helpful and healthy, in many ways.

3.2. Business

Another realm of knowing that is commonly absent in architectural education is business – business principles, business practices, business knowledge, business acumen and so on. While many graduates of architecture schools go on to work in private practices, or eventually start their own firms, few leave the university adequately skilled and equipped to succeed in the business end of the profession. Looking over almost any school's curriculum one is hard pressed to find serious content addressing business knowledge, short of small modules embedded in professional practice offerings. While studio is the heart of the education of architects, and building designs (almost all new constructions) are the subject of the vast majority of studio exercises/ projects, very few schools require business assignments within said studios. For example, it is rare to have students run pro-forma on projects they are designing. In few cases do studio instructors require cost estimating, even order-of-magnitude, or take-offs to be addressed. Most commonly students are given free reign with respect to the cost of projects, the nature of materials, the energy loads, etc. Certainly the hypothetical aspects of studio are understandable. However, at least some of the studios within a student's program of studies, should be intensely grounded in the realities of cost, practicality, viability and buildability. Without doubt some studios should and must be free to explore the fantastic, the futuristic, the spectacular, the unbound and the unbridled. However, tempering such necessary folly must be experience in meeting budgets, in ensuring constructability and in fostering fiduciary accountability. At present such aspects of education are few and far between. Money is often seen as an unpalatable subject that contaminates the purity of the pursuit of design. Business is often seen as a burden in the curriculum and is knowledge best left to the profession to push into interns and associates as they learn the ropes. Architectural education, however, must attend to business knowledge within the confines of the degrees. The architecture schools do not need to cover this content alone – they can and should partner with business programs in exploring how architects can be equipped with skills needed to flourish financially in practice. After all, if an architectural firm is not liquid how can they realistically pursue their true desire to design & construct buildings?

3.3. Research

Due in part to the character and composition of architecture, and to an extent its public mystique, there are longstanding concerns and criticisms around the shallow nature of the discipline's knowledge base. Many decisions in design are rendered in ways that other fields view as thin or suspect. Such approaches may include intuition, tacit knowing, iteration as experimentation, precedent studies, etc. While these strategies can be, and often are, potent in their own right they tend to be insufficient given the complexities and responsibilities of contemporary building design and construction. The terminal degree in the field (e.g., BArch, MArch, etc.) has, for a very long time, been an acceptable entry into the ranks of the academy. While on one hand, historically, this was an appropriate posturing, in recent decades the call for greater research activity, higher research funding, more impactful research discoveries, etc. has clearly disadvantaged many schools of architecture. The academics within architecture programs have often struggled to secure grants and execute serious research projects, much to the chagrin of senior administrators. And while the author is quick to acknowledge the value of curiosity based research and the worth of design as research, in the present milieu architecture professors can and must do more. This inadequacy in their own research skills and acumen has naturally had demonstrable impacts on architectural curricula. In many schools the pursuit of research by, and the

imparting of research skills for, students is seen as a distraction at best and irrelevant at worst. Even in so-called research studios, or within regular studios that call for the conduct of research, this research work usually comprises only internet searches based on some key words or design precedents. Few students in professional programs (note: research or thesis programs are a different situation), whether at the undergraduate or graduate levels, have a solid grasp of qualitative and quantitative methods, know how to read and apply research findings to their design work, or even how to search periodicals for articles and papers that might strengthen their problem solving. Clients and governments today demand greater accountability and higher performance, including expectations around the deployment of evidence-based design. To be fair some professional programs contain or retain thesis components to their BArch or MArch (or DArch) programs – and in numerous instances such programs do underscore the need to deeper, more thorough and more thoughtful investigations. However, such programs tend to be in the minority with many programs opting to abandon time-intensive thesis projects in favor of migrating towards course-based curricula. Even within course-based programs, and in light of an absence of accreditation criteria mandating any real research content, there are few if any research courses and limited cases of studio engaged in what most universities would deem to be actual research. The author argues that, for many reasons, schools of architecture must include research courses, research skills, research ethics and research impacts as part of the education and training of future architects. Aside from meeting societal expectations, building research skills in our students will undeniably place them in a more competitive position to contribute to firms, to contribute to the profession, to contribute to the industry and, in the end, to contribute more meaningfully to society.

3.4. To sum up ...

Without a doubt it is a daunting challenge to have a faultless curriculum – one that is complete, one that is robust & resilient, one that covers all professional & societal needs and one that fully prepares students for graduation. The author in no way claims that any curricula can be perfect, but rather has aimed to identify perhaps the most glaring gaps in architectural curricula in North America. The selection of Psychology, Business and Research as the most pressing deficiencies in present day education of architects serves to highlight the most evident areas in need of attention – that pertain to the human-centric nature of the built environment, to the need to be financially responsible & solvent in the conduct of practice, and to meet the serious responsibility to make decisions, design and otherwise, based on evidence, facts and reality.

4. FILLING IN THE GAPS

> "In spiritual education the world comes alive. Living and education become inseparable. Self and the world become inseparable. Something is always happening that can be learned from. The only things that are required are openness and attentiveness: the allowing and examination of direct experience." Glazer,[5] 1999

Much debate has transpired over the years concerning the worth and tactics around accreditation. For sure many benefits accrue in pursuing and ensuring accreditation regimes, especially considering that in North America the profession of architecture is regulated – scope and in many cases, title are enshrined in and protected by statute (legislation). In exchange for the privilege of restricted practice, the profession, in our case architecture, must ensure competency. This competency is fostered through numerous mechanisms, including critically the delivery of sound and

[5] Glazer, Steven. The Heart of Learning: Spirituality in Education. Penguin Putnam Inc.: New York, 1999. Pages 136-137

effective education by schools of architecture. Accreditation shapes the content, consistency and consequences of education across jurisdictions, meaning that disparate schools in far removed locations produce graduates with comparable knowledge, skills and values. The author is not raising issues about the value of accreditation but does encourage the arrival of criteria (e.g., student performance criteria) and conditions that capture psychology, business and research as indispensable ingredients to a potent education in architecture. At present, in both the USA and Canada, language and intention around these three vital subject areas, in any meaningful sense, is largely vacant. In considering the robustness and tactical landscape of the architecture curriculum, it is important to understand that the most critical aspects revolve around preparedness for anticipated conditions. It is, in the author's view, insufficient to remain too connected to the past or to be too obsessed with the present. On the contrary, contemporary society is under rapid pressures to twist and turn based on unanticipated developments, demanding & dynamic needs, and shifting expectations. In order to prepare students for an uncertain tomorrow it is especially wise to build a curriculum that hits the main points. The author's inclusion of environmental psychology, business principles and research acumen, into the diet of modern architectural education, attends to this urgent need for relevancy, responsivity and capacity. The following realms pertain to an approach to curriculum building that considers indeterminacy and uncertainty.

Comprehensive Knowledge:
While the education of architects cannot be complete in exhaustive ways – time and resources operate against such grandeur – it should prove comprehensive, spanning divides between art and science, the general and the specific, the poetic and the pragmatic, the subjective and the objective, and so on. Architecture is unique, as has been previously noted, in its dwelling in the nexus of many disciplines, principles and practices. In many ways, to the author's mind, an ideal education should be comprised of a liberal arts undergraduate degree followed by a professional degree in architecture. Over these two components it is reasonable to develop knowledge that is professionally focused while also providing a well-rounded based (that contributes to awareness and responsibility on the citizen side). In those cases where the curricular sequence differs from this ideal, it is contingent upon individual schools to develop a curriculum that is comprehensive on one hand and balanced on the other.

Strategic Nimbleness:
Advanced education is not the same as technical training. Of course many critics have argued that architectural education is out of place in the university, and might better be directed to technical schools. However, the counter argument revolves around the intense complexities of contemporary society and its accompanying problems. Modern day crises are not merely about technical matters – including of course climate change and global warming. The wicked nature of problems that architects face, and not merely building challenges, demand far greater depths of understanding than technical training alone could ever provide. Many dilemmas today are as much political and cultural as they might be technical in character. Architecture students must not simply be inculcated with facts and figures but must be educated in how to learn with nimbleness and potency. Knowing where to find answers is as strategically valuable today as simply knowing answers. The explosion of data and information has made the prospects of knowing all exceptionally slim. In fact, Socrates once mused that "wisdom is knowing you know nothing". Today we are well advised to teach our students that they cannot know everything and that survival, in a professional sense, demands an ability to know

what you don't know and then determine how best to move forward with such understanding.

Professional Competencies:
In North America the profession of architecture enjoys a special status within society – depending on jurisdiction title and/or scope are protected to varying degrees. This basically means that the profession is allowed to operate in a 'closed' fashion through a guarantee of competency. In other words, the gravity of the work of designing buildings warrants extraordinary care to ensure user health, safety and welfare. To meet this expectation of competency the architectural profession deploys a multi-stranded approach, with one strand being accredited education thatcovers realms of expertise required to practice architecture. These professional competencies are numerous and serious. Relative to the present paper, the author argues that beyond the currently categorized competencies the areas of psychology, business and research must be addressed. The author is an architect and psychologist – from this vantage point he argues the societal expectation for welfare is transcended to encompass wellness. Buildings today must tackle more than egress in the event of fires – they must support inhabitants physically, socially, psychologically, culturally and even spiritually. In order to rise to this level of 'well-buildings' it is crucial for students to be equipped with competencies spanning much broader and deeper than was the case in previous decades.

Societal Understanding:
One only has to look at the past few years to grasp the volatility and unpredictability of our world and its nations. Countries that were deemed leaders only a few years back are now in chaos and turmoil. Nations that were not on any radar a few decades back are now major players who cannot be ignored. Governance that was stable a generation back now appears to be unfolding and unraveling. Polarization of populations, the rise of mob messaging and disdain for the rule of law all loom large in our lives – the university needs to prepare students to grasp such conditions and to act in positive ways to move us ahead. This obligation, and opportunity, should not concern itself with a student's major or their degree – rather, all students regardless of college, department or discipline need to be prepared to act upon graduation. With respect to the present paper, the author argues all students and all faculty need to be aware of shifting sands and should be able and willing to make a difference. The call for inclusion of psychology, business and research buttress the skills and knowledge of architecture students in weighty ways that will better equip them to tackle some of the messy problems that await them upon graduation.

Ethical Posturing:
Finally, and not the least consequential, is the need to instill in students a moral compass to help them find their way in the torrent of noise and distractions of modern day societies. The author has written widely about the need for building a strong awareness of moral action and ethical behavior within the academy (see, for example, Sinclair 2019 "The Devil's Crop") – in both the professoriate and the student body. We live in an era where lines between right and wrong are more and more blurred, the understanding of good and bad increasingly confused and the value of facts and truth decaying and dissolving. Architecture students, being educated to operate within a legislatively protected profession, have extraordinary expectations around ethics. Architectural associations, at regional levels and at national scales, clearly delineate and subscribe to codes of ethics. A solid grounding in such affairs needs to be established within architecture schools and their curriculum.

5. HOLISTIC EDUCATION IN AN ETHOS OF CRISES

> "In the beginning, new ground must be carefully prepared; the old growth and underbrush removed; the soil tilled and raked; seeds planted; fertilizer spread; water provided in adequate amounts; while the sun provides ultraviolet and infrared rays creating a warm environment. When all this has been done through long hours of labor and required intervals of germination, a new young tree emerges. Eventually this young tree will bear fruit to reward those who have labored in the vineyard. It would be foolish to chide those who are preparing the soil and planting the seed because there is yet no fruit. It would be unwise to water too much or allow the sun to parch the land. When the time has come, the fruit will be ripe and its substance will sustain those who harvest it. So it is with knowledge." Eberhard, 2007[7]

University education is not in its primary mission about training. Rather it is more rightly concerned with the discovery of knowledge, the instilling of wisdom, and the ability to effectively and creatively solve complex problems through the application of both (i.e., knowledge and wisdom). While in some instances (for example in the case of professional education) there are aspects of skill development and occupational training that need to be addressed, the fundamental focus remains on higher level thinking and more theoretical/philosophical ways of understanding our world. Advanced education, perhaps more now than ever before, must assume the leadership required to educate a next generation of students who can critically examine widespread suffering, who can imaginatively see beyond the status quo, who can devise high-impact mindsets, methods and models, and who can garner the strength and assume the risks necessary to right a ship gone widely off course. In the author's view this challenge should begin with a reconsidered system that includes, in pervasive and transcendent ways, the features of ethics, integrity, competency + wisdom. Taken together, as an integrated system, the pursuit of these qualities should better equip students to cope with a tsunami of negatively and a mountain of incomprehensible problems. This approach assumes that these features find

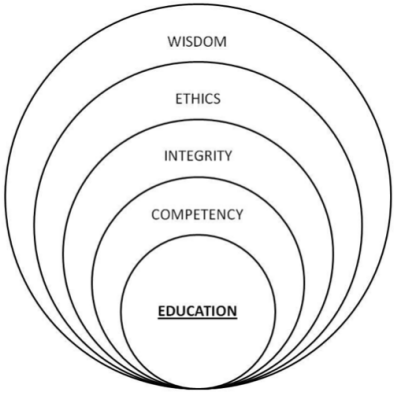

Figure 1. Holistic Model for Higher Education in a Complex World

meaningful fit and resonance within curriculum regardless of college or major. In other words, all programs of studies within the academy would set performance goals that holistically incorporate ethics, integrity, competency and wisdom. Within this mix perhaps wisdom stands out as the most challenging yet the most crucial. The researcher views wisdom as the coupling of head and heart. The university finds great comfort in affairs of the head yet struggles to embrace matters of the heart. It is easier to quantify and rationalize intellectual realms, whereas emotions present territories of uncertainty, indeterminacy

[7] Eberhard, John P. Architecture and the Brain: A New Knowledge Base From Neuroscience. Ostberg | Greenway Communications: Atlanta, GA. 2007. Page 19.

and the unknown. That said, both the pragmatic and poetic need serious adoption and conflation in order to solve modern crises and avert catastrophes downstream.

CONCLUSION

> "The essential difference between life and a machine is that a machine eliminates all idleness and ambiguity. It is constructed entirely on the basis of physical connection, functional, rational principles, and efficiency. In contrast, life includes such elements as uselessness, ambiguity, the unknown and idleness. It is a flowing interrelation continuously creating a dynamic balance." - Kiso Kurokawa[8] (1995)

Architectural education, and indeed advanced education writ large, is in urgent need of reform and redesign and in particular in ways that better equip graduates to address levels of turbulence, trials and tribulations unprecedented in severity and consequence. In considering the education of architects (within North American higher education systems), the present paper has delineated many circumstances, demands, obstacles and opportunities that should be factored into equations for teaching and learning. The author delineates, in an initial and exploratory sense, some of the dimensions of such education yet underscores further investigation is both warranted and timely. Attention to the curriculum in accredited schools of architecture illuminates critical deficiencies that, if left neglected, hold promise to further erode the profession and weaken its practice. Of special interest in the present paper are three realms that straightaway require introduction and integration into the curriculum of architecture schools (both accredited and not): namely, psychology, business and research. While the author acknowledges, by way of a caveat, that some schools do include aspects of these disciplines and spheres of knowledge, there is not consistency in substance, intention and content across the academy. Accreditation regimes must more aggressively define and delimit courses and student performance criteria that attend to student understanding of human behaviour in the built environment, of business principles + practices to ensure financial responsibility & stability, and of research methods and means essential to both the discovery + appropriate application of new knowledge. In our current times, where we face climate change, global pandemics, social unrest, escalating conflict and growing gaps between people, to name but a sampling, it seems urgent for architects, and architectural education, to be better prepared for an uncertain, confusion and risky tomorrow.

[8] Kurokawa, Kisho. "From the Age of the Machine Principle to the Age of Life Principle". In *The Master Architect Series: Kisho Kurokawa.* Editor: Stephen Dobney. Images Publishing Group: Victoria, Australia, 1995.

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PAPER #7.07

DESIGN RESEARCH AND A SHIFT IN ARCHITECTURAL EDUCATION AND PRACTICE

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ABSTRACT

Research, once associated only with academia, now equally connects to learning and practice in architecture, as focus has shifted towards a wider design research community. Research has become inclusive of formerly marginalised areas such as process-oriented and practice-based research in the arts and humanities as well as applied commercial research undertaken by industry. Providing a first study of this shift, this paper explores why design research is of growing importance to architecture. It systematically analyses a selection of current cases at the intersection of architectural practice and education within the UK to survey existing design research approaches, and asks: How can design research transform and create new architectural practices and forms of education? Following this question, the paper discusses some of the design research models used across architectural practice and education.

KEYWORDS

Design research; architectural education; architectural practice.

INTRODUCTION

Research in architecture has long been associated with design research (Archer 1978, Frayling 1993, Till 2005, Geiser 2008, Fraser 2013). Known as 'architectural design research', it highlights the design and research processes and outcomes useful for the creation of projects or a broader contribution to design thinking (Fraser 2013). This definition corresponds with new agendas and frameworks by international research institutions in support of a diversification of research and knowledge exchange.

Design research is increasingly recognised as essential to disciplinary development and architectural education and training. For example, it is one of architecture's core research activities (Rendell 2013) at both graduate and undergraduate levels. In 1999, the Bologna Declaration (Joint Declaration of the European Ministers of Education) caused a shift in education policy within Europe towards research in design-oriented disciplines (Geiser 2008). In the following years, design research in architecture was internationally acknowledged and included within the UK Research Excellence Framework (REF), the Excellence in Research for Australia agendas, and the research framework of the European Association of Architectural Education (Fraser 2013). This year, the European League of Institutes of the Arts (ELIA) presented the Vienna Declaration on Artistic Research to support the establishment of research in all disciplines of art practice including architecture.

Architecture is regarded as a research discipline in its own right (Till 2005), and research is considered to be essential to architectural practice (RIBA 2014c). In 2016, the Royal Institute of British Architects (RIBA) received the highest number of submissions to the President's Awards for Research (RIBA 2017), revealing a growing interest not only in academic research but also by architectural practices to secure funding to conduct research. Therefore, the research community

and audience have become larger, and the distinction between academia and practice lessened. Moreover, the scope and scale of the topics covered expanded and diversified in 2016, while previously most research was project-focused and technical in nature (RIBA 2014c).

Considering these changes, this paper studies how design research transforms architecture. Part of a larger study, this paper will discuss how design research affects architectural practice and creates new forms of education. Based on a survey of current practices and studios within London in the UK, it will further provide a more detailed analysis of selected cases and the differences they present of how design research is understood.

1. HOW DID RESEARCH EVOLVE IN ARCHITECTURAL EDUCATION AND PRACTICE IN THE UK?

For the UK Research Excellence Framework (REF) that replaced the previous UK Research Assessment Exercise (RAE), the definition of research changed from 'an original investigation undertaken in order to gain knowledge and understanding' (RAE 2005) to 'a process of investigation leading to new insights, effectively shared' (REF 2019), with several interim modifications occurring between 2001 and 2019. A comparison of these definitions shows a significant transformation in the understanding of the value of research and the research community over the last two decades. The change also indicates that there is a shift in focus from the academic community to a wider audience, the public. Design research is becoming more important with this shift, as it tends to have a direct impact on practices and practitioners and is directed towards a larger public audience and not just academics. Furthermore, there is a growing emphasis on the process of research and how it is shared, while at the same time still meeting the criteria of 'originality', 'significance' and 'rigour' used in the assessment of research quality. The new definition manifests that world-leading research can include formerly marginalised areas such as process-oriented and practice-based research in the arts and humanities as well as applied commercial research undertaken outside academia in industry.

Research is associated with postgraduate-level programs in architecture and a requirement specified by the RIBA. The RIBA criteria for Part 2 (master level) UK courses in architecture, which it validates with the Architects Registration Board's (ARB), emphasise a 'critical understanding of how knowledge is advanced through research to produce clear, logically argued and original written work relating to architectural culture, theory and design' (RIBA 2014a, RIBA 2014b). This criterion unfolds the significance of research in architectural education by identifying it as a necessity to advance professional practice.

Design is also increasingly regarded as important in higher research degrees. Some institutions have started to define PhD-level projects through design research, often coined 'PhD by Design', 'PhD by Practice', or 'Practice-based PhD'. For example, currently nine PhD programmes with practice-based pathways in architecture are advertised online within the UK by the Architectural Association, Edinburgh College of Art, Goldsmiths (University of London), Royal College of Art, The Bartlett (University College London), Manchester School of Architecture, University of Edinburgh, University of Nottingham, and the University of Brighton. At the same time, most other universities offer an option to integrate design research into PhD work.

In parallel, there is a growing interest in securing funding for research by professional practices. Architectural practices typically apply for research funding by collaborating with a university or as part of a knowledge transfer partnership (RIBA 2017). The new definition of research for the UK REF, which

is run by UK Research and Innovation, and an expansion of subject coverage for quality-related funding from the UK research councils are encouraging practice-based research. This expansion supports architecture – which is deemed unique as a subject and a discipline (Rendell 2004), as it brings together different modes of research that are often kept apart – to develop practice-based and practice-led forms of research and provides possibilities for new interdisciplinary research.

Architectural design research and skills are also recognised as essential to economic growth. Design skills contribute 12% to the total UK gross value added, and their contribution to the economy rose by 47.2% in the architecture and built environment sector from 2011 to 2015 (Design Council 2018). In particular, architecture schools significantly contribute to a growing pipeline of design skills that benefit not only the design economy but the UK economy as a whole. According to the RIBA Education Statistics of 2016/17 (RIBA 2018), there is a long-term growth in the number of student applications to architecture schools. However, the Design Council reported in 2018 that 82% of people with design skills gained in architecture and the built environment, work outside these disciplines in other design roles (Design Council 2015). It shows that the current skillset of architecture graduates is also effective in other industries.

To summarise, one can say that architectural design research in the UK is currently encouraged by the REF definition of research, RIBA and ARB programme validation criteria, a PhD-level focus on practice-led and practice-based research and the UK research councils' quality-related funding eligibility criteria. Furthermore, the contribution of design skills gained in architecture and the built environment studies to the UK economy is recognised as essential.

2. CURRENT UK LANDSCAPE IN ARCHITECTURE: PRACTICE, RESEARCH, STUDIO

New models of learning and practicing in architecture are encouraged and reformulated through collective processes of learning and design research (Geiser 2008), which address an audience beyond just the academic studio and professional practice (Lawson 2002). New learning and practice approaches consolidate the emphasis of the UK REF on research process and impact, an understanding of research that can be seen reflected in the professional architecture course validation criteria of the RIBA and ARB.

In recent years, architects have become progressively interested in design research in both their practice and teaching as well as the wider societal impacts it can create. Practitioners are increasingly taking part in postgraduate-level teaching as studio tutors, are involved in funded research projects and participate in exhibitions and publications. Design studios thereby provide a valuable ground to test activities at the intersection of learning, research and practice. To study this in greater detail, the paper considers necessary the following survey of postgraduate-level architectural design studios.

In the UK, there are currently 44 Schools of Architecture offering RIBA/ARB Part 2 validated courses at master's degree level. The professional advancement offered by Part 2 studies seems to attract the majority of students after passing their Part 1 and having taken a year out. The number of students entering RIBA validated Part 2 courses in 2017/18 was 2,167 (RIBA 2019). This number grows slightly year on year, but for the academic year starting 2017, it is below the number of graduates who completed their Part 1 studies in 2015/16 (2,973). The number of new entrants from outside the UK to first year Part 2 was 734. Thus, around half the students passing their Part 1 in 2015/16 examination must have decided to continue

School	Programme	Architectural Design Studio	Studio Tutors/Associated practices	AP	UK	CP	T	R	I	Int
The Royal College of Art (RCA)	MA Architecture (13 Unit)	ADS0	Steve Salembier (Bildraum)	•				•		•
			Paul Sheppeard							
		ADS1	Maria Paez Gonzalez (Foster + Partners)	•	•	•			•	
			Douglas Murphy	•	•	•	•	•		
			Andrea Zanderigo (Baukuh)	•		•			•	
		ADS2	Ahmed Belkhodja (Fala Atelier)	•		•	•	•	•	
			Diana Ibáñez López (The Why Factory)							
		ADS3	David Knight (DK-CM)	•	•	•		•	•	
			Daniel Fernández Pascual, Alon Schwabe (Cooking Sections)	•	•		•	•		•
			Tom Greenall (DSDHA)	•	•	•	•	•		•
		ADS4	Matteo Mastrandrea (Es Devlin Studio)							
			Nicola Koller							
		ADS5	Christopher Dyvik, Max Kahlen, Isabel Pietri (Dyvik Kahlen Architects)	•	•	•	•	•	•	•
		ADS6	Clara Kraft, Satoshi Isono (Kraft Isono)	•	•		•			•
			Guan Lee (Grymsdyke Farm)	•	•		•	•	•	•
			Marco Ferrari (Studio Folder)	•				•	•	
		ADS7	Elise Hunchuck							
			Jingru (Cyan) Cheng							
			Kamil Hilmi Dalkir							
		ADS8	Marina Otero Verzier					•	•	•
			Ippolito Pestellini Laparelli (OMA)	•		•		•	•	
			John Ng (Elsewhere Architecture)	•	•		•	•		
		ADS9	Zsuzsa Péter (Farshid Moussavi Architecture)	•	•	•		•	•	
			James Kwang Ho Chung (Hopkins Architects)	•	•	•				
			Gianfranco Bombaci, Matteo Costanzo (2A+P/A)	•		•	•	•		
		ADS10	Francesca Romana Dell'Aglio							
			Davide Sacconi							
		ADS11	Renaud Haerlingen Victor Meester (Rotor)	•		•	•	•	•	
			Livia Wang							
		ADS12	Benjamin Reynolds, Valle Medina (Pa.LaC.E)	•	•		•	•	•	
		Unit 10	CJ Lim (Studio 8 Architects)	•	•				•	•
			Simon Dickens (Youmeheshe)	•	•	•	•	•		
		Unit 11	Laura Allen and Mark Smout (Smout Allen)	•	•		•	•	•	
		Unit 12	Elizabeth Dow and Jonathan Hill							
		Unit 13	Sabine Storp and Patrick Weber (Storp Weber Architecture)	•	•	•	•			
		Unit 14	Jakub Klaska (ZHA)	•	•	•		•	•	
			Dirk Krolikowski (DKFS)	•	•	•	•	•		•
		Unit 15	Max Dewdney (Max Dewdney Architects)	•	•	•			•	
		Unit 16	Matthew Butcher	•	•		•	•	•	
		Unit 17	Yeoryia Manolopoulou (AY Architects)	•	•	•		•	•	
			Nial McLaughlin (Nial McLaughlin Architects)	•	•	•		•	•	
		Unit 18	Ricardo de Ostos (NaJa & deOstos)	•	•		•	•		
			Isaie Bloch (Eragatory)	•	•		•	•		
		Unit 20	Marjan Colletti (Marcos and Marjan Architects)	•	•		•	•		
		Unit 21	Javier Ruiz							
			Abigail Ashton, Andrew Porter (Ashton Porter Architects)	•	•	•			•	
			Tom Holberton (SoHo+Co)	•	•		•			•
		Unit 22	Izaskun Chinchilla Moreno (Izaskun Chinchilla Architects)	•		•	•	•		
			Ovalle Costal (Wilkinson Eyre Architects)	•	•	•			•	
		Unit 24	Penelope Haralambidou and Michael Tite							
		Unit 25	Emma-Kate Matthews	•	•	•	•	•		•
The Bartlett (University College London)	Architecture MArch (ARB/RIBA Part 2) (14 Unit)									

School	Programme	Architectural Design Studio	Studio Tutors/Associated practices	AP	UK	CP	T	R	I	Int
The Architectural Association (AA)	AA Diploma (MArch) (21 Diploma Unit)	Diploma 1	Martin Jameson (Serie Architects)	•	•	•	•	•		
			Miraj Ahmed							
		Diploma 2	Lara Lesmes & Fredrik Hellberg (Space Popular)	•	•	•	•	•		•
			Christina Varvia, Merve Anil, Eyal Weizman (Forensic Architecture)							
		Diploma 3		•	•		•	•	•	•
		Diploma 4	John Palmesino, Ann-Sofi Rönnskog (Territorial Agency)	•	•			•	•	•
		Diploma 5	Umberto Napolitano, Andrea Guazzieri(GFC Architecture)	•		•	•	•		
		Diploma 6	Guillermo Lopez Ibañez (MAIO)	•		•	•	•		
			Jack Self (REAL Foundation)	•	•			•		
		Diploma 7	Hamed Khosravi, Platon Issaias							
		Diploma 8	Rok Oman, Špela Videčnik (OFIS)	•		•		•		
		Diploma 9	Stefan Laxness, Antoine Vaxelaire	•		•				•
		Diploma 10	(TOI-T) Carlos Villanueva Brandt Architecture	•						
		Diploma 11	Shin Egashira							
		Diploma 12	Inigo Minns, Ivan Morison, Alexandra Daisy Ginsberg							
		Diploma 13	Bostjan Vuga (SADAR+VUGA)	•		•			•	
			Alvaro Velasco							
		Diploma 14	Pier Vittorio Aureli (Dogma)					•		
			Maria Shéhérazade Giudici							
		Diploma 15	Sam Chermayeff (June 14 Meyer-Grohbrügge & Chermayeff)	•		•		•	•	
			Lucy Styles (SANAA)	•		•			•	
		Diploma 16	Ila Beka, Louise Lemoine (Beka & Lemoine)	•				•	•	•
			Gili Merin							
			Gabu Heindl (GABU Heindl Architektur)	•		•	•	•	•	
		Diploma 17	Eleanor Dodman (Eleanor Dodman Architects)	•	•	•		•	•	
			Liza Fior (muf architecture/art)	•	•	•		•		•
		Diploma 18	Aude-Line Dulière, James Westcott, Lionel Devlieger, Maarten Gielen (Rotor)	•		•	•	•	•	
		Diploma 19	David Kohn, Bushra Mohamed (David Kohn Architects)	•	•	•		•	•	
			Selva Gürdoğan, Gregers Tang Thomsen (Superpool)	•		•		•	•	
		Diploma 20	Jonathan Robinson (Civic)	•	•			•	•	•
		Diploma 21	Tatjana Crossley Didier Fiúza Faustino (Mésarchitecture) Anna Muzychak			•			•	•

Table 1. Postgraduate architecture programmes and studio units leading to professional qualification (ARB/RIBA Part 2) in selected schools of architecture in the 2019/20 academic year.
AP: Architectural Practice, UK: UK-based, CP: Conventional Practice, T: Teaching, R: Research, I: Impact, Int: Interdisciplinarity

Part 2 studies in the following year after having taken a year out for Stage 1 practical experience (with a minimum 24 months work experience required before taking the Part 3 examination and fully qualifying as an architect).

London has the leading postgraduate architecture schools using design research and to analyse the current landscape of architectural design research in higher education institutions, three schools of architecture are selected among them. Choosing the Architectural Association, the Bartlett and the Royal College of Art provides a cross-section of leading schools of architecture within very different contexts. The AA is a private non-research institution, the Bartlett is one of the major centres for

research, and the RCA is a research intense art and design school with only postgraduate students.

In the 2019/20 academic year, there were 48 units/design studios in postgraduate architectural programmes leading to professional qualification (RIBA/ARB recognised) at the Royal College of Art (13), The Bartlett (University College London) (14) and the Architectural Association School of Architecture (21) (Table 1). In these studios, the total number of associated practices are 60. 89% (43 of 48) of the studios are run by architectural practitioners, of which 63% (38 of 60) predominantly work on building design, therefore, can be considered 'conventional' architectural practices. 63% (38 of 60) of the practices are based in the UK and 50% (30 of 60) of them state that their teaching is an integral part of their practice.

75% (45 of 60) of the practices explicitly refer to research as a learning strategy or associate their practice with research. 32% (19 of 60) of the practices define their practice as interdisciplinary, and 55% (33 of 60) frequently disseminate their work through publications and exhibitions to reach a wider public. All these numbers are based on the written statements given by the practices within their separate practice descriptions online. However, it is likely that more practices see their work fall into categories of practice-based research, interdisciplinarity and engagement with public audiences. Thus, these numbers are only an estimate of the current research landscape within postgraduate architectural design studios in parts of London.

3. HOW CAN DESIGN RESEARCH CONNECT ARCHITECTURAL PRACTICE AND EDUCATION?

Research-led teaching in the MA Architecture programme at the Royal College of Art (RCA) is one of the prominent examples connecting learning and practice in a Part 2 course. Validated by the RIBA and ARB since 1983, the programme philosophy responds to RIBA criteria by fostering independent postgraduate research and experimentation in design with a strong connection to practice and the material reality of the discipline.

In the 2019/20 academic year, the MA Architecture programme offered 13 different Architectural Design Studios (ADS) that resonate with the key research themes of the School of Architecture: Architecture and Social Movements, Institutional Forms and Practices, Intergenerational Cities and Climate Justice. As stated in the Programme Specification 2019/20, each ADS has unique thematic interests and offers a 'Live Project' in alignment with their studio brief and agenda. The ADS structure is based on peer learning, with first- and second-year students working alongside one another. Furthermore, second-year students are required to prepare an Independent Research Project, which is tutored through the ADS and relates to its specific research agenda and studio brief.

ADSs provided a valuable context for this study. In parallel to the programme philosophy, all ADSs at the RCA are run by professional practitioners, and 69% of them are associated with 'conventional' architectural practices (9 of 13). Based on how they describe themselves online, all of the studios explicitly use research as a learning strategy, or they associate their practice with research; 46% (6 of 13) of the studios define their practice as interdisciplinary and 61% (8 of 13) of the studios frequently disseminate their work through publications and exhibitions (Table 1).

To understand better the intersection of learning, research and practice, ADSs in the MA Architecture programme at the RCA were observed during their introductory presentations, Work-in-Progress show and the RCA2020 graduation show in the 2019/20 academic year. In the introductions at the beginning of the year, ADS tutors presented fully-developed briefs suggesting a variety of themes, sites, methods, schedule and external collaborations, which later reflected on the studio outputs exhibited in the work-in-progress and graduation shows.

ADSs differ in terms of their process-driven, output-driven and impact-driven focus. To discuss these different strands of design research they represent, ADS3, ADS6, ADS9 and ADS11 were selected for further observation during their pre-exam reviews before the Final Examination. Observations were undertaken on different days within a remote learning environment due to Covid-19 outbreak measures. For this study, only second-year students' work was reviewed, which were 22 presentations in total. 68% (15 of 22) of these students completed Part 1 in the UK and 32% (7 of 22) had gained their undergraduate degrees outside the UK.

During their pre-exam reviews, all students presented their work in the format of a research book, a design portfolio and slides, and often an additional medium relevant to their studio focus. Examples of this medium are a web platform, an Instagram page, a short film, a simulation, or a digital animation. Students introduced their design research process, stating a research question, methodology, a project brief and a design proposal, often including multidisciplinary considerations. The importance of these elements differed according to the studio approach adopted by ADS tutors.

ADS3 'Refuse Trespassing Our Bodies: Metabolising the Built Environment' is run by Daniel Fernández Pascual and Alon Schwabe of Cooking Sections. Cooking Sections is a research-based practice that explores the overlapping boundaries between visual arts, architecture, ecology and geopolitics. In 2019/20, ADS3 investigated synthetic pollutants and explored the spatial implications and circular trajectories of these substances. Similar to Cooking Sections' own design research approach, all studio projects addressed issues of locating and investigating a present pollutant, and tracing and bringing into view their spatial implications as well as their sociological, political, metabolic, environmental and ecological impact. Consistent with their chosen dissemination models, students presented their work through performance, mapping and video. Cooking Sections' practice model sets an example for design research with value to policy making and promotes an artistic focus in the studio work.

ADS6 'The Deindustrial Revolution – Garden of Making' is run by Clara Kraft and Satoshi Isono of Kraft Isono, and Guan Lee of Grymsdyke Farm. Kraft Isono is a multidisciplinary film and architecture studio, whereas Grymsdyke Farm is a research facility, fabrication workshop and live-work space that was established by Guan Lee. In 2019/20, ADS6 studied the theme of deindustrialisation and students explored potential contradictions and inconsistencies of human and non-human ecologies in relation to craft and making. The projects varied in spatial, temporal and practical contexts, as did the methods of investigation, which made use of performance, field recording, 3D scans, archival material, poetry, models, prototypes, interviews and photography. All students produced animations and films as part of their studio outputs. Diversity in topics, locations, tools and methods as well as multiple iterations and rigorous use of animation brings together the multidisciplinary approach and specialisation of Kraft Isono and the research and fabrication background of Lee. Their studio focus underlines craft and making as a design research approach.

ADS9 'Aura – A Call for Open Architecture' is run by John Ng, Zsuzsa Péter and

James Kwang Ho Chung. All tutors are practicing architects and Ng also runs a multidisciplinary practice called Elsewhere. In 2019/20, ADS9 investigates architectures of openness with a particular interest in the modes of co-existence. The students' projects explored various spatial contexts and scales in which design proposals can achieve societal, political, cultural and economic impact. Students developed their work through material experimentations, spatial explorations and environmental analysis, and presented their work through web platforms, models, poetry, videos, collages and architectural drawings.

ADS11 'Already There' is run by Renaud Haerlingen and Victor Meester of Rotor with Livia Wang. Rotor is a cooperative design practice that investigates the organisation of the material environment. They have a spin-off project called Rotor DC that facilitates the reuse of construction materials by dismantling, conditioning and selling them. In 2019/20, ADS11 examined practices of deconstructing existing architectures, working with a series of sites and collaborators to develop an understanding of the methods and design possibilities deriving from dismantling and reuse. Students investigated the regeneration of Aylesbury Estate in South East London. Their various proposals involved experimenting with hyper-density, inclusive renovations and reclaiming dismantled materials. The life cycle of materials, residents survey, speculations, learning from demolition, construction and renovation processes were their tools and methods of investigation. Rotor's and Rotor DC's influence is highly present and creates a practice-based focus in the studio outputs.

Evidently, ADS3, ADS6, ADS9, ADS11 tutors have different approaches to research in architecture. ADS3 have a process-driven, artistic focus aiming impact on ecology and geopolitics. ADS6 also have a process-driven research understanding, but they prioritise craft and making through various medium. ADS9 has an output-driven research understanding with a focus on wider societal impact, whereas ADS11 has a practice-based focus with a specific interest in dismantling and reuse. However, design research is an integral part of connecting their teaching and practice in all of them. Their practice methods highly influence the studio works in terms of research topics, research methods, project development and outputs.

CONCLUSION

Over the last decade, professional practice and research and learning in architecture have become integrated. This recognised a new international understanding of research and a growing importance of design research, which has fostered interdisciplinary collaborations, new research communities and a wider societal impact. Several factors drive this transformation and can be summarised as follows:

- Expanded subject coverage and range to include design within established research frameworks.
- Expanded subject coverage and range to include design in quality-related funding from UKRI research councils.
- New validation criteria by professional bodies in support of research.
- PhD-level focus on practice-led and practice-based research projects in higher education institutions.

This study shows that practitioners that internalise design research in their teaching and practice represent a majority among tutors of postgraduate architecture design studios in London. They have either process-driven or output-driven strands of design research, they are interested in creating wider societal impact and they are highly influential. Further studies are essential to analyse how this influence and growing importance of design research transforms design practice, learning and research in architecture. One

area of research is to conceptually frame and analyse the difference of research processes, outputs and impact in practice and academia. Another is to undertake qualitative research to understand how different practitioners experience design research and the transformations it brings to industry. Therefore, following this paper, a critical reading will be undertaken within a conceptual framework and structured interviews will be conducted with practitioners to study these influences in greater detail.

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PAPER #7.08

RENEWING DESIGN PRACTICE VIA A DIACHRONIC STUDY OF TEKTON AND ARKITEKTON PRACTITIONERS

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ABSTRACT

The Architect Peter Clegg, of Fielden Clegg Bradley Studios remarked to me in 2006, that it is the very practice of Architecture that needs to be reformed, not just the designs, forms and materials used for construction. This paper will review opportunities for different reform processes and networks, focused on renewing and incorporating into current design/construction practices, cooperation and authentic work with construction craftspersons as co-creators in Design Participation Teams or Conservation Participation Teams. The paper will review the history of such practitioners from European history, such as the Tektons and Arkitektons and look at possible cognates in non-Western cultural histories. Historian Jonas Holst, at Universidad San Jorge has written an important introduction to these key members of the construction team in history: The *Fall of the Tektōn and The Rise of the Architect: On The Greek Origins of Architectural Craftsmanship*, published at the EAHN website: https://journal.eahn.org/articles/10.5334/ah.239/ This paper will further review current practitioners that have taken on these roles and how other Architects can work with these professionals or take on these roles/responsibilities themselves.

KEYWORDS

Participation; tekton; arkitekton; intangible heritage; sustainability.

INTRODUCTION

Despite claims, made by this conference convening committee, that a new generation of architecture students and practitioners, "….is characterized by…. an inclusive, transversal and revisionist nature," which includes, "….feminism, gender, childhood, shelter, migration, wealthy, transversality, glocality, interculturality, multiculturality…." This set of idealistic concepts seems to leave out what we propose are key members of the Design/Conservation Team (DPTs or CPTs), who deliver the built environment, such as the craftspersons performing the making of settings and artefacts. Further, the above list of concepts seems to be overly ambitious and would be difficult for most individual designers and craftsperson to fully encompass, understand, let alone take on and authentically accept. The conveners further challenge this conference and the profession to: Explore the role of the city and regain the, "….leading role that architects should have in its design.While some authors have proposed a more nuanced view of the Architect's actual and conceptual leading role,[1] we agree that the Architect (or *Architekton* in ancient Greece and in pre-Socratic Greece, or *Tektons*, sometimes

[1] See for example Foster, Hal. 2013. The Art-Architecture Complex. London: Verso. in toto and the review by Rowan Moore in The Guardian, The Art-Architecture Complex – Review. Published 16. September, 2011 accessed 27. Feb., 2020 https://www.theguardian.com/books/2011/sep/16/art-architecture-complex-foster-review

written *Tektones*), as an individual player and as representing the institution of the profession, do play relevant and helpful roles in the building professions. Architects often do work as an intermediary, multi-disciplinary 'bricoleur' and advocate for the interests of the diverse group of community stakeholders, landowners/clients, the aesthetics/beauty and environmental health and welfare of the built environment and the general stability of the planet's ecology. As one way of regaining the "leadership" role in designing cities and of maintaining the key relationship to the urban peripheries (and we would add rural regions and wildernesses), we propose to work at enabling and enquiring reflexively into the *reformulation* of the profession of architecture itself, mainly through authentic efforts at inclusivity, listening, active questioning and reflective interaction and collaboration with all the members of the DPTs and CPTs. . This includes opening up to learning and teaching in convivial and collaborative relationships with often neglected members of the profession, for example skilled crafts- and tradespersons and their associated institutions which make the physical objects from the designers' concepts.

We furthermore propose that this inclusion of all members of the construction sector, including skilled tradepersons, into the multifarious working process of architectural practice is in line with its own age-old traditions, across many different cultures, places and time periods, even up to the present. For example, many well-known Architects in ancient Greece and Rome based their know-how on the archaic arts of tectonic craftsmanship, including their conceptual-intellectual knowledge and also, the knowledge, creativity, manual dexterity, and facility with formulating buildable, repairable and common-sense constructions to further programmatic and aesthetic purposes, or to use ancient terms, their senses of *phronesis, techne*, and *ars* (the ancient term for productive making, which came to be known as our modern "art" with its more aesthetic connontations)[2]. Most of these Architektons, were first-class craftsmen themselves, who possessed a detailed hands-on knowledge of materials, their selection, prudent material combinationsand highly developed, diverse manual dexterity skills, to cut, shapeand combine materials in order to create well-wrought buildings, landscapes, infrastructures (fortifications, roads, and so on), and interior furnishings. , They also mastered over many years of *apprenticeship* and *mastery-as-practice*, the essential skills of being auto-didacts while at the same time having the humility and 'teachability' to apprentice to older experts during their early training. Many of these individuals even had their own forms of inclusivity, in their acceptance and cooperation with migrant craftspersons from other racial backgrounds, cultures and nations, such as the mobility of craftspersons between the Mycanean, ancient Greek and Levant regional cultures, which contributed to their skills mastery and their ability to organize, design and construct structures with remarkable components, such as the 100 ton lintel blocks of some Mycanean monuments (approximately 90.7 metric tonnes).[3] These crafts/design mastery *communities of practice* helped lay the foundation forthe flourishing and maintenance of new and diverse Mediterranean societies, up to, during and beyond the time of Homer, or the 8th Century, B.C. . At some point,, from approximately the middle of the 6th Century B.C. the building projects, which came to define the landscape of the Hellenic and Roman world, became so large that new leading supervisors were needed to project, oversee and orchestrate the whole enterprise. The *tektones* became

[2] See Blockley, David. Practical wisdom and why we need to value it. OUPblog. Published July 11, 2014. https://blog.oup.com/2014/07/practical-wisdom-vsi/ accessed 27. Feb., 2020.

[3] See the articles on Ancient Mediterranean Civilizations and Architecture, for ex: https://en.wikipedia.org/wiki/Mycenaean_Greece accessed 29. February, 2020 and Burkert, Walter. 1998. The Orientalizing Revolution Near Eastern Influence on the Greek Culture in the Early Archaic Age. Cambridge, MA., U.S.A.: Harvard University Press. (rev. ed) ppg. 9 – 24.

architektones, the leaders of craftspeople, the organizers of the construction works, acting as liasons to the procuring powers and socio-political hegemons financing the works and as designers of the structures.Since this rupture in ancient Greece a gap has opened up within construction sector, between designers, craftspeople and, at some point in the 19th century, engineers.

Leaving out skilled trades- and craftspeople from architectural practice and the broader DPT/CPT group of collaborators, as often happens today, thus creates anunfortunate and unnecessary rupture within architectural practic itself between designers and engineers, on the one hand, and craftspeople, on the other hand. The rupture thus seems to have contributed to a cleaving of the functional roles and status levels of the ancient Tektones into three legally defined institutionalized 'professions'. Following the ancient etymology of *Architect*, Αρχιτέκτων,[4] it could be said that the leaders become separated from the people of craft and trade, thus cleaving αρχή and *tektōn* in to two. [5] This rupture or separation often leads to delays and mistakes in the working processes and even sometimes lead to an antagonistic relationship among the members of the design and construction teams. It is not out of a nostalgic desire, or normative historicist motive, to revive ancient and historical era traditions that we bring tectonic craftsmanship into the discussion in order to 'heal' this relationship. Rather This enquiry stems from a sincere concern for architecture as a multi-faceted discipline, containing a rich variety of knowledgeable professionals working together, based also on a diversity of current practical and scholarly efforts: These include several applied scientific and artistic research efforts and work in the design research and professional practice of architecture fields.

Examples include several scientific fields actively seeking out research questions and learning from the past, as in the multi-disciplinary Climate Culture Catastropher Network ,[6] led by archaeologist Felix Riede at the University of Aarhus. Also, the cognitive sciences are highly interested in design and the human perception of environments, since much recent research into embodied and social cognition takes as a necessary component of thought and 'mind,' the physical body and especially the active body, with goals or purposes, in relationship to other thinking agents.[7] Such valorization of embodied and social cognition that enables both ethical and at the same time effective and efficient construction practices is all the more critically important now that AI and parametrically defined agent systems and robots are being used in design studios and on the building site, with obvious consequences for the loss of human employment, mistakes due to non-relevant software selection, machine 'glitches' or 'buggy' software, and possible unintended consequences, such as has already happened with a reported casualty from the interaction between an AI controlled robot and humans at a fabrication shop floor.[8]

Further examples are authors working in professional design and built environment research to learn from the past, include the knowledge of indigenous and traditional cultures which encompass oral and embodied/social learning, in addition to conventional, Western models of scientific discovery, such as the work of Rudofsky, Weber, Sayigh, Mileto, Van Beek, Oetelaar,

[4] See Holst's key review and introductory paper at the EAHN journal website: Holst, Jonas. 2017. The Fall of the Tektōn and The Rise of the Architect: On The Greek Origins of Architectural Craftsmanship. Architectural Histories 5(1). accessed 15. Feb., 2020. https://journal.eahn.org/articles/10.5334/ah.239/

[5] Architect can be written in Greek script as: Αρχιτέκτων. Architecture itself, its institutions and artefacts, thus have contained within its Greek root word: craftsmanship, as in αρχή = first and τέχνη = craftsmanship = architecture. See http://www.hellenicaworld.com/Greece/Architecture/en/GreekAncientArchitecture.html accessed 15. Feb., 2020

[6] See the website: https://c3net.au.dk/ their aim to - is to bring together an interdisciplinary team of researchers concerned with the human impacts of climate change and extreme environmental events in the past – as well as in the present and future. C3NET aims to create and catalyze a Palaeoenvironmental Humanities research, education and outreach cluster at Aarhus University and beyond.

[7] Sutton, John. 2010. Exograms and interdisciplinarity: history, the extended mind and the civilizing process. In The Extended Mind. Ed: Richard Menary. Cambridge, MA., U.S.A.: MIT Press

[8] Asimov's Laws of Robotics are often used in AI work. https://en.wikipedia.org/wiki/Laws_of_robotics accessed 2. March, 2020

Guidoni, Benjamin and many others too numerous to mention. See the References for their research.

Furthermore, Architecture as a profession and research field has now a responsibility to engage with the humanities and sciences in efforts to advance the general understanding of and production of settlement design improvement and effects on human wellbeing. This is especially relevant since the acknowledgement by the Swiss Academy of Sciences that Architecture is its own field and indeed, operates at a 'meta-level' of enquiry, contributing to the methods, approaches and therefore findings that are possible from interdisciplinary collaboration.[9]

Therefore, the research and paper question: Shall this rupture be healed, how shall this be achieved, by whom and how will the healing of this alleged rupture be promulgated and accepted by the design and craftspersons communities, within the design, construction and art curation/art criticism sectors of the global economy?

Reformulating the designer/engineer to craftsperson relationship in the construction sector in Dana Cuff's updating of her own seminal work, *Architecture: The Story of Practice,* , which offered a then current account of architectural education and practice, in 1991, she argued for reviving "fabrication at a one-to-one scale" and "community-based design-build projects" (Cuff 2014: 92-93) in order to help in reforming and making more relevant the profession itself.. Yet, what she focuses less on in her studies of architectural practice, and very few other authors do even today, is enquiring into the role which craft and craftspeople could or should play in contemporary architectural practice and the entire value-chain of built environment delivery (known in the humanities as the *chaîne opératoire*). Her own research seems to confirm the tendency which has only grown stronger during the past two or three decades: Design, especially in the design studio, but also in the academic school, is the form of education and artistic *savoir-faire*, which makes the architects into the professionals they are. There is no need to argue about that, but what could be argued is that architecture should still safeguard its own historical and cultural tradition based on tectonic craftsmanship and so resist being reduced to a mere digital design discipline without any foothold in materiality and craftsmanship.

The lack of status and valorization of buildings and landscape sector related to skilled crafts-tradespeople still seems current today.[10] Predominant are the relationships between the key construction sector actors, designers, engineers and other related sector curators of style and design significance and the currently popular efforts and policy/funding implementation mechanisms driving the virtualization and robotization of construction, leading to a world of seamless, intangible concept to physical object construction.

Instead, we argue in favor of reformulating the profession of architecture in order to encourage and enable learning, teaching and collaboration opportunities in design schools, in design to fabrication work-flows, at construction job-sites and in other relevant fora, even at design and construction conferences, symposia and certainly in the design, design management and construction literature, certainly as members of the informant cohort or 'subject' of research, if not also co-creators.

To enable this reformulation in practice and research contexts: We propose the inclusion within the fields and disciplines of Research by Design, Design by Research, general architecture research into the architecture 'profession,' architectural history and contemporary to ancient buildings archaeology: The participation and co-

[9] See Zinnstag, Jakob, et al. 2016.

[10] The authors make this claim from over 35 years of practice in professional architectural design, design research, and research and teaching efforts in design and the humanities. See also Holst's paper, noted below and cf. Jean-Paul Morel's The Craftsman, a chapter in The Romans. 1993. Ed.: Andrea Giardina. Chicago: University of Chicago Press, or concerning modern design education curricula propositions: Fern Lerner. Foundations for Design Education: Continuing the Bauhaus Vorkurs Vision. Studies in Art Education, Issues and Research. 2005. Vol. 46, no. 3, ppg 211-226.

creation in research design, research work and the development of theories, methods and research designs: The knowledge sets, skillsets, learning/teaching regimes and the auto-didactic skills of ancient-to-historical *architektones* together with today's craftspeople. This includes current individuals that the authors propose can be seen as conceptual cognates for these roles, as in current master craftspersons that are also Architects and/or engineers/architectural engineers. These individuals still exist and are active in buildings and research production and this paper will briefly report on their work as a first step to guiding research questions and research design approaches for this reformulation of the Architecture profession and the role of agency of the persons and institutional frameworks performing in these design/construction sectors.

We further propose here, preliminary and early attempts at the formulation of research approaches, including theoretical stances, methods, research designs and concrete efforts to reformulate the relationships of the above mentioned actors toward deeper and more authentic conviviality, co-creative cooperation and collaboration.

We posit, further, that these individuals, from ancient eras and through to today, can be said to have a sort of role *identity*, in their known characteristics, activities, structures and functions in society, often within the same person and in the activities of groups of these persons acting together in teams. The difficulty in describing these persons' roles and structures/functions is itself an indication of this rupture, evidenced by the pre-Socratic use of *tektōn* and the *aristoi tektones*, where manual skill, design knowledge and creativity, ethics, sense of phronesis and awareness of artistic and societal purpose for making things were often encompassed to a greater or lesser extent based on training and experience, in one and the same person.[11]

A normative research and participatory Action Research type interventional agenda. This very preliminary proposed agenda is an interdisiciplinary effort between the author's own fields and those of their collaborators over many years, including: The experiences of architectural practice (thus both auto-ethnographic and anthropological as learning from peers and craftsperson collaborators), the humanities, including history, ancient material cultures studies, archaeology and the sociology of the professions/work, Participatory Action Research as interventions with informants toward transformation and the practices of engineering and the several sciences within the broad realm of long-term cultural adaptation to systemic natural and man-made change; popularly known currently as climate change adaptation and mitigation.

The approach should start from realizing that there are several dimensions of learning, design practice and research opportunities and knowledge spheres to take account of. We propose a 'mapping' categorizing the knowledge as dimensions as follows:

1. Cartography of knowledge of the recent history and current situation of the architect-craftsperson-engineer relationship

Dimension 1: overarching categories of knowledge to be gained: geographic regions, functions of the agents and their institutions as to how they perform which types of work and effects, structural relationships between the agents and their several institutions

Dimension 2: A diachronic view of the relationship, looking to the ancient past in several different regions and cultures and, forward to enquiring into current proposals and research on the future of the work and design relationships of making settlements and landscapes

Dimension 3: What are the different forms and sources for relevant, emic and etic knowledge about this relationship(s), i.e.: what can we induce from the data/information by studying

[11] See Holst's paper in the EAHN journal, as in note iii, in toto.

specific places and sites and their detailed histories, opposed to what can we learn from generalized knowledge of this relationship that scholars have induced from informants or deduced from theory

Dimension 4: What are the interesting and relevant forms of knowledge that can be thereby deduced from these empirical examples or from thinking through thought experiments and from theories in the humanities, architecture, and other scholarship, i.e.: the forms and content of the nomothetic and idiographic knowledges, or respectively the learnings about this relationship that can lead to generalizable, more or less reproducible and broadly accepted in peer communities knowledge for use in across different cultures and in different economic sectors, as opposed to what relevant findings can we learn about particular places, occasions, buildings and their specific histories, or their long-term taphonomy

Dimension 5: What is the market pushing the built environment sector to change toward, in terms of funding agendas, policy statements and implementation regimes, educational curricula and funding mechanisms for designer education and vocational training

Dimension 6: What directions are the broadly defined construction sector pulling the designer-craftsperson relationship to do, to remain the same, to change and toward what change, as the sector itself does its own reflection and self-critique, such as the several reports of the U.K. based Royal Institute of Chartered Surveyors, building quality assessments of the Building Research Establishment Constructing Excellence platform[12] the U.S. based National Institute of Building Sciences, and many other platforms and institutes calling for and guiding change because of measured and perceived deficiencies in the design delivery mechanisms and the built products of the construction sector.

Dimension 7: Above the known unknowns. This dimension should enquire into the unknown knowns, i.e. what we do not yet know that we know, such as can be accessed through the study of ancient histories of construction and architecture; and the unknown unknowns, such as what we might discover in both looking to the past and through experiments that seek novel solutions to new construction or the conservation of the existing stock/ historic buildings and landscapes

2. Normative research and intervention proposals for devising effective and ethical applied scholarship and virtuous transformation processes for the relationship between craftspersons and designers in the broadly defined construction sector (buildings, settlement related infrastructures, etc)

Dimension 1: Engage with current craftsperson-designer cooperation initiatives to develop and record, (.i.e. ethnographic, auto-ethnographic, knowledge management and sustainable innovation methods) scholarly research and participatory Action Research methods, their current and ongoing production of findings and interpretive results - quantitative and qualitative type of knowledge and practices and both explicit reportable knowledge and tacit, embodied, social cognition types of knowledge otherwise difficult to record via conventional means

Dimension 2: Compare, contrast and critique these knowledges and practices from Dimension 1 with the published records and scholarly or design research, from ancient cultures, through historical periods through to the current era to further a triangulation of knowledge, findings and interpretations, which should furthermore

Dimension 3: based on these findings and network engagement from Dimensions 1 and 2, develop preliminary proposals, for programs to renew, repair and help in the ongoing maintenance of the craftsperson

[12] See their reports and guidances at http://constructingexcellence.org.uk/about/

– to -designer relationship, starting with a focus on projects in the realm of the built cultural heritage (both buildings and ancient-to-recent era infrastructures). The research and interventional proposals should be devised and implemented with craftspersons and designers as co-equal co-creators, in as much as possible convivial and authentically collaborative relationships.

Dimension 4: Seek new funding and engage with currently funded projects in the above programs to promote these programs' work and to devise and produce new works. Such work should include: media productions such as documentary films, audio recordings, or other media, devising, buidling and producing onsite or travelling exhibitions that explicate this research and these practices and building and conservation projects where the collaborative work relationships between the members of the CPTs/DPTs is explicitly framed as the cooperation of co-equal and co-creative partners.[13]

The current state the design/construction relationships.

There is reported in the general construction industry journals and the popular press, in addition to architectural and engineering journals, several different types and levels of change, because of a general, measured and perceived lack of both quality in the built product and a lack of cooperation, from the design studio to the building site. (Sayigh, 2019, in toto; Rahman, 2014, in toto; and RICS et al 2018, in toto). Thus, what efforts to date that the construction industry has devised and implemented have had at most marginal success but certainly has produced a great deal of learning about the possible patways for leading virtuous change, producing better quality buildings and infrastructure and helping to enable more convivial construction work sites, that are simply non-antogonistic, but rather authentically collaborative and cooperative.

The authors propose one of the viable pathways to enable better job-site work relationships and product delivery should include this reformulation of the designer to craftsperson relationship.

Two examples of interventions in the building industry-design sphere are:

1. Haus der Farbe: An NGO in Zurich Switzerland that provides a workshop space and curriculum for designers and craftspersons to work together on specific projects, such as learning about and making higher quality building finishes and color coding for buildings in Switzerland. Their color map of all the buildings in the city of Zurich was produced by human sense agents, not computers, as they found humans to be more accurate and quicker than machines.
2. The Norwegian National Cultural Heritage Conservation Academy: A second example is the work of the NNCH Conservation Academy in Norway, along with the allied Norwegian Institut for Kulturminneforskning. They have over many years produced cutting edge research and products, including restored wooden, 900 year old barns, the restoration of 800-900 year old stave churches, and modern replicas of high grade near-steel iron axes that are apparently better at cutting and shaping wood than currently market-available stainless steel axes. This is based on the research work of several metallurgists at the NTNU University and Architect Anders Haslestad at the NNCH.

The above two examples are just two of many found even in the Nordic countries. Many other examples can be found throughout Europe and to be sure, further afield in Africa, Asia, North America and the Russian/Slavic speaking worlds. The authors look forward to working with the participants of the conference to build and maintain effective networks across many cultures and territories to repair and rejuvenate this relationship.

[13] From the website on Greek Architecture, accessed 15. Feb., 2020: http://www.hellenicaworld.com/Greece/Architecture/en/GreekAncientArchitecture.html

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PAPER #7.09

PLATFORM, CONTAINER, ENVIRONMENT. 2019 SHENZHEN BIENNALE AS INNOVATION IN PRACTICE

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ABSTRACT

In a time of supra-national economic, political and social crises, the architectural profession is acknowledged as necessitating of a fundamental restructuring in order to gain both renewed relevance as a discipline (Awan, Schneider and Till 2009; Till 2014, 9-11) and sustainability as day-to-day practice (Deamer and Bernstein 2010; Deamer 2015; etc.). A tendency to diversify the products of architectural practice - i.e. beyond buildings - is facilitated by a constantly increasing number of curatorial outlets - i.e. Triennales, Biennales - allowing to increase the perceived pace of innovation (Papastergiadis and Martin 2011, 45–62).
The paper looks at the curatorial process of the 2019 Shenzhen Biennale of Architecture and Urbanism[1] as a way to access a select sample of internationally mobile contemporary practices whose work is produced at the intersection between profession, academia, and independent research. Drawing on literature pertaining to the concept of communities of practice (Amin and Roberts 2008, 353-369; Faulconbridge 2010, 2842–2858), ethnography of practice (Yaneva 2009) and feminist theory (Frichot and Runting 2015, 397-411), we question the agency of the Biennale and similar curated events as facilitating environments entailing the reconceptualization of design practice (O' Neill & Wilson 2015; Szacka 2019). In order to do so, we look at the practices that populate the exhibition, how they self-represent and how they employ the exhibition to maximize the possibility of producing innovation.
Finally, we select a small number of installations that appear the most resilient to contingencies, and analyze their trajectories outside of the Biennale in order to understand the way specific networks are built and effects are achieved, within platforms that are indeed part of day-to-day practice, rather than existing outside of it.

KEYWORDS

Innovation; practice; Biennale; container technology; contingency.

1. THE AGENCY OF PRACTICE AND THE ROLE OF EXHIBITIONS

In a time of supra-national economic, political and social crises, the architectural profession is acknowledged as necessitating of a fundamental restructuring in order to gain both renewed relevance as a discipline (Awan, Schneider and Till 2011; Till 2014) and sustainability as day-to-day practice (Deamer and Bernstein 2010; Deamer 2015). A tendency to diversify the products of architectural practice - i.e. beyond buildings - is facilitated by a constantly increasing number of curatorial outlets - i.e. Triennales, Biennales - allowing to increase the perceived pace of innovation (Papastergiadis and Martin 2011). Cultural events par *excellence*, biennials are generally studied and debated as a global phenomenon, as tools of marketing strategies adopted by cities that strive to emerge in the neoliberal system of the so-called "knowledge

[1] More specifically, we consider the practices that applied to the Open Call of the "Eyes of the City" section and were selected for the exhibition.

economy." Even though they are inextricably associated with notions of homogenization, commodification and spectacularization of contemporary cultural experiences (Urry 1995; Evans 2003; Hornstein 2011), nevertheless these exhibitionary formats are commonly considered among the best-rehearsed media of dissemination and display of disciplinary knowledge in the fields of architecture and arts (Jones 2016; Smith 2012; Vogel 2010; Martini and Martini 2011; Gardner and Green 2016).

A growing amount of literature attempts to understand the role that such outlets have had in the development of architectural discourse ever since the onset of architecture as a liberal profession through the Beaux Arts, the Modern and the Postmodern (Macleod, Hourston Hanks and Hale 2012; Szacka 2019), to name just a few key moments in which the close relationship between curatorship and practice has allowed for a stronger perception of the architect as public figure. More recently, architecture as a practice has known a decrease in public relevance; disciplinary discourse tends to mirror a growing concern with the real agency of design with respect to pressing matters of the contemporary world such as urban poverty and informality, climate change, and even the very conditions within which design and construction are carried out as practice (WBYA 2018, Deamer 2015, Brenner 2015), while architectural education is showing an "undisciplined" move towards the scale of the city (Cuff 2014) in search of renewed relevance. If we accept that exhibitions are facilitating environments entailing the reconfiguration of design practice (O' Neill and Wilson 2015; Szacka 2019), thus impacting the way that design is understood and the degree to which it can claim relevance, we must understand how exhibitions are made as a real practice. In his conceptualization, architecture historian Florian Kossak (2012, 214) uses the term "productive exhibition" to acknowledge the exhibitionary format acting as the testing ground for "new forms of the production of architecture itself" and as "a continuation and integral part of the architectural praxis [..] that has a transformative and progressive role in the development of architecture": this allows for a re-consideration of the exhibitionary format in terms of potential agency outside the "white cube" conceptual space and its well-rehearsed politics of display, as investigated today by a growing bulk of curators and scholars.[2]

The discourse around the way exhibitions impact on architectural debate most usually revolves around an epistemological approach, centering on the distance between curators' intention and effect at a critical level (O' Neill and Wilson 2015), on the way mediated messages convey a real shift in the way architectural design is practiced (MacLeod, Hourston Hanks and Hale 2012), or on the way exhibitions allow for a stronger vector of change (Pestellini Laparelli 2018, 22) and internationalization of discourse (Filipovic, van Hal and Øvstebø 2010). These perspectives rarely allow for an unpacking of the relationship between the exhibition and the real conditions within which it is produced. Drawing on Bruno Latour's understanding of the "entanglement" (1988, 1996, 2007) and subsequent ANT explorations of the relationship between sites of reality and the production of any (necessarily sociotechnical) advancement, we set out to explode the real conditions of production of a specific exhibition, in the hypothesis that such real conditions – the contingent here and now - have a stronger impact on the content of the exhibit and therefore on the way it, in turn, impacts on discourse, than has been recognized. In this perspective, the observation of UABB 2019 – Shenzhen Bi-City Biennale of Urbanism and Architecture (hereafter UABB) is employed as a way to measure the effectiveness of the notion of "entanglement" as applied to the life-scale laboratory environment of the curated

[2] Recently, an entire issue of the magazine Volume has been dedicated to the investigation of the potentials and of the roles of biennials today (See Volume #54.On Biennials).

exhibition, looking in particular to one of the two main sections of the exhibition, "Eyes of the City.

2. OUTER TRAJECTORIES

In this section, we look at the way selected practices describe themselves as participants to contemporary discourse around the redefinition of the boundaries of architectural practice, in order to assess the role that UABB has played in their innovation/deviation/reinvention/development. To do so, we employ as main sources: 1) the data on all participants that we have gathered throughout the curatorial process, 2) parallel interviews we have conducted with nine participating groups, and 3) personal exchanges and conversations held throughout the development of the work. Collected data (1) refers to the type of firms that have participated and the way they describe their practice; on various occasions, the curatorial team were asked by UABB and local authorities to give exhaustive accounts of all participants to the exhibition, in terms of individual affiliations, geographical locations as well as narratives. The nine parallel interviews (2) were structured in three main parts: the first looked in closer detail to the structure of the group, the second to its reasons for participating to the biennale and the third to the way that each proposal has evolved within it. Both (1) and (3) were collected throughout the six months of continuous interaction with participating groups, while (2) were carried out after the opening of the exhibition. Using these data on an epistemological level allows us to define some of the strategies that are consciously deployed by these practices in order to actively push perceived boundaries of the discipline and gain agency within the contemporary world.

Within the total amount of 130 teams that applied to the Eyes of the City UABB Open Call, 25 defined their structure as "research group" or "academic association". Of the remaining 105, a large part defined its activity as "freelance" or "private studio", while 17 preferred more hybrid definitions such as

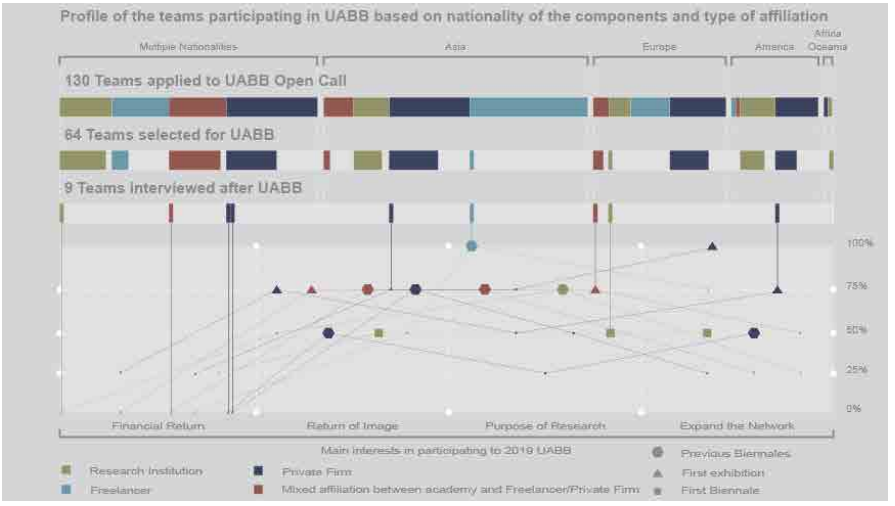

Figure 1. Tracing of the nationalities of the teams and their interests in participating within 2019 UABB – Bi-city Biennale of Urbanism/Architecture. Diagram by the authors.

"freelancer/academic", "studio/academic". Looking at the individual biographies provided by the 64 teams selected to participate, it is evident how the profile of architectural or design firm is perceived as constraining; most exhibitors show a tendency to describe their design work as other from a projection of built artifacts, towards more experimental and less tangible contents, which identify the social, interpretative and innovative role of the profession in an heterogeneous mix of multiple activities. This is
evident in the self definitions that have been provided, such as "research and media practice," "multidisciplinary design practice," "Space Lab," "platform".

While only 19% of participating groups stated an official affiliation, as group, to an academic institution, for a further 15% different affiliations explicitly coexisted as some members stated a professional affiliation to an office or private organization, while others stated an academic affiliation. Furthermore, of the 25 academic institutions involved within the UABB exhibition, 6 of them[3] participated with two or three different proposals. Some of the professional skills that were featured within participating groups were conventional ones such as architects, designer, artists and urban planners, but also extra-disciplinary ones such as "CG Artist," "Coder," "Computer Scientist," "Virtual Reality Specialist," "Software Engineer," "Aerospace Engineer," "Economic Geographer," "Actress," "Filmmaker," "Information Designer" and "Computational Designer," among others.[4] From a geographical point of view, of all participating teams, 45 have members with different nationalities, and 13 have members that currently reside and work in different cities or nations[5] .Finally, of the 64 participating groups, at least 9 were formed specifically to participate to the exhibition, across individuals and pre-existing groups.

While this sample is not wide enough to give an exhaustive restitution of the type of practices that populate architecture biennales, it is nonetheless clear that these practices, specifically, tend to structure themselves through recombinative strategies and "intercohesion" (Stark and Balàzs 2010). Contact across different cohesive groups through spatial proximity (Amin and Roberts 2008) and global mobility (Faulconbridge 2010) has been identified as the locus of innovation production; some authors argue that in order to maximize innovative potential, groups should foster "cohesion" and "connectivity" (Watts 1999; Moody and White 2003; Uzzi and Spiro 2005) as well as "closure" and "brokerage" (Burt 2005; Baum, McEvily and Rowley 2007). Building on these positions, more recently authors have proposed that communities of practice allowing for individuals to work "across" different groups show an increase in innovative activities, where "creative tensions of familiarity and diversity" are meant to "promote group performance" (Stark and Balàzs 2010, 1152).
This perspective is interesting to the degree to which the participation to a specific exhibition is not likely to be the main activity of any organised body at any time - if not in the very short term of impelling deadlines. In fact, just two of the nine interviewed groups had only low expectations of financial return, none of them had any expectation of building ties with possible clients, while they all had expectations of building ties with media, institutions and peers. Four out of nine had already participated in an international exhibition, seven out of nine had already participated in an exhibition, and all nine intend to participate in an international biennale in the future. Furthermore, nine out of nine had already been in contact with 1 to 15 other participants through a collaborative project (1), a previous exhibition (3) or a common

[3] Strelka, Massachussetts Institute of Technology, Tsinghua University, Politecnico di Torino, University of Applied Arts in Vienna, University of Innsbruck, South China University of Technology.
[4] These definitions were provided by exhibitors in the bios they submitted for the initial application and later for cultural censorship and for the catalogue publication.
[5] These data were collected by the curatorial team during the curatorial process through direct interactions with the participants, and were shown in the exhibition in the form of infographics.

network (5). In this sense, while it is clear that the construction and strengthening of weak ties (Granovetter 1973) through contact and visibility is one of the main objectives for all participants, it can also be argued that participants consciously used the exhibition as a strategy to maximize "overlappings" (Stark and Balàzs 2010) at different levels within and across communities of practice. This works at the level of organisational structures and has a direct impact on the modes of production of the project. The theme proposed by the exhibition was "partially" (6) or completely (3) in line with the team's research and work topics; significantly, in the former case, the project was a new proposal developed specifically for the exhibition, while in the latter it was an iteration of a previous project, and six of the nine groups intend to repurpose the same project for participation to another exhibition.

If we look at built installations within the exhibition as units of observation, it is clear that each installation cannot be analysed as the material effect of an abstract design idea, but needs to be read as product of an iterative process that is the result of the encounter between intercohesive practices, strategically employing the space of the exhibition as breeding ground for multiple levels of innovation, and an institutional container - UABB - in which projects go through successive rounds of modifications as the effect of a wide range of stimuli and irruptions. In this sense, UABB works as a "container" (Frichot and Runtig 2015), fostering the gradual progression of projects from world of ideas to specific, on-the-ground conditions. In the following paragraphs we look at UABB as a container for the 64 installations through a linear account of the process, and then more qualitatively at the nine installations authored by the nine groups we have interviewed.

3. CONTAINER/CONTAINED

Throughout its eight editions, since its inception in 2005, UABB has been acknowledged as one among the eleven most relevant architecture biennials worldwide.[6] Its strong impact on international discourse[7] is mainly due to its approach, the exhibition aspiring to act as a "catalyst"[8] and as a laboratory for urban transformation. UABB declares ambitions that are not limited to the display of the "state of the art" of global architectural debates: rather, the event aims at establishing a proactive transformative tension towards the issues related to hyper-urbanization processes within and around the local context of Pearl River Delta mega-region. There is a growing narrative around UABB's unconventional approach as well as the innovative charge of practices that participate in it. Despite this, UABB (as a direct emanation of the Shenzhen Urban Planning Bureau) operates within a municipal-level political scenario bound to a strong regulatory framework. As a consequence, it is necessary to take immediate distance from a narrative of epistemological correspondence between intentions and effects. Rather than linear and one-directional, the trajectory between project and built object is iterative and recursive, made of twists and turns, of constant exchanges and negotiations, as much as any work of architecture (Armando and Durbiano 2017).

In this paragraph, we look at the mechanisms of the exhibitionary institution, and at the actions that have been carried out within it by a collective of actors. In our working hypothesis, the exhibition acts as a "container" of practices: this section aims therefore at briefly unfolding the commonly intended image of the exhibition as a monolithic institution where the process involving curation as a real practice is often concealed, focusing instead

[6] https://www.archdaily.com/908891/11-architecture-biennials-to-pay-attention-to-in-2019?ad_source=search&ad_medium=search_result_all. Accessed 2020.02.10

[7] The 2017 edition of Shenzhen-Hong Kong UABB has been visited by more than 550.000 people (Source: UABB Organizing Committee. See also Volume #54 "On Biennials"). Recently, UABB has been defined by online platform Archdaily as the "The World's Most Visited Architecture Biennale" https://www.archdaily.com/930683/the-worlds-most-visited-architecture-biennale-opens-in-shenzhen?ad_source=search&ad_medium=search_result_all. Accessed 2020.02.10

[8] The term "catalyst" is commonly used by the official narrative of the event to describe the curatorial approach of UABB.

on measuring the exchanges that took place between the container and embedded practices, with the purpose of demonstrating their negotiating and incremental nature.

Our hypothesis is that there are measurable points in the collision between the ontological level of exchanges and the epistemological level of each narrated agency, and that those can be found in the progressive validation of the latter within the former.

These validations take the form of signed contracts and documents, defining how the implementation of the project has been developed. This aspect is not secondary if we want to overcome the perception of the exhibition container as simple platform, and go beyond the threshold dictated by the exhibition's communicative media to understand the mechanisms through which the exhibition works.

If each agreement remains unchanged between the parties until a new agreement is reached, as successive synchronic objects, proposals are, on the contrary, diachronic objects. In different moments of development, proposals undergo modifications prompted by exchanges with the institution that legitimizes their eventual translation into built objects. In this sense, we represent proposals as trajectories: in the exhibitors' initial intentions these would proceed linearly from acceptance to construction, but, due to

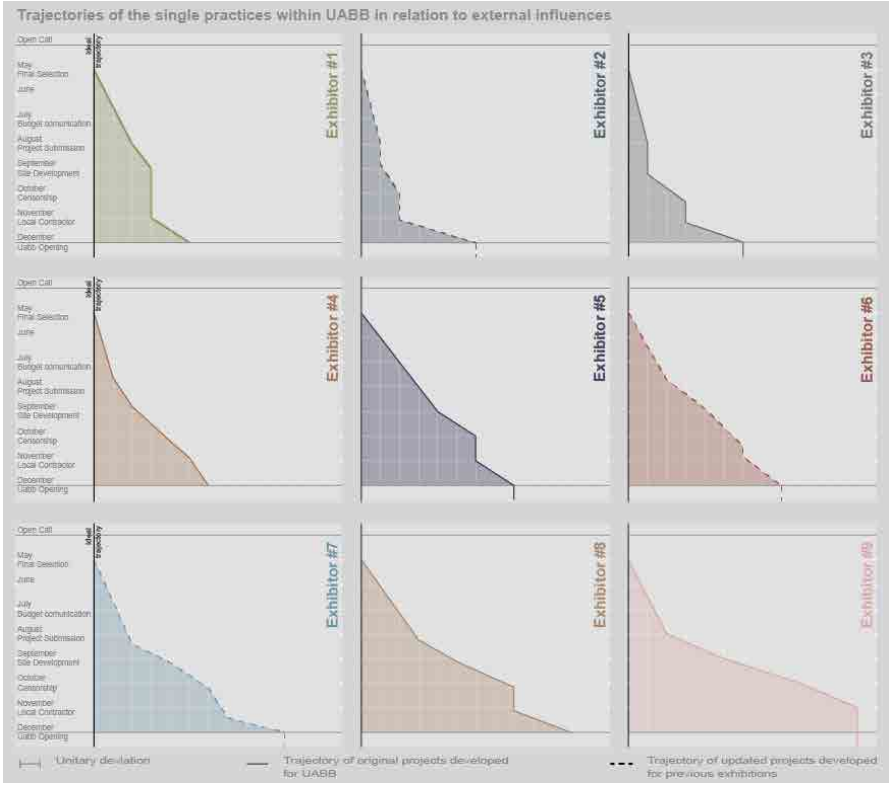

Figure 2. Tracing of the trajectories of the practices of each interviewed teams within 2019 UABB – Bi-city Biennale of Urbanism/Architecture. Diagram by the authors.

the many irruptions of the container-biennale in its many forms, they need to deviate to get to the final stage of construction.
Under this perspective, the process works as continuous exchange; each modification is neither a result of authorial intentions, nor an automatism of cause and effect, or action and reaction. Since it is capable of internalizing an enlarged vision, and carry the agency of a validating collective, we can look at it as a socio-technical and incremental process.
Also because there are no clearly stated rules that can be accepted by all parties from the start, acceptance proposals are not either accepted as-is or excluded, but are rather co-constructed through a more synergistic process, where the agency of one party overlap with the agency of the other.
This exchange was analyzed using the data derived from the parallel interviews carried out with 9 of the participant groups: these were asked to evaluate the impact of some irruptions on their proposal. Exhibitors were asked to evaluate, on a scale from 1 to 5, how much the proposal had been modified as a response to each of the following irruptions: specific budget allocation changes, contents revisions, site development, local producers requests, submissions deadlines; which, at different times along the process, influenced the proposals to varying degrees. The diagrams allow to visualize the results of the interviews and compare them (fig. 2). From these, two aspects emerge as immediate demonstrations of our hypothesis: first, that practices are not developed independently from the container, and second, that the irruptions have different impacts at different moments, depending on the specific proposal.
The first aspect points to the fact that practices consciously adapted to embed within the container. No line of the diagram is perfectly vertical; that is, no practice went through the container without having to negotiate at least some aspects of their proposal. This appeared as the only means to survive, in a continuous tension between container and contained and their opposite agencies - on the one side, the procedural and bureaucratic eagerness to get things done, on the other the need to maintain the integrity of a design intention while striving to obtain the former's legitimation.
The second aspect makes explicit that there is no generalizable relationship of causality between each irruption and its effects on proposals, as effects change from one proposal to the other and from time to time. The spatialization of this gap is a non-constant deviation between irruptions and practices' intentions. By looking at the diagrams, it can be observed that exhibitors #1, # 2 and # 3 (fig. 2.1, 2.2, 2.3) described their initial proposal as remaining more or less unchanged until it had to face site development and local contractors' feedback on feasibility. Of these three teams, two are research institutions whose proposal was the result of previously developed research work, while the third one is a renowned architecture firm. Two of them had already participated in a biennale before, and many of their components are from China. These groups likely had a clear idea from the start of the project they wanted to show in terms of conceptual narrative, and concentrated their efforts in reworking it strictly when needed, in answer to the formal requests of construction and set-up.
At the opposite end of the spectrum, exhibitors # 4, # 5 and # 6 (fig. 2.4, 2.5, 2.6) described their proposal as having consistently changed in the first phase of concept development, while being easily translated into part of the exhibition in the production phase. In this sense, their initial redefinition was deemed useful to make these proposals more resilient to formal adjustments. All these teams are small to mid-size private offices with a strong research agenda, and had previously participated in other minor exhibitions. This shows how some proposals may be innovative in their capability in discovering how containers work step by step, strengthening their perspective at each negotiated stage.

Finally, exhibitors # 7, # 8 and # 9 (fig. 2.7, 2.8, 2.9) show a definite diagonal trajectory, telling a story of constant negotiation throughout the process. These three teams had previously participated in a biennale, and defined themselves as experimental practices. Their proposals were described as having undergone the most changes, both in the initial phase of conceptual development and in the phase of development and construction. In this sense, these are the practices that have demonstrated the most willingness to adapt to contingent factors and, more generally, to the container.

These three categories are intended to define a spectrum of the possible strategies that practices employ in order to legitimize their work within an institutionalized container. To trace the complex tangle of relationships that are in place allows to redefine the narrative of an exhibition, past the interpretation of each object as a result of a curatorial intention.

4. CLOSING REMARKS

By tracing the variable trajectories of proposals, we attempt to describe how selected practices constructed their progressive legitimation and, therefore, the feasibility of their proposals, through strong conceptualizations, constructive detailing or minute negotiations.

The graphs demonstrate that there is a continuous interchange between the space of ideas and construction: within the container, the two poles converge and diverge continuously.

The irruptions of final selection, blueprints submission, cultural censorship, all had effects on the level of the symbolic values of the proposals, supporting the vision and authorial perspective of each exhibitor. Budget communication, site development, and meeting with the local contractors had effects mainly on the translation of projected symbols into physical matter. Their turnover along the route depends on the rules of the container as well as on the contingencies that can co-exist with those rules.

A description of exchanges allows the observer to define categories based on the different degrees of interaction, with the purpose of deconstructing the narrative of the "white box" toward an operative definition of "productive exhibition".

There have been proposals capable of holding firmly to their contents and having to change only to the test of reality. Others have experienced the opposite while still others have had to incrementally stake the entire proposal to be able to legitimize themselves inside the container. Under this perspective institutionalized containers should be read as negotiated spaces rather than platforms. Narratives on exhibitions focus on communicative and epistemological stances, while this paper aimed at observing how the development of projects engenders symbiotic exchanges between practices and containers. Mapping how practices deploy strategies to spatialize their ideas opens the possibility to shift scholarly attention from synchronic media objects to the diachronic procedures through which they are produced. The preliminary categorization shown in this paper is intended to point towards a possibility of measuring the relationship between the symbolic and the material, to explore practices and define the circumstances within which they work.

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PAPER #7.10

GLOCAL ARCHITECTURE AGAINST CLIMATE CHANGE: RICE STRAW IN VALENCIA

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ABSTRACT

Global warming is today a reality, and some countries are already suffering its consequences. The building industry is one of the main contributors to this effect, being responsible for around 23% of the carbon dioxide worldwide emissions. Despite this being a global problem, the already available solutions are mostly local. To tackle this situation, each country or community needs to maximize the possibilities its local resources offer sustainably. This way of thinking globally about local solutions is called glocal. This paper tries to exemplify this concept with the case of the rice fields located in the Albufera park in Valencia. After the harvest, there is a vast amount of straw that remains over the rice fields. This rice straw is typically considered a residue and ends up either burned or mixed with the soil. These management practices not only generate a considerable amount of CO_2 and CH_4 but also represent a threat to the local population and the integrity of the flora and fauna of the natural park. One possibility for avoiding the mentioned impacts is to use the straw as a raw material. This study analyzes the environmental benefits and the acoustic characteristics of prefabricated building panels containing rice straw as the primary element for building façades. The environmental results show that using the straw panels not only reduces the carbon dioxide emissions but also avoids the emissions related to the straw management practices. When it comes to the acoustic insulation, the results obtained are comparable to most common façade typologies in the Spanish construction sector.

KEYWORDS

Glocal architecture; climate change; LCA; carbon emissions; building acoustics.

INTRODUCTION

Climate change has become a priority in all aspects of human life. Since the first climate emergency declaration (Ripple, Wolf, Newsome, Barnard, & Moomaw, 2019), 25 countries and more than 1250 local governments have released their own. The effects of climate change are starting to be noticeable worldwide, and they are already causing severe damage in some impoverished countries (Climate Centre, 2018). This is just the beginning of a process that is only going to accelerate unless international measures are taken immediately. Considering the severity of the situation, industries must adapt and find ways to carry their activities without compromising present and future generations. The building sector has shown to be especially reluctant to change. Despite the relatively high amount of new materials with a low environmental impact, most new buildings tend to use conventional high-impacting options. This is the case of concrete, responsible for a large amount of the total carbon emissions in the world, as well as metal structures, glass, bricks, and many others.

Since buildings are designed to last for decades, both construction companies and costumers lean toward materials and building typologies with a proven record of reliability. There is only one solution to counteract that tendency: to prove that the new alternatives and biological products are better for the environment than the conventional options and perfectly adequate for the building sector. In many cases, bio-based building materials have better thermal properties and are healthier for the dwellers.

Materials used on a global scale like concrete or metal are not compatible with a sustainable future. The extraction of the raw materials and the processing required during the manufacturing process generates an immense amount of waste and carbon emissions. Many innovative solutions are made from biological materials. Each country or even region has a different environment with different crops and different local conditions. That is why the availability of biological raw materials changes geographically. Each region should try to find raw materials extracted in its surroundings to minimize the emissions associated with transportation. Focusing on a local scale to tackle both global and regional problems is called Glocal. This concept was coined by Akio Morita in the 1980s (Dr. Pradip Kumar Das, Mr. Pema Lama, & Tamang, 2019). Since then, it has been used for developing business models in international companies, but it has barely had any repercussions in the architecture sector. This concept could be applied in architecture to counteract the growing homogeneity both in design and in construction materials used worldwide.

Valencia, a city located on the Spanish Mediterranean coast, is well-known for the use of rice in its local cuisine. The rice used to meet the demand is mostly farmed in the southern part of the city, in an area surrounding a coastal lagoon called Albufera. The Albufera natural park, formed by the coastal lagoon and its surroundings, is considered a symbol of the local identity. Rice cultivation is an important economic activity for the city and a source of pride for its inhabitants. However, the impact over the environment this activity generates has been controversial for several decades and continues to be an unsolved problem nowadays. The conflict originates from the vast quantity of straw remaining over the fields after the harvest. In just a few weeks, the rice fields in Valencia generate between 75000 to 90000 tons of rice straw. Properly managing this quantity of straw requires an amount of machinery and workforce that the farmers are not able to afford. Because of that, straw has traditionally been burned over the fields. This practice generates not only CO2 but also NOx and Sox. As a way to avoid those impacts, the Common Agricultural Policy forced the farmers to mix the straw with the soil as a fertilizer. Although this practice might seem better, it generates an enormous quantity of CH4 due to the anaerobic decomposition of the straw. Taking everything into consideration, the only way to avoid those emissions is by turning that waste into raw material.

Using a wooden frame and compressing the straw, it is possible to create straw panels. This idea was pioneered by the company Okambuva Figure 1. This study will compare the carbon footprint and the acoustic insulation of the rice straw panel with a conventional façade typology

Figure 1. Construction process using rice straw panels.

1. GOAL

The goal of this study is to analyze the potential environmental benefits of using rice straw panels as the building façade instead of other conventional constructions. Additionally, the study assesses its airborne acoustic insulation.

– To compare the carbon emissions generated by a square meter of straw façade with a typical double-layer brick façade. The software used to create the inventory and perform the calculation is Simapro

– To analyze the influence the management of the straw has over the total impacts of a square meter of façade.

– To obtain the acoustic insulation offered by the rice straw panels and to assess if it meets the required building standards.

– To exemplify how using regional biological materials can be a way of both mitigating climate change and preserving local environments

2. METHODOLOGY

This study is structured around the comparison between rice straw panels and a double layer brick wall typology, common in the Spanish construction market. The work can be divided into two separate phases:

– Life cycle assessment: The first phase consists of performing a life cycle assessment from cradle to gate of the rice straw panels and comparing it to a conventional two-layered brick façade. The calculations and life cycle inventory are carried out using Simapro. Simapro is a software that uses reliable databases to account for all the environmental impacts generated by any human activity.

– Airborne acoustic insulation measurement: This part consists of measuring the acoustic insulation of the typologies under study in the acoustic transmission chamber. The transmission chamber consists of two rooms, an emitting room, and a receiving room, separated by the construction that is going to be tested. Pink noise is emitted from a loudspeaker in the emitting room. The sound pressure level of the pink noise is measured in both rooms to determine the acoustic pressure attenuated by the wall. The methodology follows the process described in the ISO 717-1 standard (ISO, 2013)

2.1. Typologies under study

As explained in previous sections, the main typology under study is a kind of prefabricated panel composed mainly of rice straw. The straw is compressed and held together using a wooden frame. The standard panel is designed for low rise buildings, but its wooden frame can be adapted to bear loads

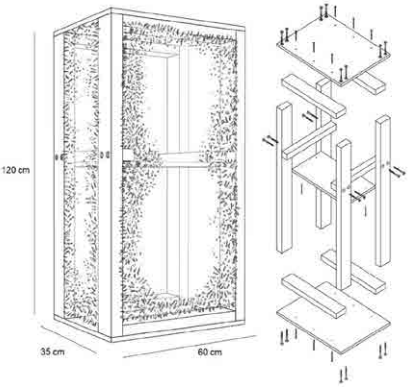

Figure 2. Straw panel dimensions and frame design SOURCE:("Okambuva," n.d.)

Material	Mass (kg)
Rice Straw	49
Clay mortar	100
Lime mortar	31.5
Pine wood	7

Table 1. Inventory for 1 m2 of rice straw wall

of higher constructions. Therefore, the structural integrity of the panel depends on the wood frame, while the compressed straw provides thermal and acoustic insulation, besides some extra rigidity. The physical characteristics of the panel are depicted in Figure 2, and the material inventory is detailed in Table 1. By covering the panels with lime mortar, the straw core and the wood frame are protected against the weather conditions, fungus, xylophagous, and other kinds of insects (Elert, Rodriguez-Navarro, Pardo, Hansen, & Cazalla, 2002).

The other typology used for the comparative study is a double layer brick wall Figure 3. This wall type is described in the Spanish Technical Building Code in its catalog of building elements (Ministerio de Fomento, 2011). The inventory of the façade is specified in Table 2.

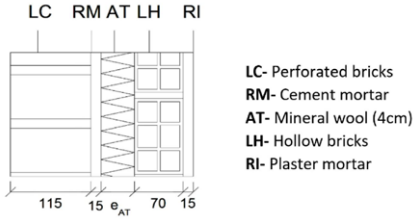

Figure 3. Double layer brick façade.

Material	Mass (kg)
Perforated brick	83.63
Hollow brick	53.33
Cement mortar	90.7
Mineral wool	5
Gypsum mortar	18

Table 2. Inventory for 1 m2 of Façade 1

3. CARBON FOOTPRINT. LIFE CYCLE ASSESSMENT

3.1. Scope definition

This study will analyze the life cycle of the straw panels from cradle to gate. All the impacts related to the building process, maintenance, and end-of-life will not be considered. In this particular study, the only environmental indicator will be the global warming potential. This indicator is measured in kg of CO_2 equivalent.

3.2. Functional Unit

The functional unit used to assess the carbon footprint is 1 m^2 of wall. The life cycle inventory for the façades is summarized in Table 1 and Table 2.

3.3. Data quality

The data used for the article come from different reliable sources. The data for developing the Life Cycle Inventory of the rice straw panels comes from direct contact with the production company("Okambuva," n.d.). The carbon emissions produced during the burning process and the process of mixing the straw with the soil were obtained from the study developed by Elena Sanchis (Sanchis Jiménez, López Jiménez, & Calvet Sanz, 2014). The data needed to create the Life Cycle Inventory of the brick wall was extracted from the Ecoinvent database V3.5 (Ecoinvent, 2016). Ecoinvent is a not-for-profit organization founded by institutes of the ETH Domain and the Swiss Federal Offices. This database collects highly reliable information due to its peer-review process (Pascual-González, Guillén-Gosálbez, Mateo-Sanz, & Jiménez-Esteller, 2016).

3.4. Life cycle scenarios for the rice straw panels

The study will compare the carbon emissions that are avoided depending on the waste management practices. The different possibilities will be divided into three scenarios:

– Base case scenario (BCScenario): The influence of the management of the straw is not considered in this scenario. It accounts for the impacts generated during the recollection of the straw, the transportation, the manufacturing of the panels. The rest of the raw materials are also considered.

– Avoiding burning scenario (ABScenario): This scenario accounts for all the processes considered in the base case and subtracts the greenhouse gases produced during the burning of the straw. This scenario shows how much CO_2 equivalent could be avoided per square meter of rice straw façade used in case the straw were going to be burned.

– Avoiding mixing with the soil scenario (AMScenario): In a similar way as the previous one, this scenario considers all the impacts in the base case scenario and subtracts the greenhouse gases generated when mixing the straw with agricultural soil after the harvest. This scenario accounts for how much the emissions can be reduced by using one square meter of rice straw panel in case the straw were to be mixed the soil.

3.5. Carbon footprint results

The carbon emissions generated are depicted in Figure 4.

The results obtained, Figure 4, clearly show a big difference between the impacts generated

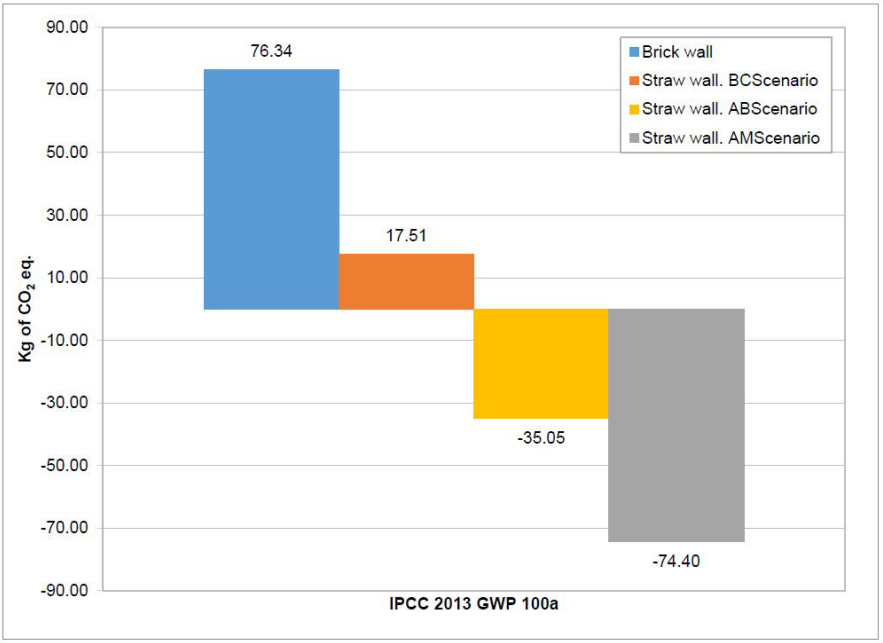

Figure 4. IPCC Global Warming Potential.

by the Brick wall and the impacts generated by each one of the three straw wall scenarios. When comparing the Brick wall to the less favorable straw wall scenario, the BCScenario, the straw wall reduces 76.3 % of the impacts generated by the brick façade. It is, therefore, safe to say that the straw wall façade reduces the impact over the environment in comparison to the brick façade studied.

The comparison between the results of the three different building façade scenarios illustrates clearly how the different management practices of the rice straw affect the environment. Looking at the ABScenario, it can be seen that by manufacturing 1 m^2 of rice straw wall and preventing the burning of the amount of straw contained in it, the emission of 35.05 kg of CO_2 equivalent is avoided. The results obtained in the AMScenario show that preventing the mixing of the straw with the soil by manufacturing straw wall panels avoids the emission of 74.4 kg of CO_2 equivalent.

4. ACOUSTIC PERFORMANCE

A straw wall has been built at the acoustic lab of the Polytechnic University of Valencia to assess the acoustic insulation of the straw wall panels. The preliminary results show that the acoustic insulation of the rice straw wall is adequate as a building façade. As said in previous sections, the acoustic measurements have been performed according to the ISO 717-1 standard (ISO, 2013). The equipment used to perform the acoustic measurements is detailed in Table 3. The comparative preliminary results of the straw wall insulation are shown in Table 4.

Device	Company	Model number	Serial number
Building acoustics analyzer	Brüel & Kjäer	4418	1086424
Spectrum analyzer	Brüel & Kjäer	2148	1701550
		7667	1819863
Microphones	Brüel & Kjäer	4416	1776748
			1776646
2 rotating microphone stands	Brüel & Kjäer	3923	1877571
			1877572
Sound source	Brüel & Kjäer	4224	1148210
Pistonphone	Brüel & Kjäer	4220	1404458

Table 3. Equipment used for the acoustic measurements

	$R_{,w}$ (C; C_{tr})
Brick wall	49 (-1, -2) dB
Rice straw wall	47 (-2, -7) dB

Table 4. Weighted sound reduction index of the typologies under study.

As can be seen in table 4, the sound reduction index Rw of the rice straw wall is 2 decibels lower than the one obtained with the brick wall. Two walls separated apart by two decibels could be considered as equivalent, regarding the fact that the human auditory system can only notice differences in sound pressure level of at least 3 decibels.

5. DISCUSSION

After obtaining the carbon footprint and the acoustic results, it is possible to consider the use of rice straw panels as an alternative to other more conventional solutions. This study has been developed to exemplify how architecture, and the building sector can take part in solving local and global problems. Manufacturing and using the rice straw panels not only avoids the emission of between 35.05 and 74.4 kg of CO2 equivalent but also tackles a very controversial local problem. As explained in the first section of this study, there is a complicated relationship between the local ecosystems, rice cultivation, and the city of Valencia. The impact the management of rice straw has in the area goes beyond the carbon emissions. The burning of the rice straw releases chemical compounds into the air that harm human health. Depending on the direction of the wind during the burning, a big cloud of smoke can cover part of the city, having an impact on the local population. In the case of mixing the straw with the soil as a fertilizer, the methane emissions generated are not the only problem either, since the rice straw fields are connected to the Albufera wetland. The incorporation of the straw has a direct effect on the coastal lagoon, producing an effect known as eutrophication. Eutrophication refers to the excessive growth of algae produced by high levels of nutrients and minerals in the water. Eutrophication is one of the most common problems in lakes, lagoons, and rivers in Spain, and it is responsible for flora, and fauna depletion (Cobelas, Olmo, & Ruiz, 1992). This effect, combined with other environmental problems threatening the Albufera natural park,
has put the local ecosystem in extreme danger(Lloret, Marín, & Marín-Guirao, 2008) (del Barrio Fernández, Gómez, Alba, Díaz, & Revilla Cortezón, 2012).
Problems such as this one affect many countries and regions all over the world. The building industry, as one of the most impacting production sectors, must take responsibility and try to help in solving, or at least mitigate those situations. Fortunately, the use of biological products not only is favorable environmentally wise but also, it usually provides good thermal insulation, which has a positive effect on the entire life cycle of buildings. Besides, using these kinds of local materials raises awareness in the general population. It is a way to get local people involved in their environment. Taking everything into consideration, designing buildings with a glocal idea is a perfect way for architecture to be part of the solution to both climate change and to many problems that affect local communities and ecosystems everywhere.

CONCLUSIONS

After the completion of this study, several conclusions can be drawn:
– Using straw panels as a building façade reduces 76.3% the environmental footprint compared to a typical double-layer brick façade
– Considering that the two likely scenarios for the rice straw are either burning or mixing with the soil, it can be stated that using the straw to build façade panels avoids the emission of carbon dioxide. When the straw is burned, manufacturing a square meter of rice straw panel avoids 35.05 kg of CO2 equivalent. If mixing the straw with the soil is the considered scenario, the straw panels avoid the emission of 74.4 kg of CO2 equivalent

per square meter. The preliminary acoustic measurements show that the rice straw panels provide adequate acoustic insulation to be used as a building façade. The acoustic insulation is comparable to the ones obtained with the other commonly used façades in the Spanish context.
– The results obtained so far indicate that building using rice straw panels as the building envelope is a perfect alternative in the Valencian context.
– Glocal architecture is the best way for the building sector to take responsibility by mitigating climate change and contributing to bring back local ecosystems to a healthy state.

ACKNOWLEDGEMENTS

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PAPER #7.11

TRANSFERRING VISUAL METHODS FROM DESIGN TO SOCIAL SCIENCE TO ADVANCE BUILT ENVIRONMENT RESEARCH

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ABSTRACT

Designers are well positioned to transfer visual methods from design-focused prospective sensemaking activities to qualitative social science methods in order to deepen translational research efforts. This paper contributes to the discussion regarding methods designers can employ to strengthen hypothesis building when working with qualitative data by demonstrating the use of visual tools available in Computer Assisted Qualitative Data Analysis (CAQDAS) software. The paper outlines steps in the initial analysis process for a research project investigating the relationship between collaborative professional practices and design outcomes. The pilot data were analyzed in MAXQDA to conduct thematic analysis with codes developed inductively and added to a deductive organizing framework. The Visual Tools, including MaxMaps and the Code Matrix Browser, were employed to build visualizations that identified emerging thematic relationships, and to develop and refine hypotheses. This paper argues that visual tools available in CAQDAS software position designers to build on their disciplinary expertise to more meaningfully contribute to research methods that seek to improve the built environment.

KEYWORDS

Qualitative data analysis; CAQDAS; visual tools; architecture; collaborative practice.

INTRODUCTION

There have long been calls for qualitative researchers to create more systematic and powerful displays of qualitative data (Miles and Huberman 1994). However, since many qualitative researchers are not trained in the visualization and pattern-synthesizing methods central to "designerly ways of knowing" (Cross 1982), there are few examples in the social science literature to help researchers understand how to employ the visual tools found in Computer Assisted Qualitative Data Analysis (CAQDAS) software to do so. Designers are well positioned to advance this literature by demonstrating how to transfer visual methods from design-focused prospective sensemaking activities to qualitative social science methods. This paper demonstrates the use of visual tools available in CAQDAS software by outlining steps in the initial analysis process for a research project investigating the relationship between collaborative professional practices and design outcomes. The pilot data were analyzed in MAXQDA to conduct thematic analysis with codes developed inductively and added to a deductive organizing framework. The Visual Tools, including MaxMaps and the Code Matrix Browser, were extensively employed to build visualizations which identified emerging thematic relationships, and to ultimately develop and refine hypotheses. These led to a sharpened focus on the participants' expressed drives towards quality, innovation, and experimentation in their work as well as the varied methods, strategies, and structures they exercised to

achieve these objectives. By employing visual techniques, previous assumptions about the original research questions were challenged and new refined research questions were developed for future phases of work.

1.BACKGROUND

1.1. Qualitative Social Science Methods in Built Environment Research

Many methods drawn from social science research can contribute to the exploration of essential architectural research questions. As outlined by the AIA in their 2019-2020 Research Agenda, these questions cut across individual, building, and societal scales of action. Qualitative social science methods may be particularly useful to explore architectural agendas that concern the many areas of human behavior, relationships among project agents, and understanding the role of design, community engagement, and culture to improve equity and quality of life ("AIA Research Agenda 2019 and 2020" 2019). Qualitative methods are particularly well suited to address research problems in which the variables are not well defined and when the literature does not yield sufficient information about the phenomenon of study (Creswell 2012). Because data are usually collected in naturalistic settings, qualitative methods possess many strengths for built environment inquiry, including their identification of contextual factors as they relate to the phenomenon of interest, and their responsivity to local contexts and stakeholders' needs. These aspects stand in contrast to quantitative studies, in which the researcher may miss out on important data because the focus is on theory or hypothesis testing rather than on theory or hypothesis generation (Johnson and Onwuegbuzie 2004).

1.2. Qualitative Data Collection and Analysis

Qualitative data collection methods take many forms, including interviewing, observations gathered in the field, reviewing texts, documents and records, and gathering audio visual materials and objects. These data collection strategies produce a wealth of data but not all of it may be significant to the research question. In order to identify and focus on the data that is most meaningful, qualitative researchers engage in cycles of analysis to search for patterns in the data and for concepts that explain why those patterns are present (Bernard and Ryan 2010). Miles and Huberman (1994) provide one way to visualize this process by describing qualitative data analysis as phases of data collection, data reduction, data display, and conclusion drawing and verification. (Figure 1)

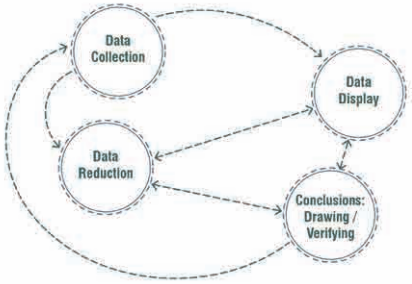

Figure 1. Components of Data Analysis.

In their systematic framework, data reduction refers to the process of "selecting, focusing, simplifying, abstracting, and transforming" raw data and occurs continuously throughout the life of any qualitatively-oriented project. It may take forms ranging from initial sampling decisions to data coding, identifying themes, and writing up project summaries. In this model, data reduction is not separate from analysis; it is a "form of analysis that sharpens, sorts, focuses, discards, and organizes data in such a way that 'final' conclusions can be drawn and verified" (Miles and Huberman

1984, 10-11). Data display, the organizing and assembling of information that permits conclusion drawing is, likewise, a central part of the analysis process. Since qualitative data often comprise large volumes of text that are hard to cognitively process, it becomes essential to find methods so that researchers can visualize the data, begin to draw conclusions, and then verify their findings.

1.3. Visual Tools in Computer Assisted Qualitative Data Analysis (CAQDAS)

Over the last forty years, Computer Assisted Qualitative Data Analysis (CAQDAS) software packages have been developed to assist with a wide range of tasks associated with taking a qualitative approach to qualitative data (Wolski 2018). These special purpose database management programs provide tools to expedite the practical aspects of qualitative research project work including content searching, linking, coding, querying, writing, annotating, mapping and networking. Silver and Lewins (2014) diagram the main overarching qualitative tasks as integrating, organizing, exploring, interpreting and interrogating data, and they outline how these tasks are supported by CAQDAS software in order to build explanations or theories, or to enlarge on a theory.

One practical aspect of this project work is creating and visualizing connections to understand and to communicate relationships, patterns, processes, and ideas as they are observed in the data (Silver and Lewins 2014). CAQDAS packages increasingly include advanced mapping or networking tools which accelerate the visualization of these connections. For projects based on deductive analytic frameworks, these tools can be used to graphically represent hypotheses or theoretical models from the project outset. For projects employing inductive, bottom-up approaches, these tools may be instrumental for generating and representing developing theories and explanations, as will be demonstrated in the Study Example.

The next section will demonstrate the use of a select group of visual analysis tools found in the CAQDAS package MAXQDA (Kuckartz 2018). In particular, the MAXMaps tools, available in the Visual Tools panel, build on Miles and Huberman's (1994) suggestion to create more systematic and powerful displays of qualitative data (Kuckartz and Rädiker 2019). While visualizations are valuable both in the analytic process and for communicating results, the Study Example focuses on data-based representations that visually represent relationships during data analysis to advance hypothesis building.

2. STUDY EXAMPLE: VOICES FROM THE FIELD

The use of QDA visual tools will be demonstrated by discussing the initial process and findings from a research project, Voices from the Field: Impact of Collaborative Practices on Design in Nordic Countries, investigating the relationship between collaborative professional practices and design outcomes. The data were analyzed in MAXQDA to conduct thematic analysis with codes developed inductively and added to a deductive organizing framework. The Visual Tools were used at regular intervals to visualize emerging thematic connections and, as the project progressed, to develop and refine hypotheses.

2.1. Research Design

The data for this project were generated as part of a constructivist interview study (Charmaz 2014). The study design aimed to capture the perspectives of participants and focuses on how these different viewpoints can contribute to an understanding of the larger phenomenon under study—the relationship between collaborative professional practices and design outcomes in the Finnish practice context. When gathering data on differing values, understandings, and experiences,

interviews are an appropriate method for gaining insight into how different participants construct meaning from their shared experiences (Kvale and Brinkmann 2008). Research questions structuring the project included: Who are the participants' most influential collaborators and how do these collaborators contribute to enhancing the quality of their work? How and why do these design professionals collaborate? What value does collaboration hold for them in achieving their design objectives? What challenges do they encounter in the collaborative process? And, in what ways does the Finnish context contribute to these phenomenon?

2.2. Data Set

Theory or concept sampling was used to identify participants for this study in order to select information-rich cases to contribute to understanding the central phenomenon under study (Patton 1990). Recruitment took place in advance of data collection through introductions to firms by an academic colleague in Finland. The four selected firms had received acclaim for their public design projects, as measured by winning significant peer reviewed public competitions and design awards. However, the selected firms are each at a different stage of development, are different sizes, and conduct work in different markets, providing a range of perspectives.
A semi-structured IRB-approved interview protocol was employed during the fieldwork (Patton 1990). Interviewees understood that the research concerned the role of collaboration in contemporary design practice and that one purpose of the visit was to understand more about their practices and the Finnish practice environment. Interviewees were sent a set of standard questions in advance, which were used as a framework for the interview combined with knowledge about their specific projects that had been researched in advance. The conversation was free-flowing; questions were not necessarily followed in a particular order though the overarching questions regarding the role of collaboration in their work and the most influential agents in these collaborations were asked of each participant.

2.3. Data Analysis

Interviews were digitally recorded, transcribed verbatim by a transcription service, and checked for accuracy during coding. The data were analyzed by importing transcripts into MAXQDA to conduct thematic analysis. Only text was coded; non-verbal interactions were excluded. The transcripts contain free-flowing text, which is delineated by turns at talk. The unit of analysis is a chunk based on an "idea unit;" chunks are coded based on where a single idea starts and ends (Kurasaki 2000).
Codes were developed inductively combined with a deductive organizing framework, which was employed to develop the start list (Bradley, Curry, and Devers 2007). The preliminary codes were drawn from existing literature, the author's previous research on this topic, and practical experience in the field. These deductive codes concern the primary agents with whom architects collaborate including other architects, consultants, clients, manufacturers, fabricators, and contractors. The initial deductive codes also included methods and strategies for realizing built work including contracts, project structures, and collaborative behaviors. Additionally, as the transcripts were analyzed, codes were created that captured themes related to the particular culture of the architecture, engineering, construction, owner (AECO) industry in Finland. These were used to highlight similarities and differences from the US context. These initial general codes were sorted according to whether they described the Finnish academic, practice, or cultural contexts. At different stages of the process, the Key Words in Context (KWIC) tool was employed to test additional codes as the meaning and context of the words in use drew attention to some important themes, among them *Quality, Competitions, and Innovate/*

Experiment (Wutich and Gravlee 2010). Key words were coded for the sentence before and after in order to provide context.

2.4. Identifying Themes through Visualizations

A detailed coding of the first interview was conducted to begin this analysis in the sample study. One of the most common methods for identifying themes in early stages of analysis is identifying repetitions within and across narratives (Bernard and Ryan 2010; Weston et al. 2001). While open coding the first narrative, repetitions were identified and a grounded approach was used to note the emergence of new themes (Markovic 2006; Strauss and Corbin 1990).

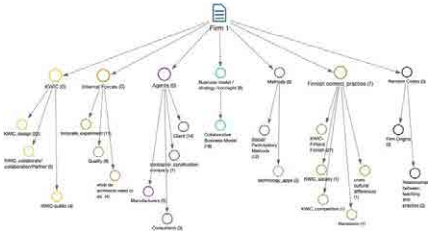

Figure 2. Single-Case Model with Code Hierarchy for Sample Study Firm 1 with modifications by the author for clarity

While researchers can build data visualizations in a freehand and additive manner, MAXMaps provides nine built-in model templates useful for initiating visual analysis. The Single-Case Model and the Single-Case Model with Code Hierarchy templates show which codes have been assigned to the document and their frequency can be expressed through symbol size, line weights, and numbers in order to quickly assess the document's content (Figure 2).

More useful for advancing inductive analysis is the Code Co-occurrence Model template, which focuses on intersections among a grouping of codes. Documents and codes are

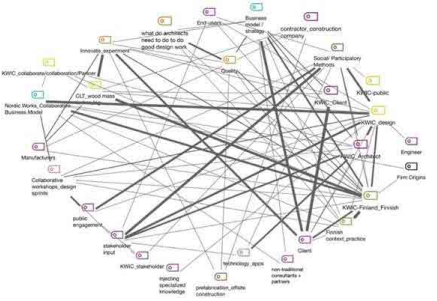

Figure 3. Co-Occurrence Model for Firm 1 as generated by the software. The Code Co-Occurrence model is useful for discovering interrelationships among codes but requires analysis and design agency to make meaning from the data

selected for inclusion in the model by activating them prior to creating the map. A minimum number of co-occurrences can be selected to focus on the most important relationships. These relationships can be amplified by setting the line width and code symbol size to register the frequency of overlaps. Within the model, the code frequencies can also be expressed numerically. In the Sample Study, the Code Co-occurrence Model was employed to render connections in the data visible. During the first coding process, the author identified a set of themes concerning the business, technological and social/ participatory methods the interviewee employed to collaborate. Another grouping of codes was

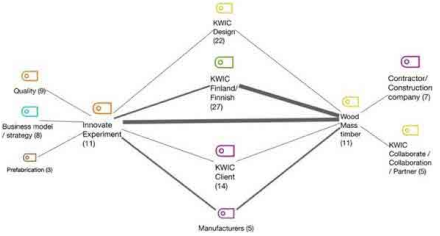

Figure 4. Focused Code Co-occurrence model exploring the codes Innovate/Experiment and Wood/ Mass Timber

identified that concerned the interviewee's understanding of the phenomena of engaging in fruitful collaborations and achieving positive design outcomes.

Building hypotheses by employing relational visual maps is an iterative process. If a large selection of codes are initially activated, the map generated by the algorithm provides a dense and often unwieldly web of code interrelationships (Figure 3). One strategy is to build simpler maps containing fewer codes in order to confirm the relationship among themes. For example, a focused Code Co-occurrence model (Figure 4) looking at the strength of the relationship between the codes "Innovate/Experiment" and "Wood/ Mass Timber" confirmed the author's hunch that when the first interviewee discussed Innovation and Experimentation, they also frequently discussed the role of Mass Timber in their work and referenced the importance of design, the Finnish context in which they operate, and their relationships with clients and manufacturers. Iteratively studying smaller confirmatory clusters is an analytic action focused on data reduction which can, as more complex maps are constructed, help to eliminate non-productive codes.

This visual analytic process simultaneously balances data reduction and data display. If too many codes are activated, the relationships can be overwhelming and not conducive to theory-building; if too few codes are activated, the webs are not sufficiently thick and important relationships may be missed. Organizing the codes into clusters and clarifying their interrelationships requires actively engaging the software and making analytic decisions when rearranging the elements in the workspace. Once the selectively edited codes are organized into areas of interest, the attendant graphic and thematic hierarchy can contribute to more complex, yet orderly, exploratory maps. In the Study Example, an iterative process building maps of increasing clarity identified salient thematic patterns among the coding clusters (Figure 5). These central tendencies were each explored further in new maps as additional transcripts were coded.

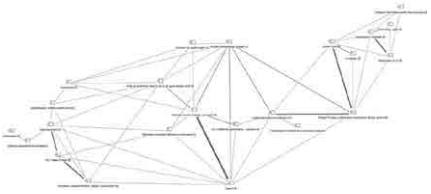

Figure 5. Revised Co-Occurrence Model for Firm to spatialize code clusters and identify areas of theoretical interest.

The next step involved exploring clusters of codes by exposing the underlying text. Revealing the text provided an opportunity to engage in further analytic techniques akin to a software-supported version of traditional manual cutting and sorting methods (Bernard and Ryan 2010). This step enables researchers to rule out concepts that might look similar due to code co-occurrence, but are not actually quite as related once the associated full text is visible; the ensuing code clarification can prompt revision of inclusion and exclusion criteria. Further, the process of analyzing the text associated with the linked nodes made apparent some repeating key words from the Study Example transcripts. These discoveries activated a new round of analysis employing the Key Word in Context (KWIC) technique in which, supported by the software, additional text units were coded and then added to the model. The initial codebook was further refined and a revised visual map was constructed to establish relationships among the major themes. (Figure 6) After reaching conceptual exhaustion from coding this first interview, themes from the first interview produced a series of hypotheses, which were then tested, modified, confirmed, and expanded in subsequent interviews (Markovic 2006).

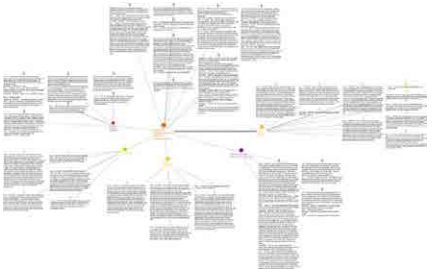

Figure 6. Co-Occurrence Model with Select Text Clusters Exposed

2.5. Visualizing Systematic Comparisons

One method for analyzing narratives that can produce a high number of themes early in the analysis process is looking for similarities and difference within and across narratives (Bernard and Ryan 2010). Searching for similarities and differences by making systematic comparisons across units of data brings a focus on the data itself and is a way to bypass the researcher's assumptions (Strauss and Corbin 1990). In this Sample Study, interviews continued to be coded in the order that the firms were interviewed. After open coding each narrative, MAXMaps and the Code Matrix Browser were employed to compare the themes among the interviews.

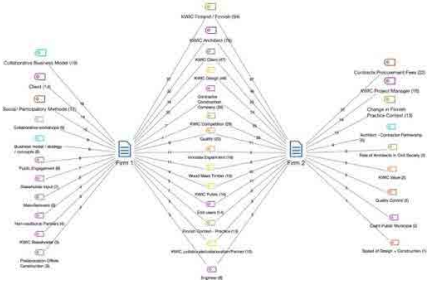

Figure 7. Two-Cases Model exploring similarities and differences in the first two transcripts.

The Two-Cases Model is particularly useful for visualizing relationships among two documents as it quickly demonstrates the strength of overlaps and renders codes spatially so that outlying codes are easy to identify due to position. In the Study Example, this exercise showed the growing importance of the codes for *Quality, Wood, Competitions, and End-Users* but it also made clear that while the first interviewee spoke extensively about their innovations in collaborative business strategies to achieve their design goals, the second interviewee focused on the importance of setting up contracts and procurement strategies that would support their design objectives. (Figure 7) The similarities and differences discovered prompted further refinement and reorganization of the Codebook. As more transcripts are coded, the Code Matrix Browser provides a graphic and numeric assessment of which codes have been assigned, how frequently, and in which documents. Though it is more difficult with the Code Matrix Browser to directly interact with the underlying data, these visual representations of code distributions help to identify patterns, as well as exceptional cases, and can thus serve as a useful validation technique.

2.6. Building Hypotheses

Once the data set is fully coded, individual codes and code relationships can be explored in a more focused fashion by building maps to investigate specific codes of interest. Exploring their code co-occurrences graphically can play an integral role in hypothesis generation. In the Study Example, a quote from an interviewee concerning the importance of wood in public architecture sparked an exploration of the associated invivo code. Mapping the code co-occurrence for key words associated with wood architecture, such as CLT, mass timber, and log, enabled a consideration of the interwovenness of technical methods with a building material that carries meaning

in the Finnish culture, building traditions, and contemporary economy. Another exploration concerned a central tendency of the narratives—that *Quality* and *Innovation* come from direct participation and involvement with the *End Users*. The relationship between *End-Users* and *Innovation* was investigated by building a visual map exploring code co-occurrences. When generating maps to advance theory building, it may be helpful to first set up binary relationships before making more complex maps. While earlier iterations considering a three-way exploration of the codes *End-Users, Innovation*, and *Quality* proved difficult to read, a map looking at the expressed relationship between *End Users* and *Innovation* provided more clarity.

3. DISCUSSION

While qualitative researchers have called for a greater role for visualization in conducting empirical research (Ravasi 2017) and have urged a more inventive and iterative stance towards their generation and use (Miles and Huberman 1994,11), there are few resources to help researchers bridge the gap between the instructions found in software manuals and the path to useful data visualizations. This paper contributes to the literature by providing an outline of strategies to iteratively use visual tools for codebook development and theory building. These strategies may be particularly helpful for qualitative studies situated on the exploratory end of the exploratory-confirmatory spectrum (Wutich and Gravlee 2010). Employing visual maps as a central feature in the ongoing "materialization of cognitive work" (Stigliani and Ravasi 2012) challenged previous assumptions about the research question and enabled development of more focused research questions for future study phases. As described in the Study Example process, the strategies suggests a refinement of Miles and Huberman's diagram of the Components of Data Analysis (Figure 1). The robust and interactive visual tools available in the CAQDAS software now support a process to bring data reduction and data display into a much tighter and more iterative relationship than suggested by the organization of components depicted in the original diagram.

Visual modes of representing, thinking and communicating may pose a challenge to qualitative researchers who generally prioritize linguistic and text-based data in their work. However, the centrality of visual materials in the knowledge-intensive work of built environment practitioners (Whyte and Ewenstein 2007) position architects and designers to be adept at using these tools to generate new forms of knowledge. The fluidity of moving between the underlying data and the emergent maps activates the pattern-synthesizing methods central to "designerly ways of knowing" and facilitates designers' orientation towards "constructive" modes of thinking (Cross 1982). Further, the visual tools promote the translation of established design practices into social science methodologies. For example, designers typically rely on practices such as seeing thoughts and ideas as they are being worked on, and physically moving materials around to detect commonalities and emergent themes (Stigliani and Ravasi 2012). As the literature on codebook development frequently addresses the need to develop shared understandings of phenomenon among members of research teams (Weston et al. 2001; MacQueen et al. 1998), visualizations may prove invaluable as they have a history of use in design practice as exploratory objects for shared project framing, knowledge development and meaning making (Whyte and Ewenstein 2007). Cross pollinating social science and design methods by using visual tools for systematic analysis adapts and expands both of these methods' sensemaking capabilities (Weick 1995; Krippendorff 2006) as well as their prospective sensemaking potential (Gioia and Mehra 1996).

CONCLUSION

This paper contributes to the discussion regarding methods architects and designers can employ to strengthen hypothesis building when working with qualitative data by demonstrating the use of visual qualitative data analysis tools. In the drive for continual advancement of research methods to improve the human built environment, this paper argues that that visual tools available in CAQDAS software position designers to build on their disciplinary expertise in order to more meaningfully contribute to impactful research.

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PAPER #7.12

SOCIAL RENTAL HOUSING SITING & MAINTENANCE: CONSIDERING THE ARCHITECT'S CRITICAL ROLE

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ABSTRACT

In several countries across the globe, social rental housing (SRH) is lost for a variety of reasons. In Nigeria, SRH, a housing type typically associated with the most disadvantaged people in the society, is lost due to reasons predominantly associated with siting and maintenance (Daniels-Akunekwe & Sinclair, 2018). Although, SRH constitutes just over 5% of the total housing stock, a significant amount of these developments are *still* lost. To address these issues, in several contexts – including in Nigeria, the responsibility is accorded the architect, who is considered the chief culprit. This is because historically architects have been charged with overseeing building processes from inception to completion; their responsibility spanned beyond the breadth of the structure's aesthetics through to successful construction and even liability for its failure. Now, the profession has morphed into one of intense specialization, where the role of the architect seems to be reduced to design – the role of a "shaper"… of "form-giver" (Franck, 2017). Leaving architects to placate themselves with the opinion that designing is at the core of all things building, while being painfully aware that this is a "mere shadow of the competencies" they command, and a demotion from their roles as master builder and "generalist-practitioner" (Franck, 2017).
With the progressively narrowed/narrowing role of the architect, and the absence of a universally outlined description of the architect's obligations, it is difficult to establish in certain circumstances (where buildings are considered unsuccessful) the extent of involvement in the problem for which the architect is liable (Daniels-Akunekwe & Sinclair, 2019a). It is our suggestion that the characteristic extremely limited budget of SRH projects should confer on the architect, the additional responsibility of artist, researcher and anthropologist… to not only design an adequate, affordable, and aesthetically pleasant development but one that considers the location, and post-construction life, with equal intensity.
Therefore, riding on this reasoning, we select four SRH developments situated in non-poor (both middle and high-income) neighborhoods in Lagos city, Nigeria. These cases were selected because despite being located in 'choice' neighborhoods, the specific sites combined with a non-existent/non-effective maintenance management program have proved unfavorable and unbeneficial to its occupants, the surrounding residents, and to the neighborhood as a whole. By deploying mixed methods including literature investigation, interviews, and phenomenology, the study seeks to define to which extent siting and maintenance are related to the profession of the architect.

KEYWORDS

Social housing; siting; maintenance; design; architecture.

INTRODUCTION

> "It is hard to argue that housing is not a fundamental human need. Decent, affordable housing should be a basic right for everybody in this country. The reason is simple: without stable shelter, everything else falls apart." - Matthew Desmond

Historically, social housing (SH) is believed to have originated in Europe and over the years, as it has spread across the globe and taken on myriad forms, what it means has evolved [United Nations Economic Commission for Europe (UNECE), 2006, 2015; Organization for Economic Co-operation and Development (OECD), 2016]. This is because "each country has forms of housing that are broadly designed to satisfy the needs of households who are unable to compete in the marketplace for housing of an acceptable standard" (Oxley 2009, 2) therefore terms like public housing, common housing, limited-profit housing, government subsidized housing, and not-for-profit housing etc. are now used interchangeably (UNECE, 2015). As a result of this, the UNECE (2015) defines SH as essentially being a "key word used to enable governments and interested stakeholders to exchange knowledge about the part of the housing system that is aimed to satisfying need, that is supported by the state and distributed through administrative process distinct to their local contexts" (UNECE 2015, 14). A more specific definition is that provided by the Canada Mortgage and Housing Corporation (CHMC), which describes SH as:

> an umbrella term referring to rental housing that is designed to cater for the needs of people on very low to moderate incomes who may be experiencing 'rental stress' in the private market" (CMHC 2017, para. 3).

The allocation of SH is strictly dependent on the severity of the households' need (Whitehead & Scanlon 2007). SH is the singular public rental housing type that focuses on the most deprived group in the population (Polak 2007).

Unlike in Europe, in Nigeria, via the 2011 National Housing Policy (NHP) draft, the government redefined SH to connote "housing for no income earners, low-income earners and lower medium income earners" (Ekong & Onye 2013, 257), which was adopted. The NHP document defined the three classes to mean:

"(i) All persons whose income does not exceed the national average of 25% of the National Minimum wage [which is eighteen thousand naira (N18, 000) per month" (or USD49.25 as at February 2020)]; "(ii) all persons whose annual income exceeds the 'No Income' level, but does not exceed the National Minimum wage; and (iii) all persons whose annual income exceeds the National Minimum wage, but does not exceed four times the National Minimum wage" (Ekong & Onye 2013, p. 258).

SH in Nigeria is patterned after Western styles (Ukoha & Beamish, 1996), and was recognized as a vital housing development in the 1970s (Olayiwola et al., 2005). This recognition [where the government first made mention (specifically) of SH as a solution to the then budding housing shortage challenge] occurred during the period (1975-1980) of the Third National Development Plan (NDP); after which, the nation's first Low-cost housing (LCH) program was launched (Olayiwola et al., 2005). While, there is no confusion as to what SH means in the Nigerian context, researchers such as Ekong & Onye (2013), Ilesanmi (2010) and Ihuah & Fortune (2013) have interchangeably used the term SH with public housing in their papers (which essentially focus on SH in Nigeria). This substitution is seen to also exist in daily news publication on SH in Nigeria (Aboderin, 2017).

> "In spite of the different meanings and connotations of public housing in literature, there is consensus among authors and researchers as to the goal of social housing

> provision in most countries of the world… which is to ensure the provision of subsidized housing to households and individuals who are unable to gain access to decent housing at market prices" (Balchin et al., 2000; Liu, 2007 quoted in Ibem et al., 2011a; p. 423)...

and constitute a strategy that is pro-poor – created in order to ensure housing affordability (Yates, 2013, Aboderin, 2017). To this effect, rent is determined by tenant income and is generally set at 25 or 30% of household income (Yates, 2013). Contextually speaking (within the setting that is Nigeria), SH is an umbrella term, which covers a variety of tenures including: social rented/ rental housing, LCH, co-operatives, private-rented SH, and shared ownership housing (Ndubueze, 2009). Among these different tenures, LCH is the most dominant.

Having adequately described what SH represents in Nigeria and more broadly – in other contexts, the reason why the authors have selected this specific housing type is because in the last two-plus decades, SRH has been acknowledged as the "housing of the future" (Harloe, 1994; Maclennan & More, 1997; Delgado & De Troyer, 2017)…

> based on its ability to – when strategically situated in non-poor neighborhoods – exert minimal pressure on wages and salaries, create more livable and cohesive cities, and allow for shorter commutes and proximity to labor (Daniels-Akunekwe & Sinclair, 2018).

While considering the above statement against the situation in Nigeria, it is apparent that the latter is an antithesis to the promise that SRH proffers. Although SRH is not characteristic of the housing sector in the country, recent attempts at providing this housing type has resulted in a continued mirroring of a long-term pattern of vandalism and/or abandonment experienced with previous SRH developments (Ihuah & Fortune, 2013; Adesola, 2018; Yakubu, 2019).

As this is not an entirely novel study, previous research (which has been conducted on a larger/broader scale) has indicated existing links between the failure of the urban built environment and the role of the architect and his/her inability to lead other built environment professionals towards the creation of a holistically sustainable environment. In this more focused study (where we consider the changing the role of the architect, investigate to what extent this constantly changing role is impacting their ability to effectively perform, and to what extent the current issues impacting the success of SRH can be linked to the profession of the architect) however, the singular constant identified in the design and delivery of SRH and its continued inability to achieve its goal (that is, improve the lives of its inhabitant and create more liveable and cohesive neighbourhoods/cities) is the architect (Daniels-Akunekwe & Sinclair, 2019), who in the Nigerian context, is expected to be the leader of the built environment professionals (Allu and Elimisiemon, 2017), and, in addition to…

> traditional roles of design and specification, … also contribute through training and education; research and development; public enlightenment; and advocacy (Opoko 2015).

While this is expected from the architect, it has not necessarily often translated to what is delivered. The expectation from the architect in the Nigerian context is not atypical but rather is in alignment with studies by Allen (2009), Cheshmehzangi and Deng (2016), and Tan et al. (2017), which stipulate that sustaining all parts of the built environment *should* indeed be the responsibility of the architect.

1. UNDERSTANDING THE RELATIONSHIP BETWEEN THE (ROLE OF THE) ARCHITECT AND THE TWO MAIN ISSUES IDENTIFIED WITH SRH

This section provides background and historical information on the themes around which our study anchors. In the following sections, we attempt to review and understand: (I) the historical expansion and/or reduction of the role of the architect; first, generally, and secondly, as it relates exclusively to pro-poor housing, (II) the training process required for the architect in order to ascertain if they are (continually, to present day) furnished with the skill set to manage more than just design, (III) the role of the architect in the production and provision of SRH, and (IV) the architect's role as it pertains to the siting and maintenance of SRH in Nigeria.

1.1. The historically changing role of the architect: 'Jack-of-all-trades' or specialist?

> "The jack-of-all-trades seldom is good at any. Concentrate all of your efforts on one definite chief aim." – Napoleon Hill

The architect was traditionally referred to as the master builder (Kahn, 1979). In fact, the term architect was derived from ancient Greece where *Arkhi* meant head chief or master and *tekton* meant worker or builder (Berman, 2003). Architects such as Michaelangelo and Leonardo da Vinci are exemplary of the…

> omniscient master builder who was charged with the responsibility for the total success of a construction project. In this role the architect not only graphically portrayed the basic concept of the aesthetic and structural components of an edifice, he also took charge of its implementation, and was liable for its failure (Kahn 1979, 216).

Because of this history, the word "architect" carries with it preconceived notions (Faraudo, 2019); that the architect *must* bear the entire responsibility for both project design and project construction from inception to completion (Franck, 2017). As a result of the breadth of expectation from the architect, he had sufficient design and construction proficiency to undertake the entirety of his responsibilities (Burr and Jones, 2010). Between then and now, over the last couple of centuries, the role of the architect has continually evolved (Burr and Jones, 2010). The profession has morphed into one currently characterized by intense specialization so that the entire process of building design and construction is segmented to provide the different professions within the building and construction industry clearly defined roles. The master builder of the past, in many contexts, is now fundamentally considered to be the "designer" and "accorded very limited responsibility regarding the outcome of the entire endeavour" (Franck, 2017). While researchers can agree that the role of the architect has changed considerably, and is now significantly narrowed, it is commonly unclear as to their exact role.

There are several reasons why the role of the architect has narrowed. One of which, and perhaps chief among them, is the increased complexity of construction (Jones, 2006; Burr and Jones, 2010). As building projects become more technical, increase in scale, adopt new technology, incorporate myriad systems, are subjected to increased "time pressure, dangers of liability, of lawsuits regarding malpractice…" (Franck 2017, para. 4) the notion that the architect may be unable to maintain an expertise level to accommodate all the trades and aspects of the building continued to arise (Jones, 2006). Eventually, this led to the *splitting* of the master builder role into two principal professions/professionals; the designer and the builder, with the architect exempted from building activities (Jones, 2006; Thomsen,

2002). Even within the design section, further specialization resulted in the identification of additional architects or designers to attend to "landscape, interior, and acoustic…" (Woods, 1999). With specialization came intense fragmentation, which has evolved to the point where, rather than the architect single-handedly assuming the responsibility for an entire project,

> It is not uncommon today to have an architect with 15-20 consultants, a general contractor with 40-60 subcontractors, and subcontractors with hundreds of manufacturers and suppliers (Jones 2010, 3).

This fragmentation has also accommodated the creation of and inclusion of new roles within the industry such as the construction manager, who has inadvertently become the principal agent for the construction process. The arguments surrounding the creation of the construction manager profession/position were predominantly along the lines of: (I) the architect being too much of a designer (with a focus on aesthetics) to manage a project from inception to completion, and/or (II) the outright inadequacy of the architect in construction management services (Berman, 2002; Yates, 2003). This arrangement is fraught with its own problems, and while it does address some of the general concerns with burdening the architect with excessive responsibility, issues around the "confusion of definitions and conflicts of roles" continue to emerge. Once again, the architect is routinely left without a clearly defined role or position.

1.2. The contextual variance in the architect's role: is broader better?

While the role of the architect is seen to be generally narrowing, in countries such as: Australia, Austria, Netherlands, Uganda, in terms of pro-poor housing, the role of the architect appears to be broadening (Salcedo and Straub, 2014; Adengo, 2017).

In the Netherlands, according to Salcedo and Straub (2014), based on their study of 21 SH developments, results revealed that projects typically employ the services of an architect and a main contractor; along with consultants and advisors, but the former is *still* expected to take on responsibilities larger than just designer – responsibilities that are technical and advisory in nature. In Austria (Vienna), the development of SRH requires the services of the architect, who should also be versed in urban planning, and to a significant extent, ecology and social policy. The rationale behind this is that more important than good design, is the relationship with that design to its surroundings (Forster, 2018).

In Australia, the architect and his architecture are critical in the delivery of pro-poor housing (Maher, 2017). Before the 70s, the contribution of the architect (via design) towards the delivery of SRH was "most overlooked" (Maher, 2017). After the 70s, a new era began where the government and architects began working together towards providing SRH. As a central part of the built environment, the Australian government recognizes and has openly declared that the architect remains relevant through to completion. The Australian government states that the architectural profession is able to handle crucial issues that can *genuinely* deliver affordability, sustainability, and housing flexibility, "in both upfront costs and the on-going cost of occupation" (Maher 2017, para. 19).

Across Africa, it is not atypical for architects to *persuade* the community, their clients, and colleagues in the design/construction sector that their profession should exceed design, in Uganda however, stakeholders require little to no persuasion. As it relates to SRH, while the architect is expected to have an "entire technical team on board, including engineers, quantity surveyors and land surveyors" (Adengo, 2017), the architect is still expected to "wear all these hats simultaneously" (Adengo, 2017). Even the misconception that the service of the architect is unnecessary

during the construction phase is very seldom debated in the context. In fact, it is popular opinion that without the architect's presence through to project completion, the construction manager may tend to make discretionary changes and take

> shortcuts that may lower the quality of the outcome of the project; the result of which can be seen in the recent building collapses in Kampala (Adengo 2017, para. 3).

SRH building collapse has been known to happen in Uganda because the architect "plays too broad a role in the initial design process, but too small a role during construction" (Adengo 2017, para. 4). Research indicates that this broadening of responsibility in various contexts is on account of the characteristic extremely limited budget of SRH developments. The nature of this budget confers on the architect the duty to not only design an adequate, affordable, and aesthetically pleasant development but one that considers the location, and post-construction life with equal intensity. Therefore, the architect must – in addition to designer - also be artist, researcher and anthropologist. If all this expectation is piled on the architect, it is important to consider the quality of training that is provided for and required from him in order to deliver his responsibilities.

1.3. The training process for the architectural profession

Architecture education in Nigeria commenced in 1952 with the establishment of the first School of Architecture at the Nigerian College of Science and Technology in Ibadan (south-eastern Nigeria). Three years after which, the School was relocated to its northern campus, located in Zaria. Initially, the 5-year program culminated in the award of a diploma and the qualification to write the Royal Institute of British Architect (RIBA) examinations but soon after the College was upgraded to a "full-fledged university", rather than diplomas, it began to issue Bachelor of Architecture degrees (Maina, 2008). By 1969, Nigeria had adopted and implemented a 2-tier B.Sc/M. Sc 'American-styled' program, which is still in existence in many Nigerian Schools today. Globally, in order for the architect to practice, he must obtain a license, which follows the acquisition of a graduate degree from a college that has been accredited by the designated national accreditation board, as well as a mandatory internship program and architectural exam (Jones, 2006).
Acquiring an architecture license is designed to be lengthy, tough and demanding [particularly from the student perspective (Dare-Abel et al., 2015)] in order to be adequately equipped for a career-long gruelling journey "characterized by long hours of design, drafting, and modelling" (Dare-Abel et al. 2015, 169). While the entirety of the architect's education is not gained in the school of architecture, it is critical to afford the student a solid foundation for all future learning.

1.4. The architectural education: expectations versus what is obtained

Architectural education worldwide is fundamentally a multi-disciplinary program, which integrates essentials from urbanism, structure, building physics, real estate, construction, services, etc. The multi-disciplinary nature of architecture exists predominantly in the undergraduate degree in order for the individual enrolled (during the typical 5-year period) to decide on a specialization (Moonen and Veeger, 2014). To understand why architectural education is relatively encompassing, it is necessary to appreciate that architecture exceeds design, building and even construction, to
the improvement of the human habitat. Thus, the goal of architectural education, which is essentially to advance the profession of architecture, is to contribute to the attainment

of a humane and responsive environment (Magaji and Ilyasu 2016, 13).

Similarly, a notable architect in Nigeria; Arc. Ibrahim Haruna, in the annual Architects Registration Council of Nigeria (ARCON), expressed and emphasized that the nation's expectation of architects is to shape and re-shape the built environment. Despite this premise, architectural education in Nigeria is increasingly falling behind in comparison to international standards, with regards to both training and output, because it has become stale (Dare-Abel et al., 2015; Magaji and Ilyasu, 2016). Considering that architectural education in Nigeria is just over seven decades old, it has remained regressive when compared to other countries that have taught it for significantly longer periods (for centuries), and still have kept up with the globally changing rules around becoming "skilled and work-ready" (Onyegiri et al 2014, 65). In the last 50-plus years, schools of architecture in Nigeria, have left architectural programs; "studio learning culture, and its underlying rituals and processes" (ibid.) unchanged. This neither implies that the government is unaware nor that it fails to set standards. In fact, according to Dare-Abel et al. (2015), following the lead from the American context, it is the intention of the Nigerian government to continually reform the education system by incorporating both globally and locally tested solutions as is evident in the Third National Development Plan (NDP) but despite the intention, there is a mismatch in execution.

While the expectations for and results of (in terms of service delivery) the architect do not correspond, the attraction to an architectural degree remains high. Over the last 17 years (2003 to 2019), the graduates from the fully accredited (to Masters level) Nigerian universities is recorded as just under 13,000 (Nairaland, 2020; ARCON, 2020). Despite this large number, only an average of 100 students are registered annually (ARCON, 2020). With an opportunity such as that present in Nigeria, where (I) the population is over 206 million (World Population Review, 2020), (II) there is a rapidly increasing rate of building construction, and (III) the nation has only 3,500-plus registered architects (ARCON, 2020), there is a huge prospect for architects in Nigeria. Additionally, in 35 years, the number of registered Architectural firms has risen from 38 to 649, with a larger growth ascribed to the firms that are "unregistered by the professional bodies but are licensed by the Corporate Affairs Commission (CAC)" (Dare-Abel et al., 2015). According to Njoku (2011), while this huge growth in the establishment of architecture firms is representative of the relevance of the architecture profession and architectural services in the country, it is not representative of how much architectural services are actually being utilized. Also, because Nigerians are constantly seeking foreign architects, it does not mean that locally trained architects are incompetent rather the opposite is the case, "there are a lot of Nigerian architects who can do the job better than foreign architects" (Njoku, 2011), but Nigerians typically recruit expatriates over the millions of job-seeking Nigerians.

By simple extrapolation, the opportunity presents a ratio of one (registered) professional architect to service over fifty eight thousand Nigerians. With the majority of these Nigerians being poor or of the lower income class, it is important that architects are trained, not just for the specific context where they practice but also to address the needs of and design for all income classes.

Having established several elements: that (I) the education level may not have improved in Nigeria in the last several decades, (II) despite the former, the level of architectural education in Nigeria is still able to produce architects who are relatively skilled and capable, and (III) the architect is increasingly relevant and operational considering their ability to cater to the rapid construction rate in the city/country, we then conjecture as to what the issue may be with churning out successful SRH projects. As we build on the suggestion

that the architect is the major concern with developing adequate SRH (in terms of siting and maintenance), we consider what makes the architect; that which enables him perform in his role, which is the quality of education. We will briefly review the quality of architectural education with regards to the curriculum.

1.5. Curriculum for architectural education

There are several elements that make up quality architecture education; some of these are: intake/admission requirements, teaching quality, (awareness about) transition from student to professional, professional practice, keeping pace with trends and technology in architecture [such as increasing the proficiency of students in the use of Computer Aided Design (CAD)] but by far the most important is curricula (Maina, 2008; Dare-Abel et al., 2015). In 2012, Joanne Banks identified four pathway standards for all students in order "to raise performance and close achievement gaps", and they all revolve around curriculum. In fact, Magaji and Ilyasu (2016) describe curriculum as the entire educative process including the "environment, student, lecturer, course, course content, method, and physical and psychological environment" (15).

Based on reviewing studies on similar themes, the curriculum of architectural education in Nigeria has "largely remained the same" (Maina, 2008) since the 60s. This stagnation has persisted despite the massive global evolution that has occurred with the discipline and has also resulted in the insufficiency of the courses taught to furnish the students with the knowledge required for a professional career. These courses, which are required to be fundamental to providing the springboard for success, are failing to prepare students for real-life situations (Maina 2008, 3). Besides the ineffective course content within classrooms, students are also failing to acquire the requisite skills during the mandatory Industrial Training (IT) program (ibid.). While this is not a problem of the educational institutions per se but of the Architectural councils (the policy making bodies for architects in Nigeria) in the country, there remains a responsibility of tutelage from participating architecture firms to the student, in order to fulfil this portion of the curriculum. Additionally, allied courses that aim to produce a well-rounded professional such as the knowledge of building materials, electrical and mechanical services and drawings, and in some cases, Masters degree programs, are increasingly inadequate. Another point Maina (2008) makes is that the Nigerian curriculum, which was based on the British/American program, is now out of touch with providing the know-how to deal with the nation's current prevailing problem of squatter settlements, of minimum cost housing, of slum renewal and many of those problems usually associated with the developing countries (Adeyemi, 2000).

2. THE ROLE OF THE ARCHITECT IN THE PRODUCTION AND PROVISION OF SRH

> "Architecture is really about well-being. I think that people want to feel good in a space… on the other hand, its about shelter, but its also about pleasure." – Zaha Hadid

This section of the paper seeks to understand the role of the architect in the production and provision of SRH and attempts to draw a connection between their responsibilities in this regard and how it could be accountable for the siting and maintenance issues highlighted in Nigeria.

2.1. The architect's role in SRH production and provision

The historical role of the architect in the production and provision of pro-poor housing has been limited to design. Within this already limited responsibility, the design produced by the architect was/is sternly impacted by the

government (Cheng, 1980; Nimmo, 2001). The rationale behind this is the government's insistence that the design of SRH has to follow a defined conception; SRH had/has to be stripped of unnecessary extravagancies, and could not be anything above the bare minimum. What the government insisted on was characterless, high-density blocks and "if the architects employed… proposed anything else, they will have a battle on their hands" (Nimmo, 2001). There was/is no encouragement…

> to pursue quality design solutions and an outright resistance to innovation, especially if that means that the housing might be different to what surrounds it (ibid.).

Interestingly, in many contexts, SRH design proposals outside of these limitations will typically be unsupported. The brief is simple "do not design the very best you can" (ibid.). When you consider what design means to an architect, this expectation is both strange and difficult for him, and an antithesis to what the profession represents. The result of this is that what the architect delivers is not truly his but rather a 'brainchild' of the government.

Despite this being the case in Nigeria, in many countries (Netherlands, France, Spain, Slovenia, Australia, Belgium, Italy) across the globe, the architect is encouraged to produce the finest design while still prioritizing affordability. In fact, in Austria (Vienna), two things have begun to transpire: (I) the government has begun to seek star architects to design SRH, and (II) the mention of upcoming SRH projects has begun to attract an "impressive list of 'star' architects as a way to demonstrate the importance of the development" (Forster, 2018).

2.2. The architect's role in the siting and maintenance of SRH

The government's focus on cost issues has significantly distracted it from issues such as siting and maintenance, which are guaranteed to impact its performance. In cases where the architect has access to and perhaps, also consults the end users, little can be done in terms of incorporating their suggestions into the design proposal.

Typically, the siting of (government provided) SRH is beyond the responsibility of the architect. If the government assumes responsibility for developing the SRH structure, it would provide the land, thereby determining where the development is situated. This is the case in Nigeria, where the Nigerian government is responsible for allocating land for SRH (Ajayi et al., 2014). Again, because the government's focus is on cost saving, the land allocated for SRH, is characteristically located in poor, blighted fringe neighbourhoods. 70% of all SRH is located in such neighbourhoods (ibid.). Literature shows that there is no slated location for siting SRH on record; and if SRH were to be developed privately, permission to proceed would still be sought from government authorities (Isah, 2016). There are however, a handful of scenarios where the government has allocated high-demand, high potential, and profitable land to SRH – some of which we highlight later on in this paper. Although, land selection and siting may not be the architect's responsibility, the argument can be made that based on the skills acquired from an architectural education, the architect is equipped to manipulate the environment to elevate the SRH development and apply their knowledge of planning, urban design etc. as tools to marry the existing environment and the SRH development.

Still there are instances in Nigeria, when the Architect is consulted by an individual/party within the private sector, with the intention to develop some form of pro-poor housing. Adewunmi (2016) discusses two routes that

are typically taken following the decision to develop land towards the provision of SRH: one, the individual/party, based on counsel from professionals within the building and construction industry (the architect included), is advised on the 'right' location to seek out and purchase land prior to embarking on design and construction, or two, the individual/party identifies a parcel of land that they consider favourable (for myriad reasons: some being affordability, location, size), purchase it, decide to develop a variation of pro-poor/mass housing, and then proceed to hire an architect, who at this point is (and can only be) responsible for siting decisions (going forward) that are limited to building orientation, vehicle access (integration), physical barriers, landscaping, parking, and protection of utilities to mitigate threats, among other things.

Interestingly, while there are neither current nor comprehensive documents explicitly describing the mechanisms through which the allocation of sites for SRH in Nigeria take place, Ilesanmi (2010) provides an idea based on what transpired in the late 70s/80s. The government earmarked land for the construction of pro-poor housing, specifically (variations of) public housing. For any corporation or interested party to secure land for the development of LCH (etc.), an application had to be submitted through the Land Use and Allocation Committee (Ilesanmi, 2010). The application process was cumbersome, and the administrative process, demanding and a major constraint to propagating the development of all kinds of public housing schemes. The major requirement following acquisition was confirmation of the development of massive scale housing for low-income groups (ibid.).

Like land allocation and siting, the maintenance of SRH was the responsibility of the government (Isah, 2016). SRH maintenance is considered to be so burdensome [because it spans beyond the building itself (that is, its efficient performance, physical appearance, and economic returns/value), and its users to the surrounding environment] that developments (Ihuah & Fortune, 2013)…

> are abandoned either half way to completion, after completion, or not even embarked on as a result of there being no framework to address it (Fatoye & Odusami, 2009)

Despite the enactment of several housing policies that emphasize the need for both a planned and an unplanned maintenance policy, Nigeria's notoriety for having a poor maintenance culture remains unchanged (Ihuah et al., 2014). As far back as in 1991, a review completed by the Federal Government indicated that the backlog of maintenance required to bring the existing units to acceptable standards was equivalent to the cost of three million new units [Federal Republic of Nigeria (FRN), 1991]. As a result of the severity of the maintenance challenge, recent policy discussions papers have suggested the transference of the responsibility of maintenance to the inhabitants of the development as part of the government's plan for an operational subsidy (Isah, 2016). The argument the authors make here is that because maintenance is crucial yet expensive, the architect through design, and allocation/selection of building materials, can address some maintenance issues. The architect, through his craft, is required to produce sensitive, aesthetically pleasant and sustainable design proposals. One element within the sustainability bracket speaks to the 'maintainability' of that design. This implies that – to an extent – there is a responsibility conferred on the architect to ensure practicality, durability, and 'repair-ability'. Research reveals that scenarios where the SRH design has indicated finishes or materials (which proved efficient), there has been a direct impact on reducing loss on that property. It has also resulted in easier to maintain units/developments, "better retention of tenants, and a positive financial reserve to operate and maintain the property" (Jubany, 2011).

3. A REVIEW OF THE FOUR CASES IN NIGERIA:

The four SRH developments selected for our study are: (I) Jakande low-cost housing estate, Lekki, Lagos *[speculated to be completed in 1988, 125 housing blocks/686 total housing units]* (II) Jakande low-cost housing estate Amuwo-Odofin, Lagos *[completed in 1992, 488 housing blocks/between 2,948-3,106 total housing units]* (III) Jakande low-cost housing estate, Surulere, Lagos *[speculated to be completed between 1972 and 1975, 226 housing blocks/1,356 total housing units*], and (IV) Shagari (Federal) low-cost housing estate, Ipaja, Lagos [completed in 1983, 125 housing blocks/1,514 total housing units]. Among the 23 SRH developments in Nigeria, we selected these four that demonstrate explicit and implicit links between our research purpose and objective, which are also large enough to highlight the issue being explored, and are situated in 'choice' neighbourhoods. The latter is crucial because there is research that shows that locating (any kind of) public housing in poor neighbourhoods is tantamount to propagating poverty and the negativities associated with the poor. On the other hand, there is research that shows that there are income benefits and character change associated with residents of public housing when the development is situated in non-poor neighbourhoods. Research also opines that such developments have a higher possibility of being afforded care and are typically better maintained than those in poor neighbourhoods.

Limited research findings and development details exist, pertaining to SRH in the Nigerian context, that have been documented for public & scholarly access. That said; the researchers during on-the-ground work in Lagos have accessed certain information typically pertaining to some statistical/ logistical aspects of SRH project – however, clarity around more nebulous dimensions, such as posturing/policies around ethics and professional responsibilities remain scant and largely inaccessible. What we discovered however, in all four neighbourhoods was fundamentally consistent. The Nigerian government was heavily involved in the entire process from design to construction such that the architect's role was to put the government's concept on paper so that the final design was essentially the governments'. This included the choice of building materials; cheap building materials (Olurode, 2009), which was again, a reflection of the governments' weighty influence in the process. At the time, with poverty rising and housing becoming expensive, the developments were "cheaply built, but were of great value" (ibid.) to the population. There are arguments however, that because the government had taken on a vast amount of projects running concurrently such as: schools, medical facilities, and a metro line for mass transit, that in order to deliver the 30,000 housing units provided, the government had to resort to the use of substandard building materials (ibid.). There are also arguments that the "excitement" surrounding such a novel endeavour at the time was overwhelming for the existing residents that there was little concern, through the period of execution, about the sustainability of the project (ibid.). Furthermore, being the pioneering developments when these SRH estates were constructed, there were no benchmarks for the country to aspire to or local precedents to inform the residents. Ever since, SRH has continued to be built in much the same way, that is, with (I) substandard materials founded on the excuse of too little funding, (II) the intention to achieve more housing units with less expenditure, and (III) the plan to institute and/or improve the maintenance program upon project completion, etc.

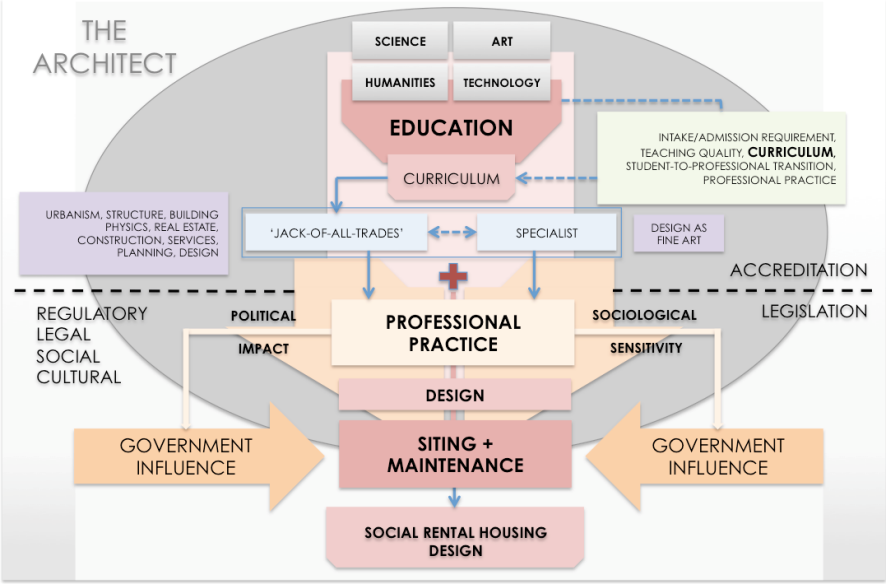

Figure 4.

CONCLUSION

> "… An age of greed has made it so that the architect no longer feels a duty to society." – Richard Rogers

Having already established the poor architectural education standards, demonstrated the architects limited role in the production and provision of SRH, as well as in its siting and maintenance (as a result of substantial government involvement and the typical tight budget allocated to this housing type), discussions with stakeholders [officials in the local government offices affiliated to and/or overseeing the four cases we studied, planners, developers (with experience erecting SRH developments), and residents of the non-poor neighbourhood], revealed an angle that has not been (well) explored in our context. The absence of two interlinked elements: (I) the architect being unaware how vital a role he *actually* plays in maximising siting and minimizing maintenance, and therefore, the overall outcome of SRH developments, and (II) the architect's social insensitivity.

While the architect may not have free reign in executing his duties, he is not exempt from complicity. In Iliopoulou's 2015 paper, she emphasized the architect's role as a 'double agent', which she explained speaks to their role as designer being as important as their social responsibility to the community. Despite the limitations in any context, she argues, as does

Jubany (2011) that the architect must never sacrifice his duty to represent the voice and needs of the people in an attempt to design insensitively. Social sensitivity speaks to the knowledge that his design is able to create a more civilized community by making a place more livable, affect quality of life, "influence social conditions, and cause positive social change" (Jubany, 2011). It also extends to championing ideologies that achieve the above, over alternate design that disregards focusing on the above-mentioned elements. The implication of this is that there is an expectation from the architect that rather than designing buildings that are bound to deteriorate/fail from the onset, and put financial pressure/strain (and otherwise) on the occupants (specifically the poor), their education, and ability demands that they refuse to comply and never compromise on quality. The problem, we speculate, is that the Nigerian architect has not fully come to understand their social responsibility. This obliviousness was recorded several decades ago when it occurred in the United Kingdom ensuing a dichotomy among architects, where there was a group of architects that created designs that had been inspired by, or advocated social struggles, and the other that triggered societal struggles, and prioritized/favoured practice and 'having work' (Iliopoulou, 2013). This dichotomy is currently being experienced in Nigeria, with the greater portion of architects more focused on practice. The result of this focus on 'having work' is reflected in how SRH has continued to manifest in the country, that is, poor siting/use of the location, and poor or inexistent maintenance program, which has in turn resulted in abandonment and vandalism, and more commonly now, building collapse (Hamma-adama and Kouider, 2017; Okagbue et al., 2018).

In the European context, the architect's education has evolved according to their responsibility and alongside advancements in technology (Franck, 2017). Having identified that the previous responsibility accorded to the architect was quite broad (ibid.); the role has "been de-coupled from the realization of the building, and even from its constructive completion" (Franck 2017, para. 3). The Nigerian government needs to learn from other contexts, and must clearly define the architect's role in its plans for providing SRH. If the architect is expected to design, then he should genuinely be allowed to masterfully execute his profession so that the outcome is indeed a real solution. The architect also needs to be taught, reminded and encouraged via the curriculum, during the mandatory Industrial Training and upon commencing practice, that architecture extends well beyond narrowly defined legislated practice.

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PAPER #7.13

YOUTH DECARCERATION: USING SKETCH MODELS TO EXPLORE NON-PUNITIVE ATTITUDES

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ABSTRACT

Many forces drive change in the youth incarceration system in the United States, including a newly appreciated need to treat youth offenders with trauma-informed care (Olafson et al 2016). In the case discussed here, the University of Minnesota, and Hennepin county in Minnesota, USA, interested in replacing the existing suburban youth correctional facility with community-based treatment facilities, worked together to explore the role of architecture in creating appropriate settings. The design of existing youth incarceration facilities despite intentions of rehabilitation and treatment, often conveys negative ideas such as punishment, privation and shame. The design studio asked how to design architecture that supports positive attitudes such as pride, hope, curiosity and safety? The focus of this paper is an exercise in which students were asked to explore different attitudes using sketch models.

Sketch models, rough, quickly made, ambiguous physical models, "crafted for their own ends, separated from the goal of a final design." (Morris, 2006:37), allowed students to explore how architecture conveys and/or supports feelings, attitudes and behaviors. This paper presents student explorations that combine models with annotations and drawings, demonstrating their value in exploring attitudes. Such models show spatial arrangements without a big investment of time, allowing spatial ideas to be quickly developed. Combining comparative models with annotations and drawings allowed for development of more detail and examination of design intentions, often generated unconsciously, to be made explicit. The exercise gave students an understanding of how the attitudes they were exploring could be manifest in design, thus permitting their pursuit consciously in later phases of the project. By pursuing two contrasting attitudes students came to understand how they could combine ideas to make more complex designs.

KEYWORDS

Youth; incarceration; trauma-informed care; sketch models; attitudes.

INTRODUCTION

In the United States a concern with mass incarceration, high rates of minority confinement, and in facilities for youth, has generated a national movement toward deinstitutionalization and inclusion of trauma-based treatment. There is increasing awareness internationally, that youth who get in trouble with the law often are subject to trauma in their home and community (Royal Australasian College of Physicians, 2011), and that facilities need to treat youth for this condition (Ford et al, 2006).

The research described here took place between 2018 and 2019 in the context of an architectural design studio that was jointly taught by Julia Robinson a university instructor, Daniel Treinen an architect in BWBR Architects, a firm that designs justice facilities for youth, and Angela Cousins, a government official in the local, Hennepin

County department of corrections who works with facilities for adjudicated juveniles. The purpose of the studio was to investigate new approaches to program and design of facilities that move away from older attitudes of punishment toward youth, and toward education, rehabilitation, transformation, and de-institutionalization. The studio, taught for two years with anticipation of at least one additional year, was conceived as a research-based course that engages in exploratory research as community-engaged scholarship (Robinson & Christenson, forthcoming). The first year it was taught, working with the corrections data, the class identified two neighborhoods from which most adjudicated youth in the juvenile facility originated. The subsequent year, the studio affiliated with the University Research and Outreach-engagement Center, a university neighborhood research center, and worked with community participants to understand, and design for the specific neighborhood context of North Minneapolis.

A central purpose of the studio was to understand how ideas, attitudes and behaviors represented in architecture can inform the design of youth facilities in support of healthy environments. Sketch models are described by Morris as "three-dimensional sketches , ideas made visible but not concluded in any way, They need not strain to arrive at a definitive model, but can be crafted for their own ends, separated from the goal of a final design." (Morris, 2006:37), They were chosen as a way to explore the relation between design and attitudes. These are accompanied with sketches and annotations that explore why and how the models are designed, addressing assumptions, hypotheses and design directives.

1. SKETCH MODELS AT THE UNIVERSITY OF MINNESOTA

The material architectural sketch model is an acknowledged form of investigation in architecture (e.g. Mills, 2005), but there is little scholarship around its use to study sensory ideas of materiality and relationship, rather than such concerns as structure and buildability. In contrast to the study model, or the digital sketch model, which represent an already-formed design idea, the content of the material sketch model emerges as it is constructed.

There is a history of the use of sketch models at the University of Minnesota School of Architecture. In the 1980s inspired by design instructor and phenomenologist, Gunter Dittmar, who introduced the Rip-N-Tear model to the school (Mulfinger, 1985), many colleagues began to use sketch models in a variety of ways (e.g. Weeks, 1985; Robinson 1990). Dittmar saw the sketch model, or Rip-N-Tear model as he named it, as a way to explore the phenomenological aspects of design. He assigned the models for their potential to suggest the ineffable, of the poetics of space. The ambiguity of the models allows designer and viewer to read many possible ideas into them, which interested other faculty to apply them in a variety of ways, even though Dittmar thought his colleagues used the models incorrectly.

Several faculty members used the models to explore narrative; for example, students might read a provocative story and design the place it evoked. Students would model and sketch the settings, using the narrative descriptions as the basis for a design. Other faculty members saw the possibility of annotating models and drawings to making implicit ideas conscious. For example, Dale Mulfinger (1985) and I (1990), have paired sketch models with annotations that encouraged students to identify elements in the model that could be used in design. In a studio with Stephen Weeks in the early 1980's

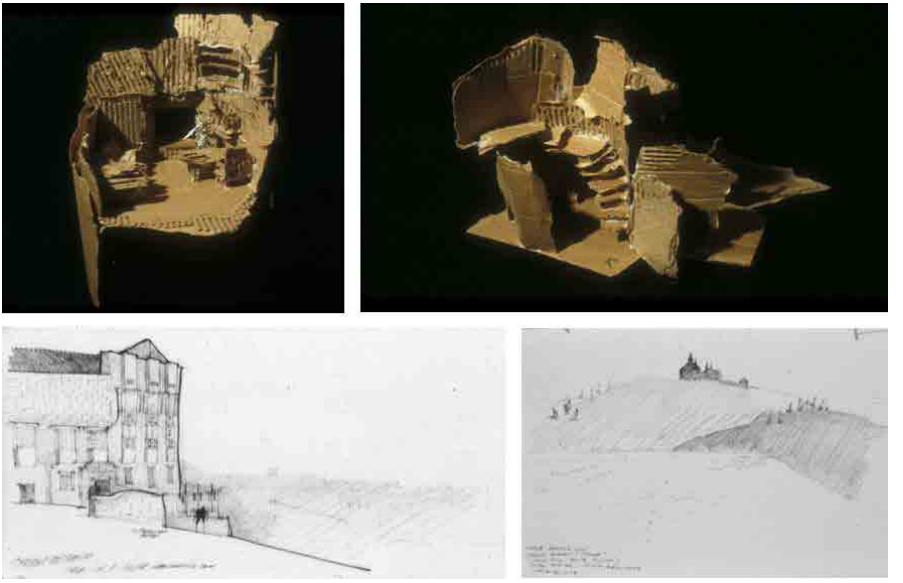


Figure 1. Sketch Models and Annotated Drawings Used to Explore Scholar Spaces at a Sherlock Holmes Library. Work by Julie Maple, 1988, Instructors, J. S Weeks and J. W. Robinson

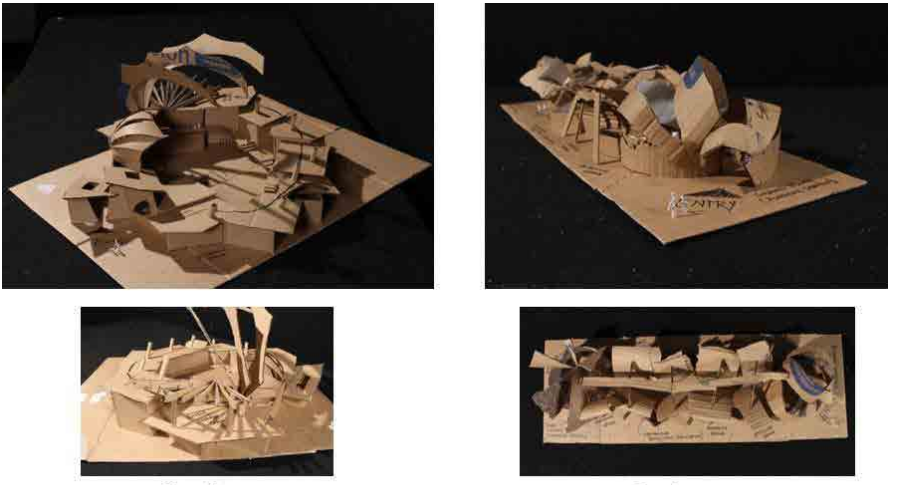


Figure 2. Sketch Models Showing Two Arrangements of a Waldorf School Developed Using Analogy (note annotations on the models). Mark Norberg for Arch 3282: Architectural Programming, Spring 2012, taught by the author

on the design of a Sherlock Homes library, he and I were interested in annotated drawings and had the students make sketch models as well as drawings that they annotated (see Illustration #1). Additionally, in studios with Dale Mulfinger and Lance LaVine we assigned sketch models along with drawings and annotations for several different exercises. Sketch models continued to be used by a variety of faculty as a teaching tool into the 1990's, and early 2000's, although recently their use is significantly reduced.

Nevertheless, I have continued to employ sketch models in my teaching as a way for students to examine the relation between ritual and place, and, often using analogy, to bring all the small explorations together to develop an overall design, using exercises from Programming as Design (Robinson & Weeks, 1984). Typically, the ritual-place exercises ask student to include scale figures in the model, to make annotations on the model, or to make sketches of their key findings and annotate the sketches. The exercises examining individual spaces are combined to make several optional spatial arrangements for the building. The annotations of the individual spaces and of the overall arrangements are used to make the ideas explored in the models explicit, so they can be consciously used in design. This is the approach taken in this research.

2. INVESTIGATING YOUTH INCARCERATION

In the fall of 2017, stimulated by Angela Davis's and Michelle Alexander's work on prisons and Jim Crow (Davis 2003; Alexander 2012), I decided to apply earlier research on de-institutionalization (Robinson, 2006) to incarceration. Being without funding or expertise on incarceration, but having made contact with other researchers working on the topic at the university, especially law professor, JaneAnn Murray, I saw an opportunity to begin research on the issues with students in design studio classes. The names of the classes show the evolution of research and understanding between the initial semester studying incarceration in general and the later studies about addressing youth: Reconceiving Incarceration (Spring 2018), Reconceiving Youth Incarceration (Fall 2018), Preventing Youth Incarceration (Fall 2019), Expanding Youth Opportunity (Fall 2020).

2.1. First Studio: Reconceiving Incarceration for Adults

I organized the first iteration of teaching by myself with advice from faculty members from the Law School and Public Affairs, as a 7-week vertical (for years one and two) graduate student design module that focused on adult incarceration. During the module, students visited a local adult correctional facility, completed assigned and discovered readings, watched videos on prisons and Jim Crow and solitary confinement, and engaged in discussions with invited speakers. The instructional approach included exercises on preconceptions, precedent analysis, ritual-place analysis, and schematic design development. The studio assignment was the design of a non-punitive prototype to be located an ideal site type of their choosing.

The sketch exercise was a central feature of the process of designing a non-punitive facility. It was seven days long, beginning in the third week of the seven week course. At this point in the research, several invited speakers had described their experiences 1) being incarcerated, 2) as parents of adjudicated youth 3) as lawyers working with the incarceration system, 4) as designers of youth facilities for incarceration or mental health, or 5) as workers in incarceration facilities. Several of these individuals also participated in reviews. The just-completed precedent analysis included innovative European sites for adult and youth offenders, as well as other institutional settings where non-incarcerated people live in (dormitories, nursing homes, summer camps, convents, monasteries, etc.). In consideration of such

Theraputic: Living Units
Units emphasize daylighting and connection to nature, containing expansive views and direct access to the outdoors. Cushy furniture, a bathtub, and personal artwork provide theraputic touches.

Individual Growth: Living Units
Units are customizable and furniture rearrangeable to individual tastes and are meant to teach residents how to take responsibility for maintaining their own living spaces.

Figure 3. Sketch Models Exploring Non-Punitive Attitudes for Incarcerated Adults. Design Module Spring 2018: Arch 5250: Reconceiving Incarceration taught by the author

precedents, the sketch exercise explored such attitudes as education, normalization, and therapy, some proposed by faculty others by students.

Students were asked to choose two contrasting attitudes to represent, and most took normative incarceration as one attitude and another attitude for contrast. The paired models and associated sketches and annotations led to design features the students employed (see Illustration 3), although the annotations were somewhat limited, and the level of insight was inconsistent across students, with some students identifying a number of specific features, and others providing more generalized conclusions. The graduate students understood the purpose of the exercise and used it effectively, including generating a final schematic design from the sketch models of the parts.

The guests at interim reviews included faculty from the law school and the institute for public affairs as well as several from the county department of corrections, including Angela Cousins from juvenile facilities, with whom I agreed to continue to research the following fall. The reviewers were especially fascinated by the explorations of alternative attitudes.

2.2. Second Studio: Reconceiving Juvenile Rehabilitation

The second iteration of the class was a 15-week design studio in which pre-professional undergraduates in their last year of study work with practicing architects. In most instances, practicing architects with teaching experience lead the students in a project that their office has completed or is working on. The studio is conceived as providing the opportunity for students to complete the design development of a project, providing experience with working drawings. In contrast, this project was research-oriented and both the practicing architect and the instructor from the county department of corrections were interested in understanding more about youth incarceration. The architect's firm designs facilities for adjudicated youth, and the department of corrections was interested in improving their youth facilities as well as developing a spectrum of care for youth.

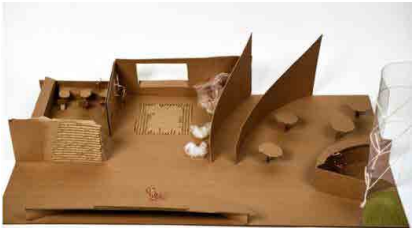
Because we had fifteen weeks, we were able to visit more facilities, this time including the adult incarceration facility visited in iteration 1, but also the local site for youth offenders, and as an exemplary comparison, an architecturally notable addiction treatment

center for adolescents. Again, during the semester the students completed assigned readings, identified new important areas for research, watched the videos on incarceration, and heard guest speakers, but this time focusing on youth and including a psychiatrist who spoke on adolescent mental health. The instructional approach was similar, but with the extra time, included neighborhood and site analysis.

The two-week sketch models assignment took place in week four, right after the precedent analysis exercise and lasted two weeks, again exploring the themes of non-punitive design. Unfamiliar with sketch models, it took the undergraduate students a while to understand how they could reveal attitudes, and how to use drawings an annotations to document their learning. Some students grasped the idea (see Illustration), but others did somewhat impoverished models and drawings.

Once again students were encouraged to understand attitudes such as education, normalization and therapy. As before, they were asked to make paired models of a range of place types such as social spaces, eating places, circulation or corridors, sleeping areas, etc. Students used the models to explore different attitudes about spaces, but only loosely used pairing as a tool. Nevertheless, most students carried ideas identified at this stage into their final designs. We did not ask students to use their sketch model explorations to generate the overall design.

Subsequent to the sketch model study, students deepened their research, and in response to research specifically on adolescents, included consideration of trauma-based care. Additionally, students became concerned for institutionalized racism in response to our site visits, where we found that youth in the county facility housed exclusively youth of color, while the addiction treatment center housed 90% Caucasian youth. Statistics from the department of corrections showed that the youth in the county facility came almost exclusively from impoverished areas As a



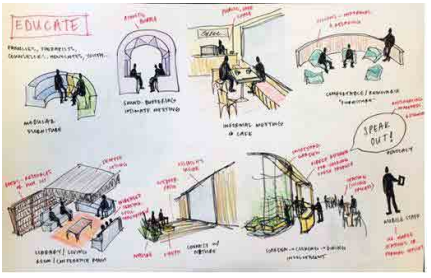


Figure 4. Model Exploring Entry & Annotated Drawings Identifying. Architectural Characteristics of Rehabilitation and Education for At-Risk Youth, Kelly Mork, Architecture 5212: Reconceiving Youth Incarceration, Fall 2018

result of these discoveries, the class decided that it was not appropriate to simply design better facilities, but that youth incarceration needed to be prevented. The county had suggested the class develop a spectrum of care for adolescents, but due to our findings, the group decided we needed to understand a spectrum of care for the families and the neighborhoods as well as youth. These discoveries led many students to consider designing places not just for youth, but also for families. At the end-of-semester review, the students suggested moving the sketch exercise to later in the semester when they had selected their program.

2.3. Studio 3: Preventing Juvenile Incarceration

Iteration three took place in fall of 2019. Because the previous studio had identified neighborhoods as being important contributors to the solution, this year -again working with architect Daniel Treinen and department of corrections juvenile representative, Angela Cousins- we decided it would be important to include community members in our research. The studio affiliated with the University of Minnesota's Robert J Jones University research and Outreach-Engagement Center on the city's Northside that was the site for a community meeting at the beginning of the semester and four additional reviews, These reviews included community participants who had been identified by a consultant recommended by the center and who received a stipend to work with us.

Like the previous year, the fall 2019 class engaged with readings and videos, visited the two incarceration facilities and the center for teen addiction, and heard from various experts. The class also toured the neighborhood and visited a neighborhood health center. Whereas previously the sketch exercise introduced the program, following the recommendation of the previous year's students, this semester we assigned the sketch exercise in week seven, after students had identified their program, as a way to explore the character of the facility. The exercise only lasted one week, which turned out to be more successful, as the

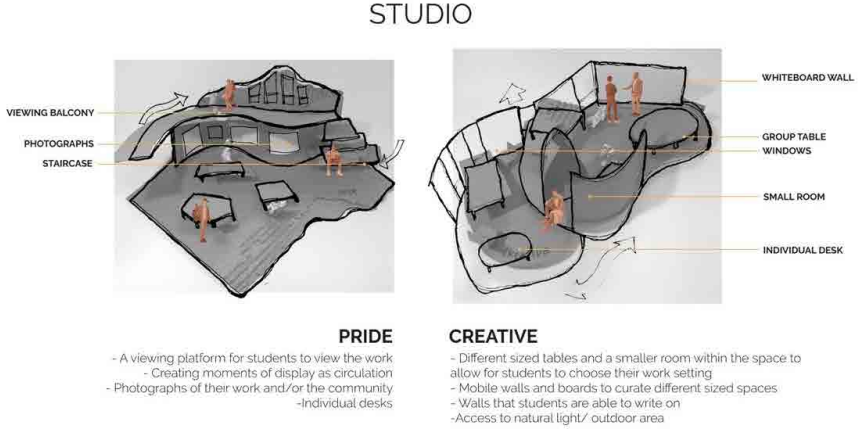


Figure 4. Paired Sketch Models Exploring Contrasting Attitudes for a Studio Space in a Residential Videography Job Education Facility, for Post- High School At-Risk Youth Maura McDaniels and Assia Rodriguez, Architecture 5212: Preventing Youth Incarceration, Fall 2019

students were motivated to explore spaces they knew were part of their design. Probably as a result of this improved understanding, the choice of attitudes transformed from being what one might call "building function-based," such as "education," "normalization"' and "therapy", to more specific terms, such as "curiosity," "transparency," "vulnerability," "security," "pride," and "creative" that captured the feelings they were trying to engender in their buildings. Again, students were asked to select contrasting terms to represent, and to feel free to represent apparent contradictions in the models.

As typical, on the first day of the assignment, students made a series of models in class and discussed everyone's models as the afternoon progressed. The big challenge the first day of the exercise was to choose contrasting terms that related to their projects. By the next class, once they had selected their contrasting ideas, they had successfully developed a series of contrasting models and fully understood the purpose of the exercise (see Illustration 4).

For the final day of the exercise they combined their paired models to create a sketch building layout. During this phase they were excited to discover that they could take the attitudes they had explored independently and combine them in various ways for different parts of their designs, this was especially interesting to those who at first thought their two ideas were oppositional. For example, the students who chose vulnerability and security realized if they could incorporate both attitudes in their spaces, it would allow more richness and choice to the people who would use them.

This time, we asked students to make a large model from their accumulated sketch models to represent their overall building design. This turned out to be very successful, and students developed a rich set of designs based on this exercise (see Illustration #5). This exercise was followed by a site exploration exercise in which students had to make 2 contrasting organizations and locate them on 3 different sites.

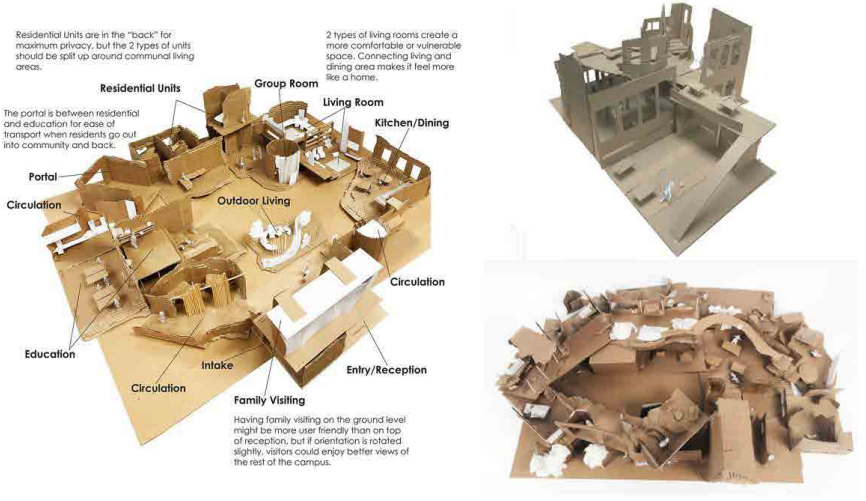


Figure 5. Combined Sketch Models Representing the Whole Building, one annotated Transition Residence by Jillian Gelle & Kristin Just, Neighborhood Youth Center by Angelo Davalos, and Videography Facility by Maura McDaniels & Assia Rodriguez, Arch 5212: Preventing Youth Incarceration, Fall 2019

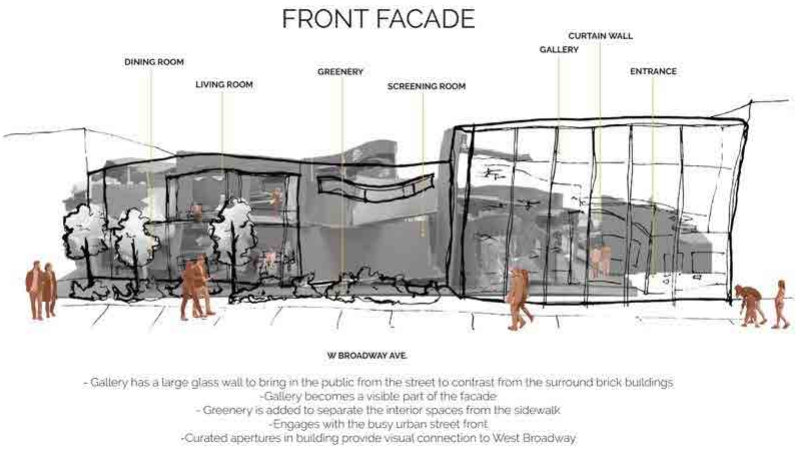


Figure 6. Annotated Model Photograph Used to Design a Façade A Residential Videography Job Education Facility, for Post- High School At-Risk Youth Maura McDaniels & Assia Rodriguez Architecture 5212, Fall 2019

This year as last, most students didn't annotate the models, and only some annotated associate drawings. But several of many of them annotated photographs of the models. And one group used their photos of the combined model to develop an interior courtyard and façade design (see Illustration 6).

The final projects for this third iteration exhibited a much better understanding of attitudes than previous classes. In the final course evaluations, one student commented "Exercises like the attitudes and rituals, with quick sketch and modeling were great! They were very helpful at visualizing the space as a design tool." Having changed the timing of the sketch exercise to later in the semester when students have chosen their program, they are in a better position to explore attitudes using sketch models.

CONCLUSION

Sketch models were chosen to explore attitudes because of their three-dimensionality, their ability to generate ideas in the process of making (as opposed to representing ideas already formed), their ambiguity that allows multiple readings, extending the imagination, and the ability to create many models quickly. By repeated use of the models over three years we discovered that the timing and pedagogical sequence of exercises significantly affected use of sketch models as a tool to explore attitudes. When we realized their best use was not as an introductory exercise, but as one to develop the architectural program, it more significantly influenced the schematic design.

At the first iteration, the graduate students seemed to be able to understand the purpose of the exercise from the beginning, and were pleased to explore the issues, although the

annotations were not as prolific as had been anticipated, and the attitudes were accepted as given, likely because of the placement in the semester. For this course, the students assimilated the ideas successfully, and the final projects reflected an understanding of how attitudes affect the design of places. For example, students were concerned to incorporate such ideas as choices in the way that residents of their facilities would inhabit their facility, sequencing activities to encourage engagement while assuring control, providing beautiful materials and comfortable furniture and locating facilities in a wooded area or incorporating natural light and plants in interior areas

The undergraduate students seemed to need more time and motivation to explore attitudes. The first year, they fully engaged in the exercise, accepting the attitudes they were given, but were not able to take the ideas as far as the previous year. Although originally, it seemed that sketch models would be a good exercise to introduce students to the challenge of designing with an understanding of how spatial configuration and arrangement affects people's attitudes and behaviors, this did not turn out to be true. At the beginning of a semester devoted to gaining an understanding of the importance of preventing incarceration, students have insufficient knowledge to know which attitudes are important, and why, and then to care about how to design using attitudes as a generative idea.

The sketch study exercises worked best when students had a greater understanding of the issues based on such information on readings, site visits, experts such as community members and had selected their program. Such knowledge enhances not only the comparative sketch model analysis exercise, but also the newly added combined model exercise so that it more effectively influenced the quality of the final design. When students understand and identify not only the qualities they are trying to embody, but also have criteria for generating and evaluating their designs, they can design with more nuance, more confidence and can achieve better outcomes.

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PAPER #7.14

HERITAGE AS A RESOURCE, MEMORY AS A PROJECT. RESPONSIBLE NETWORK-BASED DESIGN STRATEGIES

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ABSTRACT

The Italian territory is dotted with a large number of villages called Borghi Minori, that, for centuries, have represented the urban framework for vast territorial areas and identities inhabiting the landscape, now in a state of abandon. As part of an inter-disciplinary research on the fragility of the so-called 'minor' diffused heritage, this contribution responds to the present and future need to imagine new forms of living and transformation strategies for these abandoned settlements, through the creation of an operational methodology and the identification of specific tools. The selected urban areas are rooted in the territories of the internal areas of Abruzzo, interpreted as laboratory-villages, in which to experiment with innovative mapping processes able to deal with the complexity of these contexts. Here present fragilities become resources for imagining possible future scenarios, to be specified by the same Communities in an open and polyphonic transformation design vision. From an application point of view, this work resulted in the construction of a dynamic, multiscalar and interdisciplinary 'atlas of trans-form-actions', aimed at identifying in the stratified layers of the landscape palimpsest, those resilient and silent modifications that made these territories habitable. An atlas, a project sharing knowledge and information, which is characterized by a marked design dimension. Here the transformative processes of the landscape are interpreted as a continuous sequence between past, present and future. Topographies of memory whose feature is a non-hierarchical network, made up of layers and rarefactions, which becomes the framework for the trans-form-action, in which design actions correspond to spatial devices, whose architectural expression will derive from present and future needs, a sharing path, listening places and people.

KEYWORDS

Minor diffused heritage; transformation; weakness; abandonment; reuse.

THE WEAK COSTELLATION OF BORGHI MINORI D'ABRUZZO. AN INTRODUCTION

The Italian territory has among its peculiarities that of being dotted with a large number of small villages, the Borghi Minori, that have been suffering for decades due to depopulation, causing different abandonment conditions over time. About 6,000 villages (Istat 2014), with a prevalent distribution in central and southern Italy along the Apennines but also in Alpine areas, were abandoned over time for various traumatic reasons, such as earthquakes, hydrogeological instability, epidemics, wars and, in the years of the post-war economic boom, the rural exodus in favor of concentrated urbanization; finally, more recently, owing to the demographic decline. The Borghi Minori, in fact, are only the "tip of the iceberg" of a widespread and complex process of abandonment that involves the internal areas and that has determined a turning point, apparently not reversible, in the contemporary Italian settlement dynamics. As shown in the 'Geography mapping of

abandonment. The dismissal of the villages in Italy' (Postiglione 2006), it is possible to identify three characterizing conditions: completely abandoned villages, those partially abandoned and those in abandonment but with a newly founded neighboring center. With respect to this categorization, which intentionally reduces the complexity of the abandonment processes to bring the phenomenon to a national scale, the present research has looked at the second condition, the most widespread one. It has considered those villages that have never suffered a complete dissolution, in which the abandonment 'process' is taking place today. Economically depressed for decades, these villages are often isolated, difficult to reach, inadequate to contemporary living standards and characterized by a certain instability due to cataclysms. Villages in which the surviving communities, custodians of a material and immaterial heritage, seek forms of adaptation to the disappearance of a socio-economic-cultural reality that obviously cannot return. We will look at a specific context, that of the internal areas of Abruzzo, in which the phenomenon described above, in particular when connected to the effects of an often violent seismic activity, generated a landscape of widespread abandonment, but where, at different times, possible strategies were tested and design solutions adopted to respond to the need to inhabit the constellation of Borghi Minori that characterize this landscape. For centuries these villages were the most frequent urban settlement model in Italy and the expression of specific and resilient ways of inhabiting the territory. Today these villages reveal their yielding fragility, and, despite the interest shown by parts of the scientific community and civil society, the experiments carried out reveal working methods and tools often inadequate to the complexity of those contexts. Here the heritage dimension is 'minor', that is, not made up of exceptional elements. The value lies in the relationship between the parts, at different scales, from the territory to the 'room'. This non-hierarchical and layered network, made up of very different and minute elements, but nonetheless important, is rather foundational in the process of building and modifying the landscape identity. These elements are fragile, since they are often unknown, not registered and also, sometimes forgotten, and for this reason often distant from protection mechanisms that could take them into the present and in the future, if included within enhancing processes through a responsible transformation. The transformation project for these villages requires new looks, methods and tools capable of managing the complexity that these realities require. In an interdisciplinary vision open to various stakeholders, the architectural discipline and its project become a shared place for confrontation, to imagine new scenarios of responsible reuse for the Borghi Minori landscape.

1. RESEARCH OBJECTIVES

This work is part of an ongoing research by the Department of Architecture and Urban Studies[1], Department of Excellence, on the issues of territorial fragility. Its objective, among others, is to highlight issues, identify work methods and tools for the strategical design of the minor diffused heritage, recognized as one of the central themes to promote the future quality of the territory and characterizing contemporary cities in Italy. In this framework, the present research looks at the constellation of abandoned Borghi Minori, imagining interdisciplinary and shared reuse strategies to address today's needs. The present research has two main objectives:

• From a methodological-operational point of view, it intends to identify a working method

[1] Students and graduates from the Bachelor and Master degree programs from the School of Architecture Urban Planning Construction Engineering, Politecnico di Milano, also collaborated in the research project: Abagnale, R., Ambrosi, A., Airoldi, F., Ballarani, G., Camboni, J., Finardi, R., Forcignanò, R., Miranda, M., Montisano, M., Santus, A., Sartorio, S., Scaioli, A., Tolazzi, S. and You, Z.

and tools for the 'open' project of transforming abandoned urban settlements, by means of a continuous exchange between theory and practice mediated by the design process. Method and tools will be tested on a selection of villages characterized by different semi-abandonment conditions and located in the internal areas of Abruzzo. A taxonomy including research and project experiences has become necessary, in order to compare methods and tools, bringing out potential and critical issues.

• From an application point of view, the research intends to build a dynamic and multidisciplinary atlas of the trans-form-actions for the smaller villages of Abruzzo, to highlight the dynamism of the stratifications with particular reference to the most recurrent forms of fragility in the internal areas. The atlas is designed to offer both a reading of the transformations of resources over time, with forms of fragility and resilience, and an operational tool, capable of updating future research, processes and projects that will involve the identified areas.

2. SEARCHING FOR AN OPERATIONAL METHODOLOGY

2.1. Mapping researches and projects on Borghi Minori. State of the art

In the context of the design disciplines, the topic of abandonment and reuse of the Borghi Minori has been the subject of multiple reflections and experiments with the most varied outcomes. In a previously mentioned research work, '*Geographies of abandonment. The dismissal of the villages in Italy'*, (Postiglione 2006),), in addition to restoring the national and international scope of the theme, a taxonomy of projects for the reuse of those villages is systematized. Among the experiences mentioned: the 'cybervillage' of Colletta di Castelbianco, designed by Giancarlo de Carlo; the idea of a 'widespread factory', with which the industrialist Brunello Cucinelli rethought Solomeo (PG); the 'diffuse hotel model' of Santo Stefano di Sextantio, which will be replicated in other villages purchased by the entrepreneur-architect Daniele Khilgren. These are widespread strategies, yet limited to the reuse of the built-space. Starting from an examination of the existing literature and from design experiences on abandoned villages, work methodologies and approaches were compared, in order to bring out potential and critical issues. In this theoretical-critical framework, an orientation towards the reuse of built heritage emerges, not fully grasping their regenerative potential. Recently, the research experience of the University of Chieti, summarized in the essay *The region of the major highlands of Abruzzo* (Angrilli and Morrica, 2017) widens the scope, not only to the built heritage but also to the open space in relation to the villages, identifying, in particular, the "proximity landscape". This space is defined as a "transition space between urban formations and the open wooden-agro-pastoral space" and indicated by the authors as "strategic for territorial recycling objectives." (Angrilli and Morrica 2017, 37). The present research takes a further step forward in this direction, through an 'ecological' perspective on the theme of the Borghi Minori, and more generally on the diffused 'minor heritage'. The villages, if we consider the territorial structure of the internal areas, in fact, are nothing more than urban densities compared to a vast network of places, areas, artefacts and materials, expression of the adaptability of the communities to the surrounding environment over time.

The obsolescence process that affected them is actually more extensive, it concerns the entire territory; its profound reasons can only be understood through a relational approach in order to frame them in dynamic processes that consider space, time and the communities that inhabit them. For these reasons, we have looked at the 'minor heritage' as a 'minor heritage landscape'; a landscape, therefore a place of sedimentation of processes, an expression of the interaction between the

Figure 1. Multi-space and multi-temporal layering reading of the abandoned village of Navelli. Source: (Corradi, E., Raffa, A., Santus, K., Sartorio, S., and Scaioli, A. 2020).

environment and the communities that have shaped the territory for their own subsistence, in a resilient way, adapting to an impervious nature, to the inaccessibility of places and to traumatic events. A fragile landscape, made up of very different identity elements, in terms of morphology, materials, scales, etc., which slowly loses its most minute elements, progressively compromising its specificity.

2.2. A historical ecology perspective on minor heritage landscape. Theoretical framework

In the broad vision that this research adopts, from the village to the landscape to which it is rooted, from a theoretical-critical point of view, an element of innovation regards the opportunities, currently unexpressed, for the design disciplines that operate on the heritage landscape, which could arise from the intersection with the theoretical contribution of Historical Ecology (Balée 1998; Baleé and Erickson, 2005; Crumley 1994, 2012) for a modification-oriented knowledge. Starting from the idea of *longue durée* (Braudel 1958) and palimpsest (Corboz 1985), the landscape is interpreted as the provisional and stratified result of the interaction between man in his social dimension, the community, and nature. Historical Ecology proposes the overcoming of the division between anthropic and natural through the emphasis placed

on the process of trans-form-action on the landscape; certainly a lengthy process, but made up of numerous 'critical moments', which are contextualized in a dynamic frame in space and time, breaking down reductive schemes. Furthermore, historical-ecological approaches are multi-disciplinary (linking archeology, history, geography, ecology, design, etc.), multi-scalar (moving from macro to micro processes) and multi-oriented (researchers, stakeholders, managers and designers) (Crumley and others, 2017). In this perspective, it was decided to look at the landscape in terms of fragility. The intent was to investigate the generative processes of present fragility in a dynamic way, as the unstable result of secular interactions between man and the environment, which produced the current geography of fragility in the internal areas of Abruzzo. These fragilities have redemption possibilities, often turning into possible resources. Within the dialectic established between fragility and resources, a greater awareness of the fragile processes that have affected the areas in question, together with the forms of adaptation put in place, constitute a source of important information for projective knowledge. Past forms of resilience, combined with current innovation, can generate processes capable of facing contemporary challenges, acting local while thinking global. Through a topographical criterion it was possible to intersect various conditions of fragility linked to four key resources: soil, water, infrastructure and built-heritage.

2.3. Methodology

The methodological construction of an experimental nature intends to structure an open project, in order to welcome complexity, substantiated by "an ethic of interconnection and solidarity between humans". (Morin 2010). This experimentation of a methodological-operational nature will be better specified and verified in the future through comparison with other contexts. Within this perspective, the architectural project, understood in a broad way, plays a strategic and structuring role, capable, at the same time, of welcoming a wealth of specific visions and projects, even at different times, affirming its positioning as a listening and confrontation platform oriented towards transformation, in an interdisciplinary way.

The listening of people, groups, associations and communities, conducted on the occasion of workshops and visits to the pilot villages, was essential both to delve into a complex reality and, above all, to understand the future scenarios that those who live and care for places imagine. A highly resilient social structure, albeit numerically small, in which an attempt has been made to engage in dialogue starting from the relationship established with the minor heritage spread locally today. Therefore, an attempt to develop a 'synthetic form' was aimed at harmonizing the listening of groups and communities, their needs and to offer a framework to their planning potential, together with the scientific interpretation of local fragilities; but also at 'dissolving' the contemporary complexity of the landscape of minor villages, through the decomposition of the different contexts through specific themes, an expression of the multiplicity of visions that characterized this research experience. The resulting mapping process required extensive reflection, not only regarding the tools to be adopted but also for sharing them, in an open critical perspective, raising problems and revealing opportunities over time, in a continuous polyphonic dialogue between listeners and narrators.

The application output, that is the dynamic atlas of the villages, is a selection of interpretative maps of fragilities, among those possible. It is an expression of the dialogue between researchers, groups and communities of the four selected villages. The atlas collects mappings at different scales and also describes the Borghi Minori networks, made up by points, lines and fields, all susceptible to transformation. With respect to these areas, an abacus of architectural

actions associated with spatial devices has been finalized and will be better specified over time, starting from the needs of the locals.

2.4. Mapping as a project. The design-oriented dynamic Atlas of Borghi Minori's landscape

The synthesis maps express the multidisciplinary approach adopted. These are qualitative but also quantitative elaborations, at different scales, of both material resources (infrastructure, nature, cultural heritage, soil, energy, etc.) and intangible (such as culture and traditional knowledge), the latter investigated through multi-criteria indicators. The in-depth resources have been dynamically linked to each other, both with regard to past transformations and the development scenarios, however uncertain, that will be introduced in internal areas by global changes (in particular climatic and pandemic), in line with the open planning perspective that this work supports.

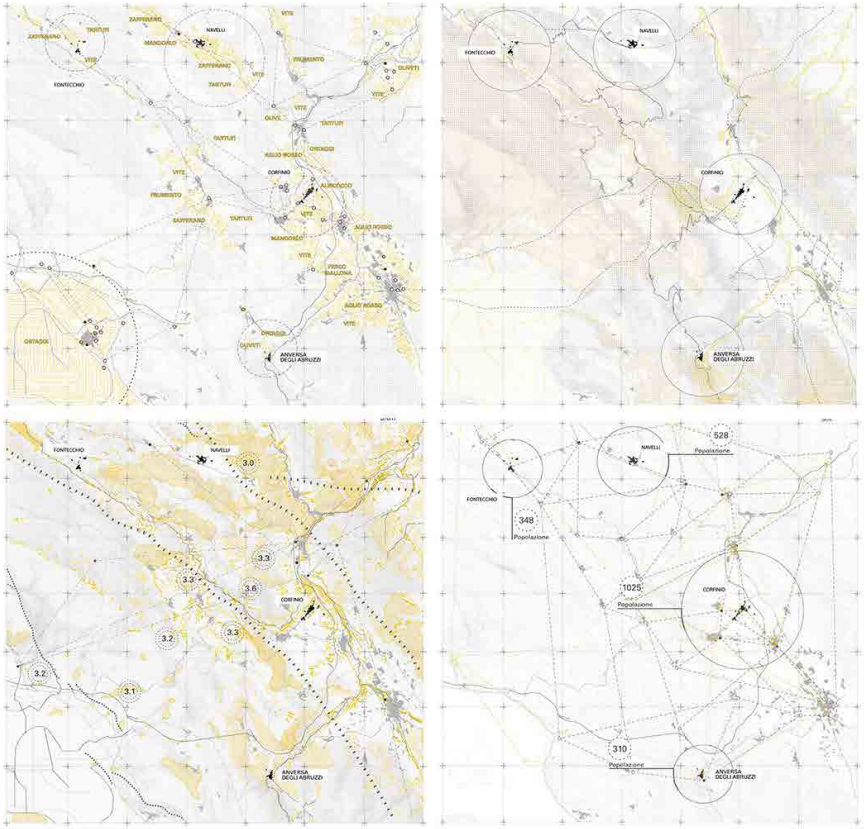

Figure 2. Maps of the Borghi Minori Network between Anversa degli Abruzzi, Corfinio, Fontecchio and Naveli. Traditional cropping infrastructure (top left corner); natural infrastructure (top right corner), tourism infrastructure (bottom right corner) and risk network (bottom left corner). Elaboration from the dynamic atlas. (PI Corradi, E., with: Raffa, A., Santus, K., Sartorio, S., and Scaioli, A. 2020).

The extension of the field of investigation, from the village to the system of relationships that deeply root the village in its context, called for appropriate tools capable of supporting a broad process / project of investigation of fragilities / resources.[2] The fragility mapping process, which took advantage of GIS technology and three-dimensional models, responds to the following needs:

- Interpreting materials and their specific fragilities in space and time, in a dynamic way, building a geography of fragility;
- Managing and communicating a large amount of data, interdisciplinary, multi-scalar and aimed at different targets (from researchers, administrations, citizens, etc.) and their implementation over time;
- Defining a non-hierarchical and operational network, a synthetic shape, which will frame specific future interventions.
- Guiding future transformations through an architectural abacus, which defines spatial devices, to be specified by future projects.

From an application point of view, the data collected were merged into an atlas of the Borghi Minori's fragile landscape. The atlas, like any form of cartographic representation, is interpretative and, in particular, is oriented to update and support future transformation processes. Furthermore, its dynamism allows continuous updating and monitoring, in order to direct the interventions according to a general and detailed vision. The aim was to conceive the construction of a dynamic multidisciplinary atlas, able to include different kinds of information, also non-topographical, over time. Furthermore, the atlas is configured as an interactive tool for researchers, administrators and professionals responsible for managing the territory, but also for civil society in order to build shared narratives.

2.5. Dynamic Network-based strategy and the architectural abacus

An operative topography of fragilities was thus outlined, a topography of memory, and therefore a project. The historical ecology approach to landscape, which allows to relate very close and distant times, spaces and visions, is based on listening to traces and their connection to present and future, welcoming the prefigurative and design-oriented dimension. The identified bio-cultural resources and the related forms of fragility were mapped together in the four selected laboratory villages - Anversa degli Abruzzi, Corfinio, Fontecchio, Navelli – revealing an operational topography in which the main feature is the network. Not a top-down network, a network originating from the intersection or coexistence of multi-temporal traces and contemporary needs of the inhabitants. A network with a high regenerative power for the Minor Villages, its peculiarities are capable of addressing in an integrated way the responsible reuse actions to the respective centers. Each of the four selected villages has its own peculiarities, which have been evaluated in order to predict possible shared futures. The interpretations outlined have been verified on the field, also through meeting occasions with the local communities and associations that brought out the daily vulnerability of an impoverished social context, but also the need for listening and dialogue; this also had an impact on the methodological construction.

From a polyphonic and open project perspective, that was considered to be pursued in light of the analysis of experiences "from above" as well as those that arose "from below", this network becomes a multi-scalar, territorial and urban framework, which defines nodes (existing elements that are involved in the strategy or new spatial devices), axis (existing connections redefined or new, elements with strong directionality) and fields

[2] The proposed approach to mapping refers to the epistemology of complexity and transdisciplinary (Morin 2001; Nicolescu 2002).

(significant areas re-signified by defining the edges) of a non-hierarchical network, made up of densifications and rarefactions, within which to identify architectural devices connected to specific design actions, through an abacus of solutions that other authors will be called to define over time (Di Franco et al., 2018).

2.6. Tools for an architectural reinvention in the Borghi Minori Network

It is clear that the set of theoretical and operational tools need to establish a defined, measurable, replicable range of actions. To define boundaries, networks, spatial and visual relationships, morphological sequences and connections to which conditions of fragility and interpretative potential are often linked, it is necessary to understand the new territorial vocation. Starting from instances and bottom-up actions - as already encountered in some internal areas- the difficulties deriving from depopulation, abandonment, and decommissioning find new revitalization scenarios through the rediscovery of the minor heritage of landscape and villages. Projects and processes in which the landscape is restored with new values and which, in turn, become maintenance strategies for the affected areas. An operating practice aimed at the recovery of artefacts and systems. The pathways, the small rural architectures linked to fields and pastures with their organization borrowed from former production cycles, increasingly find the attention of small, yet very active, communities, in which the search for life models closer to nature leads to rediscover alternative ways for production, such as the recovery of crops, techniques for sustainable land exploitation and farming. A rediscovery of artisan production cycles in which products aspire to becoming an excellence through the acquisition of values inspired by sustainability. In this experimental dimension, architecture can certainly intervene on both material and immaterial infrastructural networks, in order to guarantee a process of sustainability and sensitive insertion within contexts; neither mimetic nor vernacular, but suitable for expressing expectations, vocations and forms of living different from strong contexts, such as urban areas. An adaptation to the usage needs that fuses comfort together with technological performances, in which the digitization and access to global network resources is an important opportunity, often denied to people in these areas by market logics that act on much larger numbers of users. Building networks, even immaterial ones, can be a way of guaranteeing access to knowledge in these contexts, and if an opening process is also linked to the differentiated accessibility for users who are not only occasional, but stable because they can move and operate in contexts without constraints and physical barriers, it can be an opportunity to relaunch internal areas and smaller villages (Corradi, 2016). Architectural design can therefore become an element of coherence facilitation among different scales and heterogeneous objects and artefacts. Infrastructures, fields, houses, squares are all elements that converge to define how to use space. Different and new needs deriving from different instances and vocations need to be able to redeem these contexts also through simple operations, capable of combining on a small scale artifacts, and on a large scale, infrastructure networks, landscapes, cultivated fields, pastures, springs etc. Among the most interesting operations observed working in this direction, that emerged from the ongoing research, are those related to the architectural recovery of historical settlements such as in Fontecchio (Aq), a small town in the Abruzzo Apennines heavily damaged by the 2009 earthquake, where interventions for social housing were carried out, as well as small-scale social housing in smaller contexts, addressed for example to young families in urban areas with difficulties

in accessing the real estate market owing to their economic fragility.
This also requires innovative architectural design tools to hold together an existing heritage, which is fragile due to age, construction techniques, safety standards, technological and energy adaptation. An innovation project in which research by design can express replicable and transmissible methodologies, applying a scientific process to architecture. This also belongs to the strategies that architecture can implement to determine new topographies starting from the recognition of the value of heritage closely linked to landscape and to the context.

OPEN CONCLUSIONS

The experimentation, which is still ongoing, opens up to the identification of a possible operative methodology for the transformation project of the Borghi Minori. An approach that renews the consolidated methods of intervention towards this peculiar minor diffused heritage - essentially oriented towards the recovery of buildings - which does not lose the regenerative potential of a multi-spatial and multi-temporal relational gaze. The knowledge of the landscape's long-term processes that had produced different conditions of fragility and the needs and future possibilities envisioned by communities and groups together had been seen as an opportunity for responsible transformation. A topography of fragility which is a topography of the memory, a strong projection to the future. Furthermore, at the same time, it allows monitoring, continuously implementable, of changes accelerated by the effects of catastrophic events, as well as those also induced by global changes. An abacus of architectural devices, which correspond to specific actions, are based on this evolving multi-scalar network, which other authors will be called to specify according to present and future needs. Each transformation project finds meaning within the network and at the same time transforms it, in a process that continues the contemporary rewriting of the landscape, capable of opening unpredictable scenarios in the future. At the same time, the planning methods envisaged by the program incorporate the time variable themselves; the architectural devices show different degrees of permanence, oscillating between emergence and structurality. It was in fact decided, coherently with the type of dynamic readings of the Atlas, to imagine a project not only with several voices but also with several times, in which the architectural devices of the abacus can become pieces of an asynchronous assembly, in a continuous exchange between community and landscape, both realities in continuous transformation. The three methodological step listening, reading and designing are people-centred and interpreted dynamically. The Atlas, understood both as a form of knowledge and as a process/project, becomes an instrument for shared planning between researchers, designers, stakeholders and communities that will intervene in these places over time. In this context, the issue of abandonment is recontextualised with respect to a juxtaposition of other conditions of fragility, also social; the answers identified by the design experiments conducted in the specific contexts of the chosen Borghi Minori will manage to respond in a more founded way, both to local needs as well as to global themes. The open and polyphonic process/project is crucial for the replicability of the operational methodology: the landscape approach informs people-based heritage-centred cultural significance processes, both in the analytical and design phases. Here the architectural discipline, and its project, become a shared space for a heuristic dialogue between different disciplines, all collaborating for envisioning new scenarios of responsible reuse of the Borghi Minori's landscape.

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PAPER #7.15

DAYLIGHTING AND ELECTRIC LIGHTING POE STUDY OF A LEED GOLD CERTIFIED OFFICE BUILDING

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ABSTRACT

Integrated daylighting harvesting and electric lighting system is a key strategy to maximize energy saving and improve occupant comfort and productivity in buildings. However, providing desired amount of light and outdoor views to occupants without causing visual discomfort has been challenging in practice. Located in IECC Zone 6A, the design of a selected LEED Gold certified office building was driven by environmental performance. The building houses a mix of open/closed office spaces, laboratories, conference rooms, and cafeteria in 90,839 sf floor area. Among a number of sustainable features, the fully glazed facades and automated daylight harvesting systems play a critical role in providing daylight in 77% of regularly occupied spaces and direct outdoor views in 91% of the spaces. The building is equipped with automated roller shading systems controlled by a sun tracker mounted on the roof. Electric lighting in open office spaces are automatically controlled by the pre-determined control algorithm. The paper presents a thorough investigation of lighting quality and quantity of the building by adopting a research method combining subjective occupant survey and field measurements. Online surveys were first conducted to reveal any visual discomfort, outdoor views, or privacy issues experienced by the occupants. Various light sensors were utilized to measure daylighting and electric lighting performance throughout the building. Various lighting parameters including illuminance, correlated color temperature, and color rendering index were recorded. Luminance distributions were also documented by high dynamic range imaging technique and the lighting scenes captured in HDR format was analyzed by Daylight Glare Probability metric to evaluate various discomfort glare sensations. The survey results and the field measured lighting parameters were thoroughly compared and analyzed so that findings from this study can help develop a framework for evaluating daylighting design performance in built projects.

KEYWORDS

Daylighting; electric lighting; post-occupancy evaluation; occupant comfort; LEED.

INTRODUCTION

Energy efficient architectural lighting systems and daylighting design strategy can save building energy consumption and also improve occupant comfort, health, and productivity in buildings. As visual comfort and visual interest become critical for occupant well-being, direct view of exterior environments and sufficient exposure to natural light are greatly encouraged by sustainable architecture design guidelines. However, it has been challenging to provide direct views to outdoor while ensuring visual comfort due to the nature of consistently changing natural light environments. A thoroughly coordinated electrical lighting and daylighting design can still fail when they are not effectively controlled. Occupants in the buildings with many sustainable design features can still

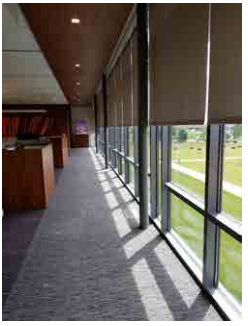
experience visual and thermal discomfort caused by sunlight penetrations, excessive or insufficient light intensity, or high contrast between workstation and surroundings (Hirning et al., 2013 and 2014; Suk and Schiler, 2012; Suk et al., 2013; Konis, 2013). Therefore, it is crucial to conduct a post-occupancy evaluation study particularly in LEED or other sustainability certified buildings in order to learn from their success and failure.

Recently, post-occupancy evaluation studies are increasingly performed by leading private architecture/engineering firms, federal government agencies, and academic researchers (Choi et al., 2019; Nicol et al., 2016; Fowler et al., 2011; Katzenstein, 2013; Hirning et al., 2013; Suk and Schiler, 2012; Suk et al., 2013; Konis, 2013). These efforts help design professionals to be able to match predicted design performance to actual occupant experiences. However, conventional lighting and daylighting POE studies still focus on either subjective responses of occupants or a few illuminance measurements. This incomplete or overly simplified study method can make design professionals to misinterpret whole building performance due to the limited amount of data. Therefore, it is critical to obtain both qualified and quantified data sets to fully understand how sustainable design features impact occupant experiences and comfort in a building.

1. BACKGROUND

The selected case study is located in Fond du Lac, Wisconsin. Located in IECC Climate Zone 6A which is classified as cold climate, the building was completed in 2017 and LEED Gold certified. The building has two floor in 83,402 sf gross floor area and also includes an open courtyard which is in 7,441 sf (Figure 1a). The project houses a mix of open offices, closed offices, laboratories, conference rooms, meeting rooms, cafeteria, etc. in four wing configurations facing each of the true orientations. Among a number of sustainable features, floor to ceiling side lighting and sophisticated daylight harvesting systems play a critical role in providing occupants 91% of direct line of sight to outdoor views while providing sufficient but comfortable light levels at workstations. The daylight harvesting system utilizes exterior louvers, a sun tracker on top of the roof, daylight sensors mounted on ceiling, and automated fabric roller shades along the glass facades (Figure 1b). With seamless communications between these elements, the project achieves 77% of regularly occupied spaces with sufficient daylight (sDA300/50%) which also helps to lower building energy consumption.

a)Exterior view of the building (view from South)



b)Open office

Figure 1. a) Exterior view of the building (source: Overland Partners) and b) automated roller shades at open office

As excessive sunlight penetrations can cause occupant visual discomfort, the interior roller shades are automatically adjusted depending on solar positions and sky conditions. While shading devices are adjusted, electrical lighting fixtures are also automatically controlled to adjust light outputs so that desired illuminance level of 300 lux is maintained at workstations. Since the building is configured with four rectangular wings facing different orientations, it is possible to predict lower sun angles in the two wings facing East and West orientations in the morning and afternoon. Because of different sun angles introduced in each of the wings, each wing is individually controlled to adjust its shading and lighting. This daylight harvesting system ensures visual comfort and direct outdoor views in open and closed offices. Open offices in the four different wings are around 12.2 m (40.0 ft) deep from windows with the ceiling heights varying from 3.3 m (10.7 ft) to 3.6m (11.7 ft) A.F.F.

2. METHODOLOGY

In order to accurately evaluate lighting and daylighting performance of the project, both online based occupant survey and quantified data collection techniques were utilized as follows. Online survey questionnaires were sent to the building occupants prior to scheduled field measurements. Two weeks later, two day site visit was performed to collect quantified lighting data including illuminance, correlated color temperature (CCT), color rendering index (CRI), and luminance distribution throughout the building during normal office hours on August 13th and 14th, 2019. During the field measurements, the building was in a normal operation so that the collected data should represent actual lighting conditions experienced by the users. For example, electrical lighting and shading devices were automatically controlled during the field measurements. Various lighting data collection tools were utilized such as illuminance meter, spectrometer, luminance meter, and DSLR camera.

2.1. Occupant Surveys

Online based occupant surveys were conducted first to understand any problematic issues related to lighting and daylighting in the building. The survey results were analyzed to see if there is any specific areas of concern to occupants. Demographic summary is as follows. A total of 123 occupants participated in the survey (45 male, 74 female, 4 not identified). Majority of the participants (88.6%) are in the age ranging 25 years to 64 years old. 72.7% of the participants have worked in the building longer than 2 years. Besides the general demographic questions, the following lighting focused questions were asked to each participant. A few selected sample questions are presented below.

• The primary source of lighting in my workplace: natural light, electric light, both

• On a clear or overcast day, the light in my workspace is: often too bright, neural, often too dark

• How satisfied / comfortable are you with the amount of light in your workspace?

• If you experienced visual discomfort, how would you rank the problem?: perceptible, disturbing, intolerable.

2.2. Measurement #1: Illuminance, Correlated Color Temperature, and Color Rendering Index

A spectrometer was used to record illuminance levels, CCT, and CRI in various spaces of the building. Horizontal illuminance levels were measured at various heights depending on primary visual tasks required in each of the spaces. For example,

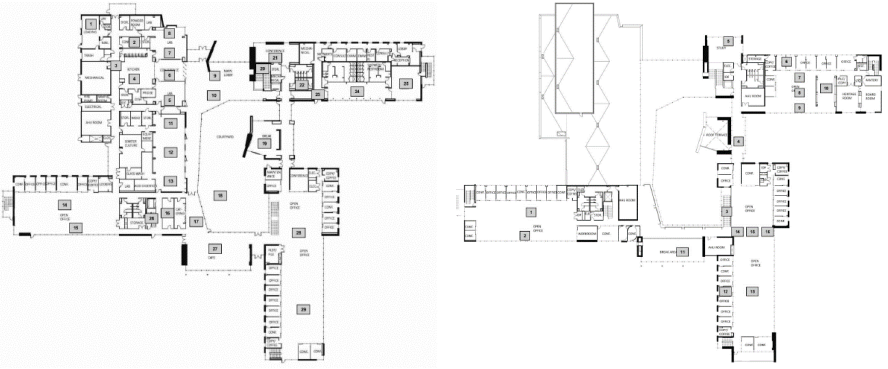
illuminance levels were measured on the finished floor levels in circulation spaces. In office spaces, illuminance levels were measured on top of a desk. The spectrometer measured and presented all three lighting parameters (illuminance, CCT, CRI) in each measurement. Figure 2 shows the locations of the measurements in each floor. The measurement covered both primarily daylit areas and non-daylit areas of the building and was repeated multiple times during the office hours from 8:00AM to 5:00PM. Outdoor illuminance levels, CCT, and CRI data was also collected to understand exterior luminous conditions while indoor lighting data was collected. A total of 29 different locations were measured throughout the first floor and a total of 16 locations were measured on the second floor (Figure 2).

2.3. Measurement #2: Luminance Documentation (HDR Photography)

HDR imaging technique was utilized to capture interior luminance distributions. Even though the survey results reported that there is little concern of visual discomfort in the building, HDR photography was still performed to validate the positive responses from the participants. A manual DSLR camera and tripod was set up at different locations. A total of 11 full-stop exposures (±5 exposures and normal exposure) were taken for each HDR photography. Each HDR photography was made solely by shutter speed adjustments without changing aperture values. The captured low dynamic range images were then combined to create a HDR image in Photosphere software. A total of 26 HDR photographs were taken at 26 locations in a perspective field of view in order to map luminance distributions. Another set of 9 HDR pictures were taken at 9 different locations in an angular fisheye view for visual discomfort analysis purpose. The 9 pictures in angular fisheye view were then processed in Photosphere software to calculate Daylight Glare Probability (DGP) scores. The camera and lens combinations were calibrated in Photosphere software with measured luminance values on a grey board prior to the study.

3. ANALYSIS

As stated above, occupant surveys were statistically analyzed first to identify potential problems of the building. And, field measurements were thoroughly made throughout the building. The field measured



a) 1st floor

b) 2nd floor

Figure 2. Lighting measurement locations

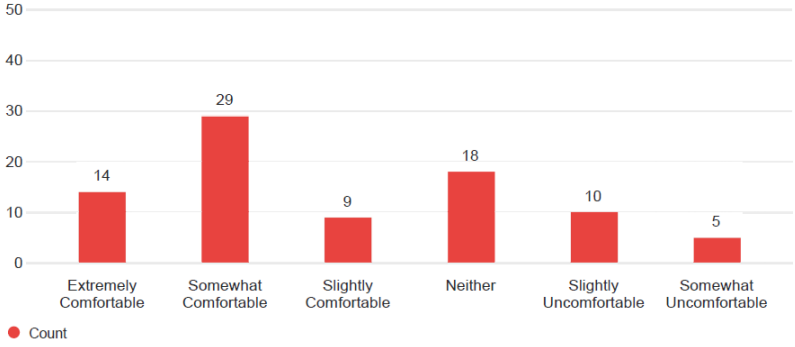
data was processed to be compared with the various lighting and daylighting design guidelines such as Illuminating Engineering Society (IES) and General Service Administration (GSA) P100.

3.1. Occupant Survey Results

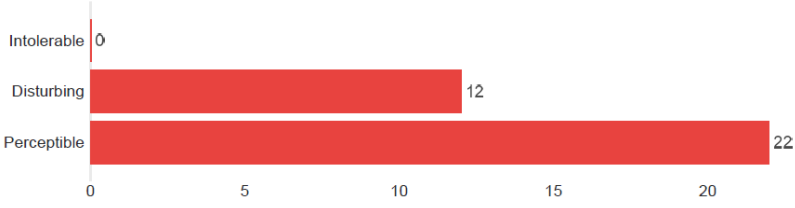
With the large side windows in most of open and private offices, 89.1% of the participants (a total of 110 responses) reported that they have natural light in their workspaces. 76.4% of the participants also reported that they have a good amount of light in clear/sunny day while 88.2% of them feels that lighting is appropriate in cloudy/overcast day. Only small percentage of the participants reported that it is either too bright or too dark at their workstations. While answering to the survey questionnaires, the participants also wrote comments regarding lighting and daylighting. Figure 3 displays the most often mentioned lighting related terminology from participants' written comments. Larger text represents higher frequencies of the terminology mentioned in written comments. The participants mentioned 'lighting', 'glare', and 'computer' the most. This clearly shows that lighting and visual comfort are considered important for computer based office tasks. Also, 'close', 'shades', and 'windows' were mentioned many times in written comments. This explains that the participants understand the influences of windows and shading devices on their lighting conditions.

Figure 4 shows visual comfort levels reported by the participants. Among 85 participants who answered the question, 82.3% of the participants reported no visual discomfort at their workstations. There are only 15 participants who reported either slightly uncomfortable or somewhat uncomfortable visual sensation. And, there is no report of extremely uncomfortable lighting condition. While 15 participants reported slight or somewhat visual discomfort, a total of 34 participants shared that they experienced either perceptible or disturbing glare. This discrepancy raises a question regarding accuracy and consistency of subjective evaluations. This clearly shows that different terminologies in similar questionnaire can cause inconsistent responses from a same survey participant. Even though the issue cannot be resolved here, this survey results explain that there are discomfort glare occasions experienced by occupants but the level of glare sensation is not severe.

Figure 3. Lighting related terminologies mentioned in comments written by the survey participants



a) Reported visual comfort levels



b) Reported visual discomfort sesation

Figure 4. Visual comfort levels reported by the survey participants.

3.2. Illuminance Data

Illuminance level ranges measured throughout the building are presented in Figure 5. This office building includes various space types which require different illuminance levels for occupants to perform specific visual tasks. Based on IES design guidelines, typical office space requires 300 lux at task areas while laboratory requires 750 lux for more accurate and detailed visual performance. Figure 5 compares the measured illuminance ranges in each space type to each space's recommended illuminance level threshold (shown in dashed black lines). The data clearly shows that the measured illuminance levels meet or exceed the recommended light level threshold for each space type. Open and closed offices have illuminance above 300 lux and laboratory has illuminance ranging from 600 lux to 1,600 lux. There is no space with insufficient light issues. Exterior illuminance level was measured at 5,200 lux at 2:10PM on August 14th, 2019.

3.3. Color Rendering Index

Figure 6 shows ranges of measured CRI values in different space types. CRI measures how well a given lighting condition renders different colors. 100 CRI value represents the highest color rendering and it is referenced to natural light which has full color spectrum of light. In Figure 6, all space types in the building have CRI value of 80 or above. The laboratory and kitchen are only two spaces with CRI

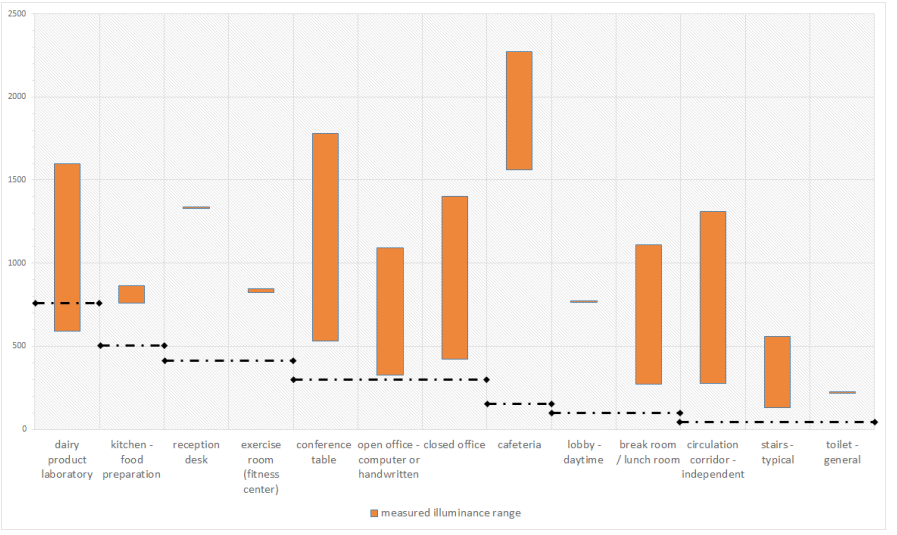


Figure 5. Measured illuminance levels in each space type and their comparisons to IES design guidelines

values slight lower than 80 CRI but their upper ranges are still at or above 80. These two spaces have slightly lower CRI values than the other spaces since they have lower light color temperature. It is typical that food processing spaces tend to have lower color temperature (cooler light) to maintain cleanliness and it causes somewhat lower CRI values. GSA P100 guideline recommends CRI values above 80. The latest version of Well Building Standard recommends either CRI values higher than 90 or CRI values higher than 80 with R9 value exceeding 50. This study did not document R9 values therefore it is difficult to determine whether or not this building meets the latest Well Building Standard requirement. However, the reception desk, open/private office, cafeteria, breakrooms, and circulation spaces have CRI value ranges above 90 which meets the requirement without confirming R9

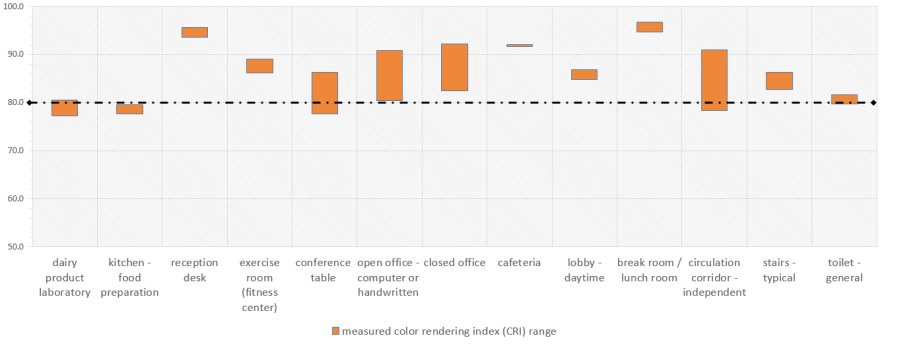


Figure 6. Measured CRI values and their comparisons to GSA P100 and Well Building Standards

value. In general, it is clear that this building has a very high quality lighting environment. As CRI and light color spectrum are important factors to affect human's circadian rhythm, it is recommended for lighting and daylighting POE studies should measure these lighting metrics.

3.4. Correlated Color Temperature

Measured CCT values widely vary depending on measurement locations. Both open and closed offices have CCT values ranging from 3,500K to 6,200K. This wide ranges of color temperature occur from the mixture of electric lighting and daylight in the office spaces. The electric lighting fixtures in the office spaces provide 3,500K which is typical in office spaces. However, natural light entering through the large windows increases CCT values and its influence varies depending on distances from the windows. It is found that workstations close to side windows has a very high color temperature around 6,000K because of large amount of natural light while workstations far away from windows has much lower CCT values around 3,500K. Same observation can be made for the corridor and circulation space. Different from these spaces, laboratory, kitchen, and toilet have lower CCT values at 3,000K because of limited exposures to natural light. Even though GSA P100 standard recommends CCT values lower than 4,000K, it is important to point out that CCT value itself does not determine quality of light. When natural light is introduced, CCT values can increase and CRI values can also increase. Recent studies show that high color temperature light in the morning can help office workers to maintain circadian rhythm when it is provided at a right time, period, and intensity.

3.5. Luminance Maps and Visual Discomfort Evaluation

Lastly, HDR photography was performed at various locations throughout the building. Luminance values were displayed in the false colored HDR image and each of the captured HDR scenes was analyzed by Daylight Glare Probability index to calculate

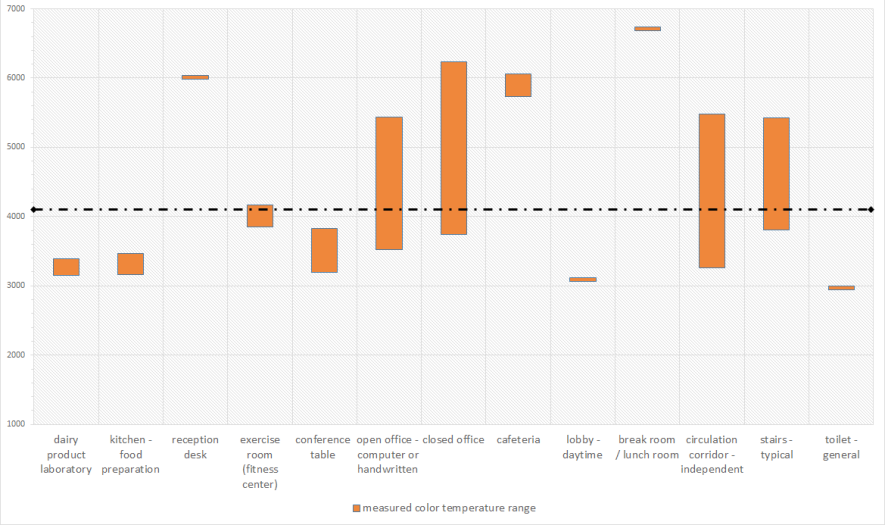


Figure 7. Measured correlated color temperature levels and their comparisons to GSA P100

visual discomfort sensation levels. Figure 8 shows four HDR scenes captured in angular fisheye lens inside open office, conference room, private office, and cafeteria. Luminance distributions in the false color images show that there are no glare sources in all of the captured scenes and the luminance values are considered to be visually comfortable based on the recently defined luminance thresholds for discomfort glare by various research groups (Suk et al., 2016; Shin et al., 2012; Wienold and Christoffersen, 2005). Relatively high luminance values were observed from the electric light sources but they are also within the acceptable range.

Daylight Glare Probability analysis evaluates imperceptible glare sensation from the four captured scenes. The open office has imperceptible glare sensation with 3% DGP score, conference room has 15% DGP score, private office has 2% DGP score, and cafeteria has 2% DGP score. Based on DGP metric, perceptible glare sensation occurs from DGP score of 35% (Wienold and Christoffersen, 2005). This results confirm that no significant visual discomfort issue can be experienced in the spaces.

CONCLUSION

Both qualitative and quantitative aspects of lighting environments were thoroughly documented inside the selected LEED Gold certified building. Online based occupant survey and physical lighting data collection methodology helped to reveal occupants' subjective evaluations with quantified lighting metrics. Majority of the participants reported visual comfort and satisfaction in the building. Measured CRI values are acceptable in most of the studied areas as they are above 80. Measured CCT values shows a wide range in different locations depending on the amount of natural light introduced into the spaces. Illuminance measurements also revealed that the desired illuminance levels were met or exceeded in every space of the building. Again, it is believed that natural light contributes to provide high illuminance levels, high CCT values, and high CRI values. This clearly shows the importance of daylighting design in buildings. Finally, DGP calculations of the captured HDR images confirm that electric lighting fixtures or natural light

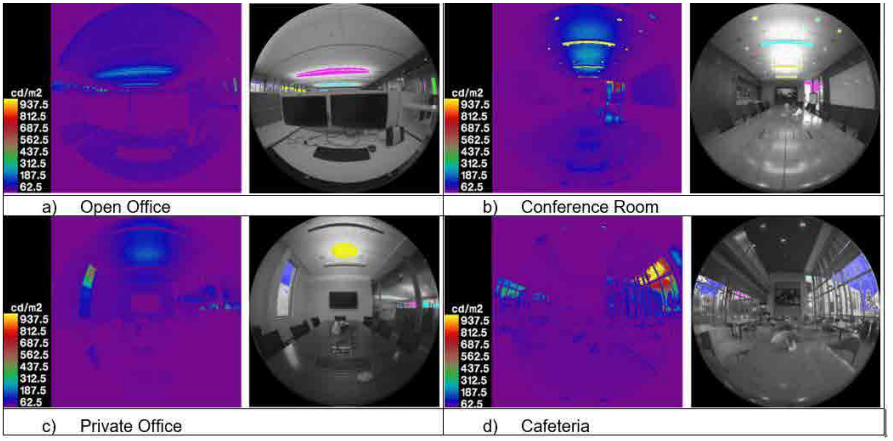


Figure 8. Captured HDR scenes and luminance distributions

through windows does not cause any serious visual discomfort to occupants. Both survey results and the field measured data agree that the project has successfully ensured visual comfort and direct outdoor views.

Compared to conventional post-occupancy study method that relies on limited illuminance measurements, this study utilized a combined methodology which analyzes both qualitative and quantitative aspects of lighting and daylighting in an office building. Use of a spectrometer helped to document important lighting parameters such as CRI and CCT. HDR imaging technique helped to document luminance distributions and allowed more in-depth analysis of visual discomfort sensation. Post-occupancy evaluation study is certainly challenging due to many unpredictable and uncontrollable factors including occupancy, sky condition, occupant behaviors, etc. and the challenge was also experienced in this study. However, it is believed that the proposed lighting POE study would allow more in-depth analysis of occupant experiences based on quantified lighting parameters.

ACKNOWLEDGEMENTS

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PAPER #7.16

NEW SYNERGIES BETWEEN RESEARCH, PRACTICE, AND EDUCATION FOR HEALTH AND WELLBEING OUTCOMES IN THE BUILT ENVIRONMENT

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ABSTRACT

Traditionally, health-related design research has been carried out mostly in academic or research settings, while designing real-world built environments has been the domain of professional practice. Conventional roles of architects, however, are undergoing significant change with new research undertakings in professional practice (Hensel and Nilsson 2019). Recent years have seen the emergence of new human-centric research programs and initiatives at architecture firms on a global scale.

Practitioners, educators, and researchers now increasingly use evidence-based designs to create spaces that have healthy outcomes for people. The AIA-ACSA Design and Health Consortium, for example, has created a multi-disciplinary network to translate design and health research into practice for professionals, policy makers, and the public.

This paper examines the transformational impact of health research in architectural practice. Through a systematic review of health and built environment research carried out by design firms, the paper includes the study of different sources of information such as peer-reviewed publications, conference proceedings, white papers, webpages, and smartphone applications developed by these firms. A mapping exercise categorizes these studies by different typologies and research goals. It analyzes the research methods and findings presented in these sources and discusses real-world implications for design, professional practice, and future research.

Finally, this research highlights gaps that still exist in the field of design and health. To bridge these gaps and create new synergies between research, practice, and education a new model for research and design methodologies in health and the built environment called LEAPP is proposed and described in this paper.

KEYWORDS

Architects; health; built environment; design implications; professional practice.

INTRODUCTION

Traditionally, health-related design research has been carried out mostly in academic or research settings, while designing real-world built environments has been the domain of professional practice (Hensel and Nilson 2019). Conventional roles of architects, however, are undergoing significant change with new research undertakings in professional practice. Recent years have seen the emergence of new human-centric research programs and initiatives at architecture firms on a global scale.

Design practitioners often refer to their design processes as being human-centered. In recent years, their approach to design solutions and design-making processes in their publications, websites, whitepapers, and advertisements have been frequently described as being human-centric and evidence-based. Indeed, practitioners now increasingly use evidence-based design recommendations suggested by educators and researchers to study and create spaces that have healthy outcomes for people. The AIA-ACSA Design and Health

Consortium, for example, has created a multi-disciplinary network to translate design and health research into practice for professionals, policy makers, and the public (Design & Health Consortium).

Evidence-based design is design-making that is grounded in research and tested in practice (van Aken and Romme 2012). The validity of evidence-based design principles depends on how well they are connected to the body of scientific knowledge and the extent to which the principles have been tested in practice. The notion of 'testing' refers to the reviews of the building or spaces from user experience, critics reviews, and performance assessment. Evidence-based design is meant to develop prescriptive knowledge and solutions that serve to improve professional practice (van Aken and Romme 2012).

Human-centered designs for spaces are solutions that emerge from involving the users of that space (Crandal, Michelle 2019). A myriad of design and design-related fields now advocate this approach. These include usability engineering, user-centered design, participatory design, and experience-based design (Johnson, Slavo and Zoetewey 2008). Architectural discourse ideally, is inspired by users' needs, and showcases skills that can address those needs. Design research methodologies serve as tools and conceptual frameworks to develop real-world solutions.

Human-centric and evidence-based design processes identify specific problems and acknowledge their conditions, locations, target populations, and other variables. For this study, the sources that were collected and analyzed, share a focus on health research in architectural practice and involve methods that address specific space typologies. Every design firm studied comes with its own variation of these methods, processes, and outcomes.

In this study, we connect professional practice in the field of design and health by firms to the identification of any evidence-based and human-centered research methods that they may have used. The goal is to reveal the influence, outcomes, and limitations of design and health related research conducted by design firms. Importantly, it also highlights the gap in the documentation of actual built projects versus the documentation of research and design processes by firms. Several methodologies and mechanisms of their evidence-based and human-centered processes or practices, therefore, are invisible to educators and researchers in academia, and industry colleagues. The research knowledge that is presumably developed for problem-solving and practice, therefore, becomes limited in its influence in the field of design and health if it is not documented and published.

1. METHODOLOGY

1.1. Approach

The research methodology consists of a systematic content analysis and mapping exercise of peer-reviewed publications, conference proceedings, white papers, websites, and smartphone applications created by professional design firms. These sources of information were scanned for scientific research and evidence-based outcomes in the field of design and health. A conceptual map was then created to identify and categorize the transformational impact of health-related research in architectural practice, and identify its gaps. Solutions are proposed thereafter, to create new and effective synergies between research, practice, and education.

1.2. Examing the role of health research in architecture practice

58 architectural design firms were identified after running a web search for practices or practitioners that focused on design and health research or projects or both, as

part of their work portfolio. The selection of these firms was not restricted to any particular geographical area or region; this study, therefore, is international in scope. An initial review of design firms' websites led to the following questions: How are design practitioners aware of concerns related to health and the built environment? What is their approach to solving problems in this field? What are their sources of information for decision-making which ultimately leads to design solutions? And importantly, how are these research and design methodologies made available publicly – to peers in the industry, scholars and educators in the field, and other stakeholders? The sources of information that were checked for included but were not limited to, news releases, popular press, academic or peer reviewed or scholarly articles, conferences, white papers, or a combination of any of these venues.The inquiries led to a systematic content analysis and statistical modeling method known as topic modeling which was used to collect and analyze different elements of the data. This method was followed by the development of the conceptual mapping and frameworks to describe how design research methods are used by the firms in the field of health and the built environment, their impact, and their gaps.

1.3. Topic modeling

The topic modeling study of the 58 sources includes keyword identification, frequency analyses, and Pearson correlations. The keyword identification process consists of finding and sorting keywords or key phrases into different themes within the sources analyzed. The results were annotated using a controlled tagging process in the computer program Hypothes.is.[1] The annotations revealed the most frequently used words or keywords that related to each theme. These results were then analyzed to answer the questions which were discussed earlier. Four main, recurring themes were identified and used to group and organize keywords and text as follows:

1. Problem awareness: This theme included an awareness of issues and concerns related to health, wellness, medical or health facilities, or medical or health treatment in the built environment.
2. Design firm's culture or values: This included all the references to the firms' mission, vision, featured projects, abstracts, and design project highlights.
3. Sources of background information: This theme includes references to previous experiences, motivations, client's requirements, trends, common sense design guidelines, research, news or economic benefits.
4. Design and research results: This included the documentation of all built projects, publications or references to publications, posted data, references to conference presentations, white papers, news, applications, etc.

The text connected to each theme in Hipoyhesis was further analyzed to understand its context or how it was referred to in the source. The frequency analysis involved exporting the meta-data from Hipothesis and sorting out the information by the focus area as described by the firms, the potential research areas based on their expertise, and the use of the products that they offer. Once this was completed, a Pearson correlation was applied to the datasets to find any significant associations between data sets and measure their strength.

2. RESULTS

The search for architecture firms with any linkages to health-related work resulted in 58

[1] https://web.hypothes.is

different national (based in the United States) and international firms. The results of the content analysis and topic modeling showed findings related to the primary and secondary areas of focus of their work, and how this was highlighted in websites, publications or other means to attract viewers' attention.

2.1. Primary themes in design and health practice

21 firms were found to have building typology as primary focus, i.e. they claim to have expertise in designing healthy environments for a variety of different building types. Nine firms mention customized user and demand-based services in any building type. 19 firms emphasize the use of special technology or a special skillset to solve unique design challenges to create healthy solutions for spaces. 11 firms describe their design focus as evidence-based. 17 firms have more than one area of focus: two link the building type with user needs or user-experience, three link a special technology or skillset to meeting user needs, eight link special technologies or skillsets with evidence-based design outcomes, two link designing different healthy building types to the use of special technologies or skillsets, and two link the users, skillsets, and evidence-based designs together. Figure 1 shows the number of architecture firms sorted by how they advertised their strengths or areas of primary focus in design and health.

The definitions of evidence-based practice and human-centric approaches by design firms were found to vary, but were mostly pragmatic and related to real-world projects. In one instance, evidence-based is described as '*a way to validate the design methods and architecture practice that incorporates de learning from experimental/ empirical experimentation during their own client-architecture relationship, sometimes based in field-related documents of various sources*'. Another firm described a human-centric approach as *'a consumer/client driven process that attend the specific needs prioritizing health, wellness, harmony, and the environment*'.

2.2. Recurring themes in design and health practice

The data extracted by the controlled tagging tool showed three main tendencies by firms in the field of design and health: 1) their main area of focus of the architecture practice within the field of design and health, 2) an awareness

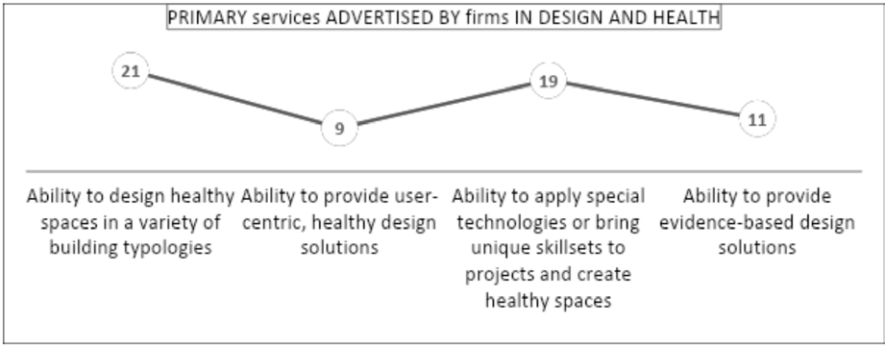

Figure 1. Number of firms sorted by their advertised primary areas of focus or strengths in the field of design and health. Source: Author.

of existing problems or concerns related to human factors and the associated areas of their existing or potential research expertise, and 3) the proposed solutions, outcomes or products of their work. An analysis of 60 different references or descriptions as to what the firms defined as the main focus of their architecture practice showed that most firms preferred writing about their general expertise and specialties, while fewer showed an awareness of issues and concerns in health and the built environment or mentioned the sources of their research or even inspiration, and very few published the outcomes of their research.

The most frequent theme was the one for proposed solutions which showed 49 keywords or text references, followed by the 33 references to the awareness of a problem to be solved. Lastly, there are 22 references to a source or multiple sources of information or evidence that led to a design solution. Quite often, however, design solutions and built projects were described without discussing problems, issues, client or user needs first. The results of these recurring theme frequencies are shown in figure 2.

The results of the Pearson correlation are shown in Table 1. They revealed an insignificant association between *problem awareness* and *proposed solutions* (-0.25) which indicates that firms in design and health are unlikely to link *proposed solutions* with *problems, issues, or concerns*. This may also indicate that they did not follow any specific research methodology while working towards design outcomes or if they did, then they did not document or describe in any way. Similarly, the correlation between *proposed solutions* and *sources of information* was weak or insignificant (0.0029). There was also found to be no association between *problem awareness* and *sources of information*. Further, only ten firms mentioned three of these themes in their descriptions, 24 use two themes, and 26 only mentioned one themes.

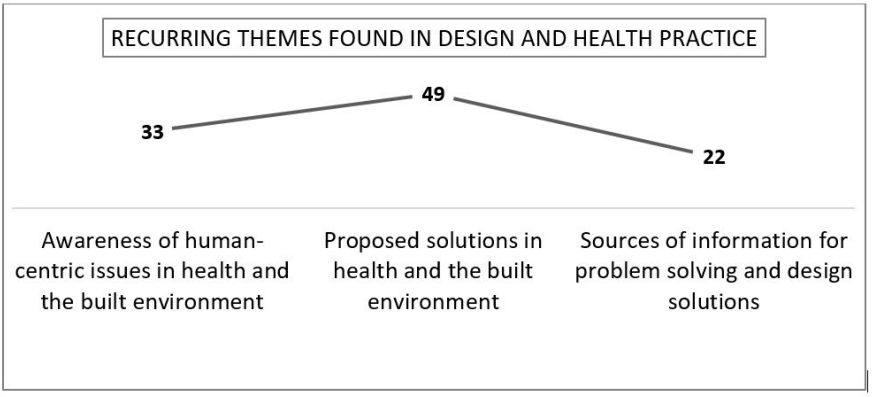

Figure 2. Frequencies of recurring themes found in design and health practice. Source: Author.

Themes		Results of Pearson correlation
Problem awareness & Proposed solutions	-0.26	insignificant
Proposed solutions & Sources of information	0.00	insignificant
Problem awareness & Sources of information	-0.01	insignificant

Table 1. Results of the Pearson correlation test between different themes in design and theme. Source: Author.

2.3. Specific reserach areas in design and health

The 58 architecture firms studied mentioned or referred to having an expertise in 73 different research areas in total. These 73 existing or potential research areas were derived by reviewing all the keywords or text from the content analysis and topic modeling exercises described earlier. The following primary fields of research expertise and knowledge areas were found in the analysis of firms of design and health: *health* with 35 references, *environment* with 13, *building technology or materials* with 17, *special talent or services offered or skillsets* with 16, particular research *methods or approach* with 50, and *economic benefits* with three references. These results are also shown in figure 3.

Since *particular research methods or approach* were found to be most frequently mentioned, another Pearson correlation was run to compare it with *health*. The relationship was found to insignificant as well, as shown in Table 2 below. Two firms claimed to have four research areas of expertise in design and health, while eight firms mentioned three research areas each. 40 firms mentioned two research areas each, and 23 claimed to have one research area of expertise. In all 58 cases, these existing or potential areas of research were found within the overall description of the architecture practice and not on another specific webpage, portfolio, or another document or part of the website.

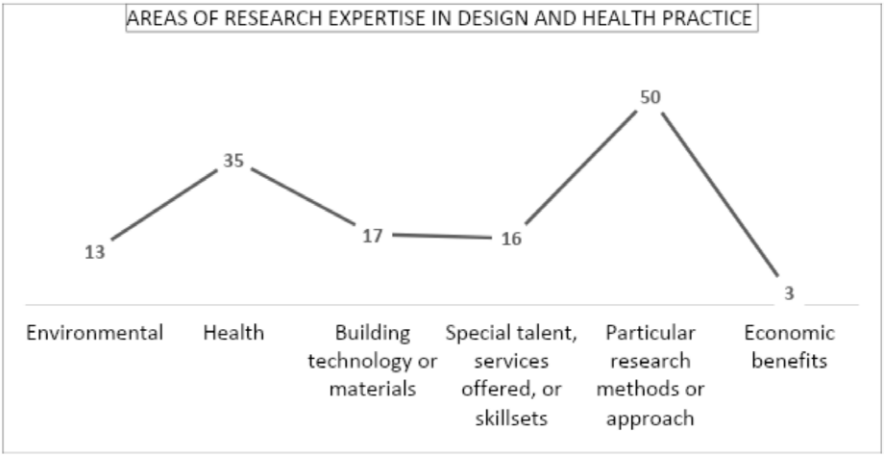

Figure 3. Frequencies of different areas of research expertise in design and health practice. Source: Author.

Themes		Results of Pearson correlation
Health & Particular research methods or approach	-0.26	insignificant

Table 2. Results of Pearson correlation between health and particular research methods or approach by firms in design and health. Source: Author.

2.4. Documenting or advertising the work

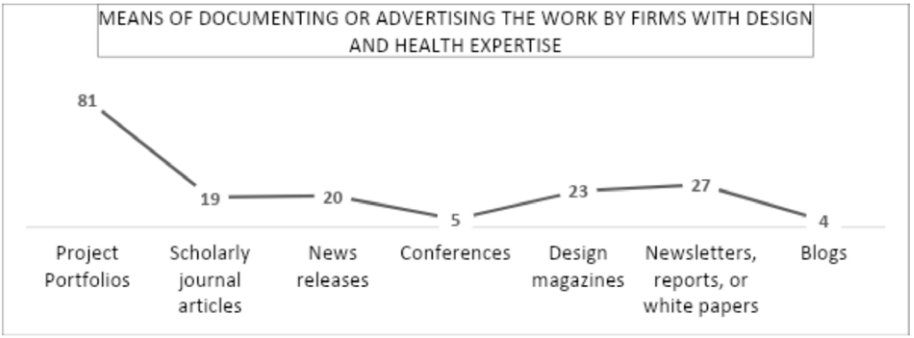

Figure 4. Means to document or advertise projects in design and health by architecture firms. Source: Author.

The results of the frequency analysis shown in figure 4 reveal that 81 firms use their *project portfolios* to showcase their expertise, followed by 27 references to the use of *newsletters*, *reports, or white papers*, 23 to *magazines*, 20 to *news releases*, and 19 to s*cholarly journal articles*. *Conferences or blogs* were found to be significantly less used in the field by firms as a way to advertise, present, or document their work.

3. DISCUSSION: SYNERGIES BETWEEN RESEARCH, PRACTICE, AND EDUCATION

The findings of this study reveal different approaches adopted by design firms that operate at a global or national level in research methodologies and design solutions for projects related to health and wellbeing in the built environment. A larger study which includes surveys and interview of principals, managers, and employees would be required to make more significant conclusions about how the work done by these firms creates linkages with peers in the industry, and has an impact on research, education, and policy in the field. The results of this preliminary study, however, indicate that design firms were focused mostly on providing solutions for different building typologies that were advertised as healthy solutions for users, clients, and stakeholders. There was often an emphasis on providing user-oriented and evidence-based design solutions, but descriptions or mentions of how these concepts were actually implemented in real-world projects were either inadequate or completely missing.

A few firms were found to document or share their approach, strategy, or research methodologies to solve particular problems and meet user needs. These approaches, however, were mostly limited to one or two types that were used across a range of building and interior design projects. Further, it appears that the reason for these processes not being mentioned or documented most of the time, is not a lack of skillsets or the use of special or state-of-the-art technologies or equipment. The teams' talents, tools, and experience in fact, appear to be very well advertised up-front, presumably, to attract clients and generate more work. This may indicate, therefore, that firms do not believe specific research methodologies to be a valuable means of attracting more clients. Evidence in the field of health and the built environment, however, reveals quite the opposite; design solutions need to be well-grounded in research findings

in the field to satisfy user-needs and create healthy environments. By not documenting or sharing research and design methodologies in the field, therefore, design firms miss important opportunities to grow the field of design and health by nurturing more research and increasing the field's knowledge base. This phenomenon may also have a long-term impact on meeting user needs as well as future research, education and practice goals. Additionally, a lack of awareness of existing and latest research could also lead organizations to reinventing the wheel instead of driving innovation in the field.

A new conceptual framework, therefore, for creating more synergies between research, practice, and education is urgently required. A five-step model known as **LEAPP** is proposed as part of this framework, consisting of the following steps:

1. A **L**iterature review on the specific topic and drawing from existing research on spaces of a similar type and function as the new ones to be designed. Creating a customized research methodology based on the knowledge gained in this process.
2. Conducting **E**valuations at the pre-design/ pre-occupancy consisting of focus group meetings, surveys, interviews, measurements, virtual reality studies, or a combination of these methods, to understand client requirements, user needs, or evaluating existing spaces to improve or redesign.
3. **A**pplying research findings from the previous step and developing a design solution in response.
4. Conducting a **P**ost-occupancy evaluation and comparing it to pre-design findings, making improvements to the space based on these findings if possible, and learning from the design outcomes.
5. **P**ublishing the design research methodologies and findings in different formats including but not limited to peer-reviewed journals, news releases, popular press, white papers, and conference presentations and proceedings. Additionally, these publications could be used to increase the firm's profile and, in its marketing, and branding strategies.

By following the steps in LEAPP, design and practitioners may be successful in increasing the dissemination of knowledge, make a bigger impact on the field of design and health, and create more synergies with research, education, and practice.

CONCLUSION

Firms committed to designing healthy environments as one of their primary focus areas or building types may have areas of special expertise that align with human-centric and evidence-based approach to design. However, they miss opportunities to disseminate knowledge by not documenting their work in scholarly journal articles, white-papers, conference presentaions, or proceedings. Clients, potential users, and other stakeholders are a valuable source of information in research and design processes. Users should be seen as informants, consultants, and participants of buildings and spaces from the very beginning of the design process.

To create a better impact, design firms must also increase the scope and role of their deliverables. Due limitations in cost, time, and required expertise, however, firms cannot be expected to conduct original research studies for every design project. There may also be some cultural or pragmatic challenges in their application. To counter these limitations, a five-step process known as LEAPP is proposed, to break down and simplify the research process, help in its broader understanding, and to market it better as part of the project. LEAPP, as discussed in detail earlier, suggests that the design of building projects may be based on existing research findings on design and health, pre-design evaluations, as well as post-occupancy evaluations after their

design and construction. Importantly, these processes and methodologies followed by the design team must be documented and shared among the larger and more diverse community to create better and impactful synergies with education and research.

Limitations of the study

This study is limited in scope and scale. To make significant conclusions, a larger study which includes an extensive survey and interviews of design practice leaders, employees at different levels, clients, and other stakeholders, is highly recommended. Five out of the 58 architecture firm websites were protected against tagging tools and their data, and were not included in the frequency analysis. Some reports and newsletters mentioned by firms on their websites were also unavailable for a qualitative review. White papers did not appear to be used to by the firms at all, and therefore, were not included in the analysis as well. A larger survey, however, may find white papers which reveal more research and design methodologies and potential synergies between research, education, and practice.

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PAPER #7.17

RETHINKING SUSTAINABLE DEVELOPMENT IN EUROPEAN REGIONS BY USING CIRCULAR ECONOMY BUSINESS MODELS

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ABSTRACT

In essence, Circular Economy (CE) is about moving from an unsustainable linear system of materials usage and waste production to one of the regeneration of resources. CE has lately developed into a rapidly progressing and competitive field of business and innovation. CE business models can be seen as tools in reducing waste, generating resource efficiency improvements and lessening the environmental impacts of industrial production and creating social sustainability. However, it's still often unclear what type of negative environmental and economic impacts CE business models may bring about. In the REDUCES project, the potential environmental impacts of CE business models are mapped and tools will be discovered for regions to not only promote the business models most suitable for their regional contexts, but also to assess the potential environmental impacts they may entail. The tools will be reviewed and evaluated by the partners and stakeholders during the projects, focusing on the previously recognised most important categories of CE business models. In order to make informed policy decisions about both economically and environmentally most viable business models, their impacts need to be thoroughly assessed. There is a growing need for a more comprehensive understanding of regional and local aspects of the transition towards a CE and of recognizing the most promising sectors for sustainable smart specialisation. REDUCES forms a cooperation network of regions that are on different levels of CE development and have a strong shared will on further supporting their region's businesses in transitioning to a CE. The exchange of experiences and knowledge within and between the regional authorities is key in developing the best action plans to support environmentally sustainable business models for each region and policy. REDUCES results in best practices and policy recommendations which will significantly benefit public authorities and institutions in supporting CE transition.

KEYWORDS

Circular economy; business model; Comunitat Valenciana; sustainability; regional policies.

INTRODUCTION

The idea for the project REDUCES originates in the recognised need to support the transition to a circular economy (hereinafter CE) on policy level in order to accelerate the transition to sustainable, resource-efficient regional economies, to tackle climate change and decrease environmental damage caused by linear business models. In order to achieve sustainable change, it is essential that regions not only recognise the value of circular business but also that the policy environment supports and activates businesses to implement these business models.
A case-based interregional exchange of experiences forms the basis of the REDUCES approach. The aim is to review best practice

CE business models in regional context as a driver for environmentally sustainable economic growth. Five general topics of CE business models have been recognized to focus on: product life extension, product as a service, sharing platforms, renewability, resource efficiency and recycling. In addition, the crosscutting themes of regulatory and governance issues as well as all dimensions of sustainability in CE are considered.

To form a better picture of regional status of CE integration, a status quo of CE business environment and critical environmental considerations in each partner region has been developed in the framework of the project. This is considered as the starting point for the later action plan development.

We must emphasize that although the approach of the project is CE in general terms, in the case of the Valencian Community and due to the political instrument of application (Decree 151/2009, basic design and quality requirements in housing and accommodation buildings), we approach CE from a general perspective to later focus on CE in the built environment and the housing sector. This paper presents the main results of the analysis on the state of the art of the CE in the Valencian Community.

1. MAIN CHARACTERISTICS OF COMUNITAT VALENCIANA REGION

The Valencian Community is a Spanish autonomous region with 4,946,233 inhabitants in 2018 (10.6% of the Spanish population). With an area of 23,255 km² (4.60% of the national extension), it is the 8th region in Spain by area. It is in the east and southeast of the Iberian Peninsula, on the coast of the Mediterranean Sea, and is divided into 3 provinces, Alicante, Castellón and Valencia, 34 counties and 542 municipalities.

The gross domestic product (GDP) has increased in recent years and stands at 108.6 billion euros in 2017 (9.3% of national GDP). According to Eurostat, the GDP per capita in the Purchasing Power Standards was 24,300 in 2017, a figure that has steadily increased since 2013 (20,900). This ranks the region in position 12 among the 17 Spanish autonomous communities, below the national averages (27,600) and of the EU-28 (30,000) (European Commission 2010).

The economy is strongly service-based, the service sector represents 71% of the regional gross value added (GVA) in 2018, which represents approximately 64% of the regional GDP. The activities with the greatest weight

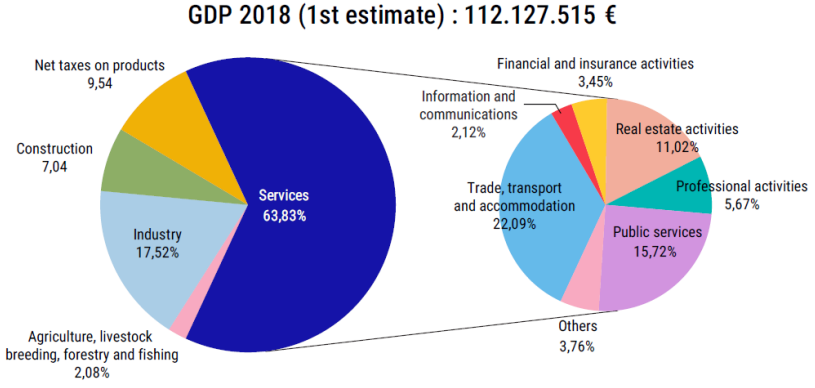

Figure 1. Gross Domestic Product of the Valencian Community. Source: (Consellería de Economía Sostenible, Sectores Productivos, Comercio y Trabajo. 2020)

are those related to commerce, transport, and hospitality (22.09%) and real estate activities (11.02%), which together represent more than 50% of activities related to the service sector (Consellería de Economía Sostenible, Sectores Productivos, Comercio y Trabajo. 2020).

The tourism sector, which began to develop widely in the 1960s and early 1970s, has progressively become one of the main wealth-generating activities in the region, not only for its direct contribution but for the expansive effect it has had on a large group of related activities. The region welcomes 28.7 million tourists each year (residents and international), with 177.3 million overnight stays, and 12,580 million spending (includes origin and destination), which represents an economic impact of 14.6% participation in GDP and 15.1% participation in employment (Turisme Comunitat Valenciana 2018).

The strategic industrial sectors in the Valencian Community are Tiles and ceramics; Leather and shoe industry; Toys and games; Wood and furniture; Textile and clothes; and Automotive industry. There are many companies in these sectors in the region, which represent a high percentage in the country in general, so that they are important for the general economy in Spain. The financial and economic crisis that started in 2008, had an impact on the global economy, and some of these sectors, such as ceramics and furniture very directly related to construction, were particularly affected (European Commission 2010).

Regarding active population during 2018 was 2.04 million people, with the Services sector standing out from the rest of sectors with 73.5% of the regional total, with industry lagging behind with 17.1%, followed by construction with 6.4% and agriculture with 3% (Consellería de Economía Sostenible, Sectores Productivos, Comercio y Trabajo. 2020).

Regarding the number of active companies based in the Valencian Community, the latest published data (2018) show that of the

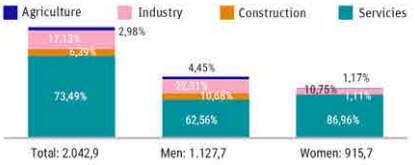

Figure 2. Employed population (thousands). (Consellería de Economía Sostenible, Sectores Productivos, Comercio y Trabajo. 2020)

total number of companies, 80.7% belong to the service sector, 12.2% to construction and 7.2% to industry, representing growth compared to the previous year above the average for industrial companies (4.69% more) and construction companies (4.44% more) while the service sector it grows below the average (1.23%). The average in the Valencian Community shows a growth close to 2% . Regarding the size of the companies, in number of employees, more than half (53.7%) are companies without employees, 41.7% have between 1 and 9 employees, 3.9% between 10 and 49 employees and only 0.7% (2,381 companies) have 50 or more employees. During 2017, companies with 50 or more employees, increased by 6.97%, followed by 10 to 49 employees companies, which increased by 5, 82%. Companies with between 1 and 9 employees and without employees grew by 1.88% and 1.49% respectively (Conselleria de Economía Sostenible, Sectores Productivos, Comercio y Trabajo 2019).

As regards the construction sector, during the 2000s, it suffered exorbitant and unsustainable growth. Thus, its weight increased to represent in 2008 more than 12% of regional GDP. The end of the real estate boom from 2008 translated into a decline in the weight of this activity, reaching a low in 2014 with 5.8% of regional GDP, a percentage similar to the national average (5.1 %) in that same year. As of that year, the weight of the construction sector has increased slowly

and steadily, but without reaching the values prior to the crisis. The economic forecasts published by different organizations for the coming years augur an increase in production, although with lower growth rates, data that are also being revised more and more downward.

2. REGIONAL CIRCULAR ECONOMY PROFILE

To get an idea of the state of the CE in the region, it is essential to start by making a brief overview of the current regulatory framework and the initiatives promoted by the different administrations, national, regional and local, with the objective to redirect the economy, production and consumption models towards circular models.

2.1. National regulatory framework

At the national level, the recently approved Spanish Strategy for Circular Economy (Ministerio para la Transición Ecológica y el Reto Demográfico 2020), its successive three-year action plans to be developed, and the Pact for a Circular Economy should be highlighted.
The Spanish Circular Economy Strategy (hereinafter EEEC), España Circular 2030, lays the foundations for promoting a new production and consumption model. The strategy aligns with the objectives of the European Union CE action plans, in addition to the European Green Pact and the 2030 Agenda for sustainable development.
For the implementation of the EEEC triennial action plans are foreseen, the first one, it is expected to be presented at the end of 2020 and will cover the period 2021-2023.
The strategy marks the following quantitative objectives to be achieved by 2030:

- reduce national consumption of materials by 30% in relation to GDP, compared to 2010
- reduce the generation of waste by 15% compared to 2010
- reduce the generation of food waste throughout the food chain: 50% reduction per capita at the household and retail consumption level and 20% in the production and supply chains from 2020
- increase reuse and prepare for reuse until reaching 10% of the municipal waste generated
- improve the efficiency in the use of water by 10%
- reduce the emission of greenhouse gases below 10 million tons of CO_2 equivalent.

The EEEC identifies six priority sectors of activity: the construction, agri-food, fishing and forestry, industrial, consumer goods, tourism and textile and clothing sectors. And it mentions as key policies to advance on the CE the policies related to economy, taxes, employment, R&D&i, consumption, industry, water, agriculture and rural areas development.
On the other hand, the Pact for the Circular Economy (Ministerios de Agricultura y Pesca y de 2017), signed by more than three hundred entities, is an initiative promoted by both the Ministry of Agriculture and Fisheries, Food and Environment, and the Ministry of Economy, Industry and Competitiveness, that seeks to involve the main economic and social agents of Spain in the transition towards this new economic model.

2.2. Regional regulatory framework

The Valencian Community has not yet started the procedure to prepare a Circular Economy Strategy. However, in October 2018 the president of the Generalitat Valenciana announced the will to promote a pact for the Circular Economy (Generalitat Valenciana 2018) participated by administrations, business organizations and citizens.
Likewise, the Generalitat Valenciana has other plans and programs that contribute to

the fulfillment of the objectives of the EU in terms of CE, among which we can highlight the following ones:

• Document d'ELX (Conselleria de Hacienda y Modelo Económico. Generalitat Valenciana 2016): Base document and guiding elements for the transformation of the economic model of the Valencian Community, whose objective is to lay the foundations for the Valencian Community to advance towards an economic model based on knowledge, innovation, openness and outside connection, articulated on the principle of sustainability, both environmental, productive and social. It defined ten strategic lines that later generated the structure of the Action Plan for the Transformation of the Economic Model 2017-2027 (Conselleria de Hacienda y Modelo Económico, 2017).

• Action Plan for the Transformation of the Economic Model 2017-2027: consists of an economic diagnosis, objectives and key strategic initiatives, as well as a monitoring and evaluation system. The proposed action plan is aligned with the Sustainable Development Goals and with the principles of the Europe 2020 Strategy. Both line 2, Promoting a modernising transformation of the Valencian productive structure, and line 5, Promoting the creation of sustainable employment and the social economy, contain objectives related to the CE, such as: O2.2: Development of new activities aimed at a sustainable and circular economy, O5. 1: Boosting the generation of sustainable, quality employment, O5.2: Implementing social responsibility policies and actions in the Valencian economy, O5.3: Promoting the economy of the common good, O5.4: Increasing the number and size of social economy organisations. Line 1 (Developing the innovative capacity of the productive fabric by strengthening the Valencian innovation system), focuses on developing initiatives related to innovation as a key element for promoting economic growth, trying to take advantage of the resources available in universities, technology centres and knowledge-intensive companies. Within this framework, the Valencian Innovation Agency was created in 2017 to coordinate the Innovation Strategy of the Valencian Community. Along the same lines, the execution of the Intelligent Specialisation Strategy for the VC, RIS3-CV (Generalitat Valenciana, 2016), is specifically included as one of its objectives.

• Intelligent Specialization Strategy of the Valencian Community, RIS3-CV, constitutes the strategic agenda to contribute to the transformation of the Valencian production model from research and innovation, for the 2014-2020 programming period. Based on the specific context of the Valencian economy, the result of a SWOT analysis, a strategic framework is built, which is expressed in a vision, a mission and some values. This framework culminates in the prioritisation matrix which includes the main options for regional development based on research and innovation. The matrix integrates the transversal axis of sustainability, which is essential to promote a low-carbon economy, in line with European policies. It is subsequently specified in objectives, which will frame the expected results and indicators for their monitoring. In the specific case of the CE in the built environment, Axis 2 is especially noteworthy. Innovative Product - 2.2 Habitat: housing and its environment, This axis includes the manufacture of consumer goods linked to the habitat and its surroundings, such as ceramic and natural stone coatings and materials for the home, lighting, furniture, home textiles, architecture, home automation, urban environment, in which its Growth and competitiveness necessarily pass through the generation of innovations focused on the product. The environment of HABITAT stands out for the demand for the development of new materials and advanced, sustainable products and with new applications of added value, together with the need for collaborative processes in production and distribution

systems, mainly international, for which the use of technologies ICT and logistics, along with materials and environmental appear as relevant.

• Acord del Botànic, June, 2019, axis 1 includes the objective of promoting a Law for the Circular Economy, in line with the principles of the European Union (Accord del Botànic 2019).

Other regulations that contribute to the CE in more specific aspects are the Strategy of the Industrial Policy of the Valencian Community 2020 (EPI-2020) and Strategic Plan of the Valencian industry 2018-2023 (PEIV), the Energy Savings and Efficiency Plan, Promotion of Renewable Energies and Self-consumption in buildings, infrastructures and equipment of the public sector of the Generalitat (PAEEG), the Valencian Ecological Production Plan, the Valencian Strategy for Climate Change and Energy 2030, the Rural Development Plan 2014-2020, the Territorial Action Plan for the Green Infrastructure of the Coast of the Valencian Community (PATIVEL), and the revision and update of the Comprehensive Waste Plan of the Valencian Community (PIRCVA), covering the period 2019-2022.

2.3. Relevant actors or entities for CE in the region

Actors or entities, within the public administration, relevant to transform the Valencian economic system towards a more circular model include the Valencian Agency for Innovation (AVI) and Valencian Institute of Business Competitiveness (IVACE).

• The Valencian Agency for Innovation (from now on AVI) is the meeting place for all the agents of the Valencian Innovation System (SVI): research centres, technological institutes, financial entities, Public Administrations and businesses. Its mission is to improve the region's productive model through knowledge and innovation, to achieve intelligent, sustainable and socially cohesive economic growth.

The AVI oversees designing and coordinating the innovation strategy of the Comunitat Valenciana and promoting the strengthening and development of the Valencian Innovation System as a whole. The participation of the agents of the Valencian Innovation System (SVI) is directly articulated in its organs: Board of Directors, Valencian Innovation Council (CVI), Strategic Innovation Committee (CEI) and Specialized Strategic Innovation Committees (CEIE). The latter are the specialised working groups created in each of the priority areas of innovation identified: *Sustainable habitat, Emergencies, Health, Agri-food, Enabling technologies for the new economy, Automotive industry and sustainable mobility, and Circular economy.*

The work-teams of these committees, identify the main challenges in each area, establish the short-medium term priorities, propose innovative solutions and define the actions to be implemented in the region's business environment, suggesting tools and incentives to maximize their impact.

The challenges prioritized by *Sustainable Habitat Committee,* which are related to the built environment and building sector are:

- Optimisation of the real behaviour of buildings and dwellings to improve their performance and maintenance, their interoperability and/or their adaptability,
- Implementation of more sustainable building materials and systems
- Nearly zero energy buildings
- Improved integration of the changing demands and needs of building and housing users.

The first and last challenges mentioned above, with their solutions and actions are connected to the business models, proposed in REDUCES, of Product life-extension, while de second and third challenges, are associated

to the business models of Renewability and Resource Efficiency and Recycling.
The Circular Economy Committee prioritized the following three challenges:

- Ecodesign
- More sustainable consumer goods
- Waste recovery and use of reclaimed water.

Challenges, connected to the business models of: Product life-extension, Renewability and Resource efficiency and recycling.
Additionally, the AVI has different instruments and lines of action to transform the productive system, among other provides grants through competitive calls, oriented to different objectives, in which the challenges and solutions proposed in the above mention committees are prioritized.

• The Valencian Institute of Business Competitiveness (IVACE) is a public body belonging to the Valencian Government, attached to the Ministry of Sustainable Economy, Productive Sectors, Commerce and Labour of the Valencian Government. It is the regional development agency in charge of promoting a new economic, sustainable and inclusive model in the Valencian Community, promoting the competitiveness of companies through R&&i, internationalization and entrepreneurship, promoting energy development sustainable and promoting infrastructures, industrial services and attracting investments.
The IVACE is organized around 4 areas: Innovation, Energy, Internationalization and Business Parks. Among its functions, it is especially worth mentioning: To manage aids and incentives aimed at the creation, modernisation and internationalisation of regional companies, to promote and assist companies in their activity and internationalisation, to facilitate companies financing, to promote research, development and innovation infrastructures, scientific and technological parks and institutes and business centres, to foster energy conservation and saving measures in all business sectors, and to promote sustainable mobility and rational use of energy.

2.4. Circular Economy projects in the Construction sector and other related sectors (ceramics or furniture sector) in the Comunitat Valenciana

Additionally, in the Annex of the report "Regional Circular Economy Status Quo, Valencia, Spain 2020", a list of projects, participated by regional stakeholders, in which Circular Economy principles are included has been compiled. These are projects at different scales (international, national, regional) and from different programs (H2020, Interreg, IVACE, etc ...), in which partners of the Valencia Region have participated (technology centers, research institutions, companies, business networks etc. ..), developed during the last 10 years, within the Construction sector or other related sectors (ceramic, furniture, etc ..). The analysis performed tried to stablish the links with the main themes for CE business models that have been identified in REDUCES project.: 1) product life extension 2) renewability 3) product as a service 4) sharing platforms 5) resource efficiency and recycling
The main results of this analysis are summarized below.
Of the 28 projects analyzed, 16 (57%) of them are currently underway. There are 34 different stakeholders (technology institutes and centers, research institutions, businesses organisations, etc.) participating, most of them involved in several of the projects.

Project	Program	Dates	Business models linked to*				
			1	2	3	4	5
DRIVE 0	H2020	2019- 2023	X				
Life Future	LIFE	2015-2018		X			X
WoodRuB	LIFE	2010-13					X
Planet-Design	MED	2009-12					
SIMBYNET	IVACE	2020-21					X
PLACE	IVACE	2020-21	X	X			X
INSYLAY 3 19-20	IVACE	2019-20					X
CIRCULARIZA	IVACE	2019-20	X	X	X	X	X
NIMBLE	H2020	2016-20					X
TRIS	Interreg Europe	2016-21					X
SPS-CIRC	IVACE	2018-19	X	X	X	X	X
URBANREC	H2020	2016-19					X
PLASTICIRCLE	H2020	2017-21					X
SHAREBOX	H2020	2015-19					X
SIMVAL	AVI (2018), IVACE (2019)	2018-19					X
C-SERVEES	H2020	2018-2022	X	X	X	X	X
ECONOMÍA CIRCULAR (Año 1, 2 y 3)	IVACE	2017-2019	X				X
SurplusMall	Climate-KIC	2017-18					X
CONDEREFF	Interreg Europe	2018-2023					X
CIRCULARCARBÓN	IVACE	2020-2021					X
PUCO2	IVACE	2020-2021					X
CIRCULAR INDUSTRY CV	IVACE	2020-2021					X
CEROH! STRATEGIES	IVACE	2018-2020					X
COBAT	IVACE	2019-2020					X
CIRCLE	IVACE	2018-2019					X
ECO&TECNO CARPET	IVACE	2018-2019	X	X			X
RECURPIEL	IVACE	2018-2019					X
BIO3	IVACE	2019-2020					X

*Themes of CE Business models: 1- Product life-extension, 2- Renewability, 3-Product as a service, 4-Sharing platforms, 5-Resource efficiency & recycling.

Table 1. CE projects participated by regional stakeholders. Own development.

3. THE POLICY INSTRUMENT ADRESSED IN REDUCES PROJECT AND OTHER RELATED POLICIES

As stated before, the main objective of REDUCES project is to adapt and update regional political instruments in order to incorporate criteria that favour the creation and adoption, by the companies, of environmentally sustainable business models based on the principles of circular economy. The political instrument of application in the Valencian Community is Decree 151/2009 (Conselleria Medio Ambiente, Agua, Urbanismo y Vivienda, 2009) which approves the basic design and quality requirements in housing and accommodation buildings.

3.1. Policy instrument: DC09 Regulations on Habitability in Housing

This Order approves the design and quality conditions that must be met by new buildings intended for housing, those that contain adapted housing, accommodation buildings or those that are subjected to refurbishment in any of these cases.
The Decree regulates functional aspects of the dwellings and the buildings: such as the minimum surfaces of the spaces, the relationship between the different spaces or enclosures, the conditions that the circulation spaces (horizontal and vertical) must fulfill within the dwellings and buildings, minimum and / or mandatory equipment that a dwelling and building must have, it also regulates certain aspects of habitability such as lighting and ventilation conditions, the specific conditions that an adapted dwelling must meet (for people with functional diversity/disability) or accommodation buildings (consisting of spaces for private use, in the form of accommodation units, and common services for collective use), as well as the conditions to be met in the event of a refurbishment of the dwellings and / or buildings in any of the above cases.

This regulation is the responsibility of the Regional Ministry with housing competencies, currently the Second Vice Presidency and Ministry of Housing and Bioclimatic Architecture. This Ministry already has a series of documents, regulations and initiatives that converge with the objectives and interests foreseen in the REDUCES project, so it is essential to keep them in mind in order to join efforts and synergies.

3.2. Other related policies and regulations

We consider the White paper on housing – Comunitat Valenciana (Conselleria de Vivienda Obras Públicas y Vertebración del Territorio, 2018) and the strategic plan Habitat 2030 (Vicepresidencia segunda y Consellería de Vivienda y Arquitectura Bioclimática, 2020) especially relevant due to their direct relationship with the political instrument of application in the Valencian Community.
The White paper on housing establishes the guidelines for the future housing policy of the Generalitat Valenciana. It is a long-term structural and strategic plan that includes a wide range of recommendations to address the housing problem. It has been conceived to foster social cohesion, housing justice and the sustainable occupation of the territory. It is structured with an analysis and diagnosis section, a strategic framework and a final proposal block with lines of action. The proposed lines of action are framed in 9 strategic axes (guaranteeing access to housing, promoting rental housing, mobilizing empty housing, promoting a social model of rehabilitation, promoting an inclusive environment, establishing a CE model in housing, orienting housing to the challenges of the future, improving the quality of housing and adapting management in the field of housing), among these, two should be highlighted:

- Establish a CE model in housing
- Orient housing to the challenges of the future,

in which actions linked to CE and the promotion of innovation through research and experimentation on new housing models are defined.

However, we can find underlying CE principles in most of the proposed axes and lines of action, such as mobilizing empty homes or promoting a social model of rehabilitation, strategies aligned with the principles of maintaining and prolonging useful life of an asset, or reuse before producing a new good.

"Habitat 2030" Strategic Plan is an operational instrument to guarantee the social function of housing in the Valencian Community and provide a quality public service that is comparable to European benchmarks. This is a ten-year plan in which the right to housing is understood as inseparable from the right to the city, therefore it postulates the right to a habitat. In addition, it is a participatory plan, starting from a base document an ambitious participation process started in collaboration with all the agents involved. Of the challenges posed, the Green Transition should be especially highlighted, in which the following objectives are proposed through the Green Transition and Circularity Pact on Habitat:

- Reduce the consumption of primary energy in conditions of comfort in the social housing stock.
- Promote final energy consumption from renewable energy sources, through the implementation of self-consumption systems.
- Promote the renaturalisation of urban spaces and their connection with natural environments.
- Promote refurbishment and renovation against new construction, urban regeneration and redensification (sustainable habitat).
- Adapt CE criteria to the real estate sector through innovative practices.
- Promotion of green employment through education and training.

It is essential to review the role of the Observatory of Habitat and Urban Segregation (Vicepresidencia segunda y Consellería de Vivienda y Arquitectura Bioclimática s.f.),hereinafter OHSU, established in February 2019. Its creation, provided for in Law 2/2017, of February 3, of the Generalitat by the Social Function of the Housing in the Valencian Community, serves the purpose of knowing, among other aspects, the situation in quantitative and qualitative terms of housing in general and public housing in particular, the territorial distribution of housing and the indicators determined in the public housing and urban regeneration policies of the Generalitat, dependent on the Ministry responsible for housing. Decree 9/2019, of February 1, creating the Habitat and Urban Segregation Observatory of the Valencian Community, establishes its main functions, among others that of advising on planning regulatory action in the area of housing and the city , and articulates its structure and composition, as well as the members (among them the IVE) that make up the plenary session of the Observatory (maximum organ of decision, control, planning, follow-up and supervision of the OHSU activity).

Finally, the Green Guide on environmental measures for public procurement in the building sector (Vicepresidencia Segunda y Conselleria de Vivienda y Arquitectura Bioclimática 2020) was draft and published recently. The environmental measures included in the guide are based on the ecological public procurement criteria developed by the European Commission and the Ecological Public Procurement Plan of the General State Administration, to which additional criteria are added. Thus, a first edition of the guide includes passive design measures for energy saving, active design measures for energy saving and water saving, as well as measures related to products, waste management and environmental certifications. However, the guide is intended to be a repository of environmental measures that are continuously updated, with the conviction that promoting the consideration

of sustainability criteria in public procurement, in addition to serving to obtain more environmentally friendly buildings, has a high exemplary value, while it can be a relevant element of influence in the market, encouraging the private sector towards new forms of production and more responsible consumption.

CONCLUSION

In general, we can consider that we are in an incipient state with regard to the implementation of a CE model in the Valencia region. Public administrations are making efforts to start introducing CE principles in the different policies (plans, strategies, or regulations), however a general, ambitious and joint action is lacking, which combines efforts from the different departments and allows the establishment of the proper priorities, while facilitating the creation of synergies, and thus maximizing results. We can also see how public administrations are working hard to improve green procurement and tendering processes, incorporating environmental and innovative criteria, in order to encourage the private sector to move towards more circular production and consumption models.

Otherwise there are many initiatives aimed at implementing CE criteria in practically all strategic economic sectors in the Valencian Community. In particular, in the sector of the built environment, we have seen that there are quite a lot of initiatives dealing with resource efficiency and recycling, and much less dealing with topics like the product life-extension or the use of renewable materials and resources. There are very few initiatives that address the circular economy as a whole, and practically none that focus on aspects such as promoting maximizing the use of products and resources, through sharing platforms, or promoting the change towards consumption models based on services. and not in buying goods.

The definition of a general framework, which coordinates and directs the efforts being made in the region from different private and public sectors, will allow also the identification of new niches or potential sectors to be developed in the Valencian Community, in the process of diversifying the economy.

As far as initiatives at municipal level are concerned, the integration of aspects related to the CE is even more scarce. It is worth highlighting the Declaration of Seville, an initiative launched by the Spanish Federation of Municipalities and Provinces, in which the signatory municipalities undertake to promote and encourage the CE in their territories. There are currently more than 230 municipalities throughout Spain, 24 of which are in the Valencian Community. Within this framework, the Local Strategy for the Circular Economy has been developed. This is a set of actions proposed as practical recommendations, aimed at Local Bodies, to facilitate the adoption and implementation of the principles of the CE in their areas of action, within their capacities and competences.

Finally, as far as citizenship and social awareness is concerned, it is still far from incorporating the criteria of the CE into their consumption habits. An effort must be made to communicate with citizens and convince them of the need to change mainly their way of consuming.

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PAPER #7.18

NEXUS BETWEEN SUSTAINABLE BUILDINGS AND HUMAN HEALTH: A NEUROSCIENCE APPROACH

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ABSTRACT

The paper presents a preliminary result of a research project aiming to develop, test, and validate a data-driven approach using virtual reality (VR) and neurotechnology (EEG, etc.) for assessing the effect of sustainable building design features on occupants' emotional and cognitive functions - proxies for mental health and wellbeing. The project will provide technology-enabled, repeatable measures for quantifying the "soft" benefits of sustainable building design features, thus providing an economically viable and repeatable assessment model, pre-build.
Case studies have consistently demonstrated the potential for sustainable buildings to increase "soft" benefits of improved wellbeing and productivity via self-reported assessments. However, selfassessments are unreliable measures, as they are marred by participant biases and confounding variables. Current building impact evaluation tools that measure occupants' wellbeing and cognitive functions are user response surveys such as the health and work performance questionnaire (HPQ) and various building wellness surveys. Surveys have two main weaknesses. First, as there are many variables affecting an occupant's response to the built environment, such as familiarity with the space, time of day when the survey is conducted, and the ambient condition of the environment (temperature, smell, noise, etc.), confounding, non-design factors can be hard to disentangle, to control for, and interpret. Second, the survey response is an indirect measure of the environment, reliant on the user's opinions (perceived likes and dislikes) and cannot provide objective data about particular environments and features. What is needed are consistent, reliable, and physiologically based measures of mental health effects that capture human response to discrete architectural elements – especially in the prebuild, design phase.
This experimental research project offers a methodology to fill this gap, capturing real-time physiological response to user experience of sustainable built environments. This research provides a method for quantifying occupant wellbeing, thereby offering the potential to leverage change in mainstream design practices.

KEYWORDS

Sustainable architecture; virtual reality; neuroscience; event-related potential; design decision-making.

INTRODUCTION

Given that Americans spend about 87% of their time inside buildings,[1] the quality and design of buildings are important contributors to human wellbeing. The trend in "sustainable building" (SB) models, catalyzed by the founding of the Green Building Council in 1993, offers a unique opportunity to leverage not just beneficial environmental impacts but also occupancy wellbeing effects in the design and construction of new buildings. Case studies have consistently demonstrated the

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potential for sustainable buildings to increase "soft" benefits of improved wellbeing and productivity via self-reported assessments. However, self-assessments are unreliable measures, as they are marred by participant biases and confounding variables. Current building impact evaluation tools that measure occupants' wellbeing and cognitive functions are user response surveys such as the Health and Work Performance questionnaire (HPQ) and various building wellness surveys. Surveys have two main weaknesses. First, multiple variables affect an occupant's response to the built environment, such as familiarity with the space, time of day when the survey is conducted, and the ambient condition of the environment (temperature, smell, noise, etc.); these confounding, non-design factors can be hard to disentangle, control for, and interpret. Second, the survey response is an indirect measure of the environment, reliant on the user's opinions (perceived likes and dislikes) and cannot provide objective data about particular environments and features. What is needed are consistent, reliable, and physiologically based measures of mental health effects that capture human responses to discrete architectural elements – especially in the pre-build, design phase. In order to fill this
gap through the procurement of reliable, objective measurements, an innovative, data driven approach is needed. Conventional buildings (CB) – those that meet basic building and energy codes but do not prioritize sustainable design elements - provide an excellent control from which to expand research on the co-benefits of SBs to improve occupant mental health and wellbeing. Moreover, buildings are usually one-off projects. Anecdotal evidence and limited case studies are inadequate to leverage changes in mainstream design practices, in which decisions are primarily influenced by building economics and regulations. For systemic change to occur, occupant wellbeing, especially cognitive benefits, must be added into the SB base rating system. The objective of this project is to leverage VR and EEG technology to develop, test, and validate a data-driven neuroscience approach to assess the effect of sustainable built environments on occupants' emotional and cognitive functioning. Cognitive performance will be tested through both individual and group-based assessments across gender differences.

1. THEORETICAL FRAMEWORK AND SIGNIFICANCE

1.1. Theory and Background

Our methodological framework is based on the marriage of an event-related potential (ERP) neuroscience approach and cognitive architecture (CA) theory (see Figure 1). The use of EEG in built environment, cognitive science research, is growing rapidly due to its portability and flexibility in allowing test subjects to move around while immersed in a real environment. EEG is used to measure ERPs that demonstrate
brain activity directly related to a specific event (stimulus), such as the presentation of an image, word, or special visual environment. Unlike behavior studies used in the cognitive psychology approach, ERPs provide a continuous measurement of processing between a stimulus and response, very appropriate for studying a built environment design. Due to the complexity and multi-faceted
attributes of design, ERP continuous measurements have the potential to objectively elucidate what events (stimuli) are affected
by particular design feature manipulations. ERP measurement is typically more affordable than fMRI, and the long tradition of ERP/EEG research provides a solid basis

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for application to design research.[2] CA was proposed by Herbert Simon, a pioneer in artificial intelligence, with the goal of creating programs that could solve problems across different domains, develop insights, adapt to new situations, and evaluate themselves.[3] It was initially employed in the fields of artificial intelligence and computational cognitive science.[4] CA refers to both a theory and method for regarding human cognition from a computational perspective. The theory is aligned with contemporary cognitive neuroscience, which generally considers the brain as having a modular organization, where individual modules interact to produce certain mental activities and emotions.[5] In 1973, Allen Newell called for the development of multiple, diverse CA styles instead of focusing on specific issues of understanding the human mind.[6] CA is considered by Langley (2017) as valuable in supporting research on cognitive science due to the complexity of humans' cognitive functions.[7] It has been used intensively in studying instructional design[8] to encourage learners to engage in conscious cognitive processing directly or indirectly relevant to the constructed curriculum.[8-9] CA has since been applied to research on 3D objects' perception,[10] spatial navigation,[10-11] and architectural design/design thinking.[12]

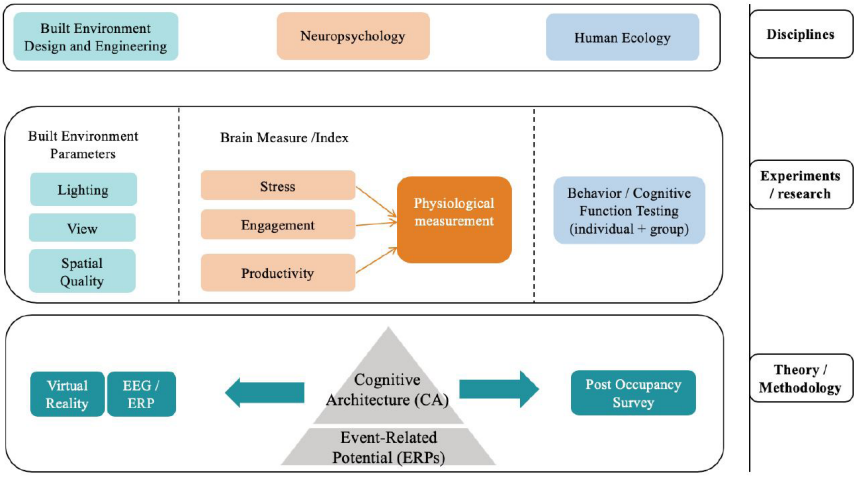

Figure 1. Research methodology based on ERP and CA combining VR and EEG.

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In this project, we rely on CA capabilities that can acquire and understand perception since cognition does not occur in isolation; an intelligent agent (person) exists in the context of a certain external environment that the agent (person) must sense, perceive, and interpret. If we can understand what perceptual knowledge is invoked by which sensors/stimuli in the environment, where and when to focus them, and what inferences are plausible, then a CA based model can be built to acquire and improve knowledge by learning from previous perceptual experience.[7]

1.2. Built Environment Parameters

In this study, we will use three sustainable built environment parameters as the design basis for testing our hypotheses: lighting, view and spatial quality. All three characteristics are required design elements in the most commonly accepted and utilized "Healthy Building" design guidelines and rating systems,
namely WELL and Living Building Challenge.
Lighting (LG) Indoor lighting quality and quantity have physical and psychological effects (visual and nonvisual effects) on building occupants. Physical impacts include visual strain, blurred vision and irritated eyes induced by insufficient light levels (illuminance), glare, and/or high contrast between indoor and outdoor light levels.[13] Studies have related visual discomfort and a decrease in reading accuracy[14-15] to the quality of lighting fixtures including the flickering of lights. People with special health conditions including children with autism have been given recommendations to avoid flickering lights or low-quality fixtures that emit sounds.[16] The primary characteristics of lighting shown to influence short term, psychological moods include light levels, light color, spectral distribution, and temporal patterns.[17-19] Long-term psychological and physiological effects from non-visual aspects of light emerged from circadian rhythms research.[20] Circadian rhythm controls natural sleep and awake patterns and requires external stimuli including the light-dark cycle.[21] Building artificial lighting systems and access to daylight both have large impacts on building occupants' circadian systems for two reasons. First, as the circadian system fundamentally underpins human physiology, extensive ripple effects are likely when disrupted. Second, as people spend the majority of their time indoors, it is highly likely that circadian systems are affected by indoor lighting conditions. Studies have suggested that some interior light levels are insufficient to appropriately regulate the circadian clock. Under such conditions, "biological darkness" and attendant effects predominate including fatigue and excessive sleepiness.[19] Researchers have postulated that insomnia and other sleep disorders might be treated by exposure to light at right time to reset the circadian rhythm.[22] Lighting can be both the

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cause of and treatment for various health conditions.

View (VI): Views are directly related to the concept of biophilia design, coined in 1984 by Edward. O. Wilson to refer to the basic human need to affiliate with life and lifelike processes.[23] Per the attention restoration theory proposed by pioneering environmental psychologists Rachel and Stephen Kaplan,[24] nature has the ability to restore people's attention and release stress.[25] They demonstrated that people tend to prefer natural environments over built environments, and built environments with water, trees, and other vegetation more than built environments without such features.[26] Researchers continue to explore how building elements that represent, mimic, or provide access to nature environments impact restorative functions and wellbeing. Building views can be categorized in two types. The first is a direct visual connection to the outdoor natural environment.[27] An early study conducted by Roger Ulrich at Pennsylvania hospitals found the surgical patients assigned to rooms with windows looking out on a natural scene had shorter postoperative hospital stays.[28] The same restorative effects have been shown in other settings, including the home,[29] school[30] and office.[31] The second type is the visual connection to indoor natural elements, such as a green wall or water feature. In 2016, a research team studied classrooms in two elementary schools for 4 months. The results showed that children scored better on a test for selective attention in classrooms with green walls; there was no difference in the children's self-report on wellbeing.[32] Therefore, a view – either to nature or green elements within buildings - is an excellent and flexible design parameter for this research.

Spatial Quality (SP): Spatial quality and its impact on productivity and cognitive functioning belongs within the field of environmental psychology. Few studies have explored this area as spatial characteristics are difficult to define and measure. Some studies have investigated the impact of a building interior's layout (floor plan) with varied results. Early studies by Hedge (1982)[33] and Sundstrom et al. (1980)[34] found worker dissatisfaction correlated to increased spatial openness. Brennan et al (2002) conducted a longitudinal field study to examine workers' satisfaction and productivity before and after relocation from traditional (enclosed) offices to open offices. They found that workers were less satisfied in terms of increased disturbances and decreased privacy following the move; the dissatisfaction persisted after an adjustment period.[35] Other research showed layout-scale spatial measures are better predicators of how well occupants rate the capacity of a work environment to support collaboration, in comparison with workstation-scale measures.[36] A U.S national survey study in 2003 demonstrated that attractive physical school environments

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(middle and high schools) were associated with fewer problematic and risky student behaviors, whereas the less attractive physical environments were not.[37] However, this study only differentiated attractiveness from cleanness, and did not define attractiveness. Subsequent researchers have postulated that a school's multi-dimensional spatial qualities (physical environment design) are imbued with different meanings and messages for students. An attractive, clean and orderly space comprises a high spatial quality and conveys to students the message that this is a place where
learning and growth are both valued and supported [Kumar et al 2003]. At the neighborhood scale, a Netherlands study showed that neighborhood attractiveness positively added to residents' reports on life satisfaction and wellbeing.[38] This research suggests that a neighborhood's attractiveness may be associated to social status, and therefore may contribute to social safety – a wellbeing benefit.[39] The same Dutch study showed that other spatially-mediated improvements such as traffic convenience and facility accessibility did not significantly affect life satisfaction. These findings indicate the need for a deeper understanding of the relationship between spatial quality and occupant cognitive function, performance and productivity.

2. EXPERIMENT

In 2018 and 2019, the research team conducted pilot VR environment tests using the three SB parameters (lighting, view, spatial quality) with 36 participants. Two different models of the same, three-dimensional virtual building were built by using Autodesk Revit software to construct sustainable (SB) and nonsustainable
(CB) designs. These were then rendered, using Unreal Software, into two "real time" VR buildings / designs for use in the experiment. The simulated environment consisted of a two story building composed of four different spaces: (1) public: entry lobby / open staircase, (2) semi-public: collaboration space, conference room, open kitchen, (3) semi-private: fitness center, conference room in open
office, (4) private: individual working space. When the participants were in the VR environment, a "preset walk-through" allowed them to get comfortable with the equipment and the experience. Figure 2 illustrates the floor plan with walk-through route, and the

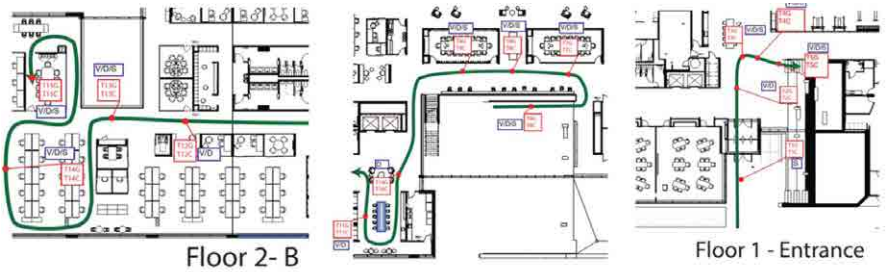

Figure 2. Walk-through routine in virtual environment.

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Figure 3. SB and CD VR.

#	Space	SB VR			CB		
		VI	LG	SP	VI	LG	SP
1	Entry lobby	Y	Y	High	N	N	Low
	Open staircase	Y	Y	High	-	-	-
	Fitness center	Y	Y	High	N	N	Low
2	Collaboration space	Y	Y	High	N	N	Low
	Conference room	Y	Y	High	N	N	Low
	Open kitchen	Y	Y	High	-	-	-
3	Conference rm in open office	Y	Y	High	N	N	Low
		Y	Y	High	N	N	Low
4	Open office space	Y	Y	High	N	N	Low
	individual working space	Y	Y	High	N	N	Low

Table 1. SB-VR and CB-VR parameters (four different subtypes of space).

location where the participants stopped and looked around in the VR environment. These stop locations were preset. They first entered through the building lobby, then walked up to the secondfloor open office area through a large open staircase. During the two-floor tour, they encountered the fitness center, open kitchen, collaboration space, and conference rooms. The differences in the 4 space types between the SB VR environment and control CB VR environment are described in Table 1 and illustrated in Figure 3.

3. PRELIMINARY RESULTS

3.1. Experiment Procedure

A three-step tasking method was developed for measuring experiences of both buildings, employing video, still images, and a guided VR tour. 45 still images, a 5-minute video, and a guided VR tour were created for SB and CB respectively; test subjects spend 25 minutes in each building. With sensor placements, task practice, and acclimation to the VR, one subject testing took about two hours.

3.2. Preliminary Data: Neurophysiological Measures and Cognitive Tasks

In this section we introduce the time-frequency (TF) signal processing methods central to the proposed work. These are introduced in the context of two of the tasks (gambling feedback and go/no-go), representing the validation of the proposed methods and tasks. Preliminary data from our application of these measures to data from the virtual environments will be presented further below.

3.3. TF measures of theta and delta: indexing salience and complex elaborative processing.

Our preliminary work has shown that TF approaches separate overlapping processes during conventional ERP components. We have developed a TF approach[40] that differentiates medial-frontal (MF) theta (3-7 Hz) and centro-parietal delta (0-3 Hz) contributions to ERP components such as the P3[41-42], feedback negativity (FN), error-related negativity (ERN)[37-43], and the No-go.[44] shows separation of theta and delta frequency during the FN[45-47] gambling task and Go/No-go N2.[48] We have assessed the sensitivity of separable theta and delta measures to mental health outcome measures, where we found that theta during the ERN [43]and delta during the FN[42] were sensitive to disinhibitory behavior problems. *This work indicates that the neurodynamics of many common ERP measures can be understood as a mixture of separate processes occurring simultaneously in theta and delta frequency ranges that are obscured in the unfiltered signal. These measures are sensitive to cognitive and affective processes relevant to mental health and task performance.*

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3.4. TF Interchannel Phase Synchrony (ICPS): indexing Functional Connectivity.

We have validated a new measure of functional connectivity for EEG neuroimaging data based on TF interchannel phase-synchrony (ICPS),[49] and have demonstrated that it is sensitive to medial-frontal to lateral PFC functional integration underlying cognitive control processes associated with the error-related negativity (ERN) [50-55] as well as the No-go N2[55] and FN [46,57]. An example of No-go N2 and FN bivariate ICPS (with FCz as a seed-reference, cf. ACC) is given in Figure 5. Here correspondence between these measures in the theta range is presented, with topographical maps displaying significance (white indicates p < .01). For ICPS, significant phase-synchrony with lateral-frontal, motor, and occipital areas are apparent. We recently tested the sensitivity of the ICPS measure to INT-relevant worry indexed by the Penn State Worry Questionnaire (PSWQ) during the ERN in a sample of undergraduate students (N=77). Using path analyses, we found that ERN theta amplitude was positively related to PSWQ (r = .26, p < .05), supporting the view that worry represents overactive salience processing, while, ERN theta ICPS between medial and lateral PFC regions was negatively related to PSWQ (r = -.31, p < .01), supporting the view that control processing was simultaneously diminished for worriers. Importantly, analyses confirmed that these relationships with PSWQ were independent, separable, processes. Finally, the path analysis supported the inference that worry indirectly influences post-error behavior via ICPS (accuracy and RT), rather than amplitude. Specifically, worry is associated with faster post-error RT and lower post-error accuracy through its relationship with reduced TF-ICPS. The indirect path between the TF-amplitude and post-error behavior through TF-ICPS was significant (Sobel's t=2.43, p=.01) indicating that theta amplitude predicts behavior primarily through theta ICPS. *Together, this work indicates that our ICPS measure of functional connectivity appropriately indexes integration during the proposed tasks, and is sensitive to worry, a primary component of stress.*

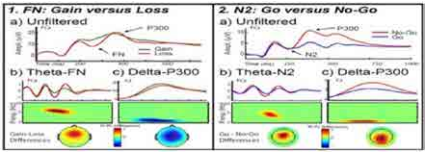

Figure 4. Theta/Delta separate processes

Figure 5. Measures of theta amplitude and ICPS

3.5. Preliminary Interpretation: CB vs. SB

We collected preliminary neurophysiological data based on CB and SB versions of the building detailed above (N=36) and applied the proposed TF amplitude and ICPS measures. For the initial data, we presented a movie from a walkthrough of the building, to record continuous EEG, and still pictures taken from the movie, to record ERP data. Results are presented from the still pictures and movie, based on the TF amplitude and ICPS approaches. TF Amplitude results for the SB and CB movies indicated significant increases in theta (presented in Figure 6), suggesting greater engagement in the SB environment, but not other bands. Still picture results are presented in Figure 7 and demonstrate robust differences between the SB and CB. The top row contains traditional time-domain measures. The waveform plot depicts overall activity in the first and second 500 ms blocks after picture presentation. The topomaps to the right depict the amplitude differences (color, where red indicates increases and blue decreases) and

the associated significance (where white indicates p < .01, and black indicates p > .10, uncorrected). Significantly greater activity in bilateral occipital regions, as well decreases in frontal regions, can be readily observed. The TF results decompose this activity, as well as index activity not observable in the time-domain. Next, the TF results indicate significant differences between SB and CB for delta (0-3 Hz), theta (3-7 Hz), and alpha (8-12 Hz) frequency bands. Delta effects in the early block (0-500 ms) primarily index the increases bilateral occipital activation observed in the time-domain, consistent with the fact that delta activity generally contains the largest amplitude and is thus more strongly reflected in time-domain measures. In the later block (500-1000 ms), delta shows significant centro-parietal decreases. Together, the early increases and later decreases are consistent with a strong early response to the SB pictures, dominated by visual simulation, which resolves more quickly than the CB in the later block. Next, theta activity in the early block shows increases in bilateral occipital activity for SB relative to CB, concomitant with occipital increases in delta, as well as centro-parietal increases. Lateral-frontal increases for SB pictures are also evident, consistent with engagement of control regions in lateral prefrontal regions. In the second block only the increases in centro-parietal areas are maintained. Finally, for alpha, a decrease in bilateral occipital areas is readily observed, consistent with greater engagement of the visual system, consistent with the increased activation observed in delta (parietal-occipital alpha indexes an inhibitory processes, such that decreases indicate increased activity in that area). We additionally assessed alpha asymmetry in the 500-1000 ms still image viewing task, where we predicted greater relative right-hemisphere activation, indicating greater approach tendency. Results provided some support for this inference, with greater relative right-hemisphere activation for overall alpha at a trend level (8-13 Hz; z = 1.74. p = .082, r = .145), as well as upper alpha sub-band (11-13 Hz; z = 2.11. p = .034, r = .176). *Preliminary results indicate ERP techniques represent a robust index of processing difference in the SB versus CB built environment, providing novel information about mechanisms underlying those differences to explore herein.*

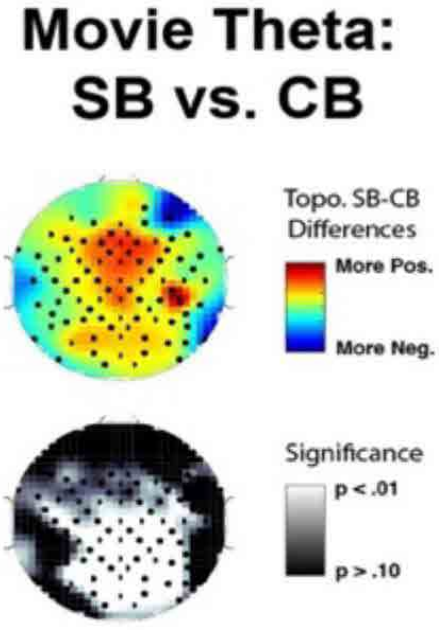

Figure 6. Movie amplitude

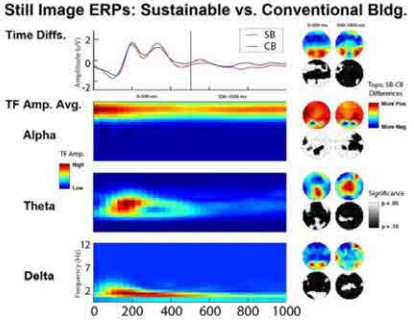

Figure 7. Still image amplitude.

Functional connectivity was indexed by ICPS at beta 2 (20-30 Hz), beta 1 (13-20 Hz), as well as alpha, theta, and delta as assessed for amplitude. Significant ($p < .05$, uncorrected) bivariate ICPS measures were computed from 8 seed regions (5 in frontal regions, and 3 in occipital regions), for both the movies and image event-related data. These results are presented in Figure 8. We assessed these seed regions, beyond just a priori connectivity between one medial-frontal seed and 2 lateral sites (as in our preliminary work above), to have a more broad assessment of engagement of frontal areas, anticipated increases in occipital processing related to engagement with the stimuli, as well as long-range connectivity between these regions. Further, because there is little work in this area, there were fewer published findings to guide our hypotheses. First, for the movies, results for delta, theta, and alpha demonstrated parallels to the still image amplitude effects. That is, both delta and theta showed increases, while alpha demonstrated decreases. This is also consistent with the increase in theta observed in the movie amplitude data. These results suggest that the amplitude effects in the still images may index functional integration occurring during watching the continuous movie of the SB relative to the CB environments. Results in higher frequency beta range were in opposite directions, with increases for SB in beta 2 and decreases for beta 1, relative to CB. This is consistent with emerging work suggesting beta 2 can index reward processing[58-61] (increased for SB in these results) and increases in beta 1 can be related to loss processing[62-65] (increased for CB in these results). Results for the still images were more complicated and difficult to interpret, although the number of significant results suggest this approach was sensitive to differential processing, both within and between frontal and occipital regions, associated with SB and CB during still image processing. While these findings must be taken tentatively, due to the small N, and associated lack of statistical power, overall effects suggest the feasibility of detecting functional connectivity associated with viewing SB relative to SB environments. *Preliminary results demonstrate sensitivity to differences in functional connectivity within and between frontal and occipital areas central to how people perceive and engage with the built environment.*

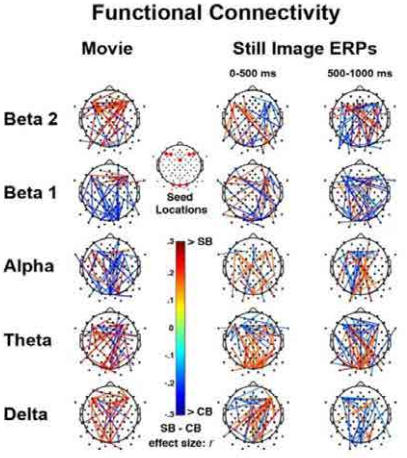

Figure 8. Functional connectivity: significant bivariate ICPS measures (p<.05, uncorrected), using 5 frontal and 3 occipital regions as seed references

CONCLUSION

The mechanisms underpinning how the built environment affects mental health and cognitive functioning are largely unexplored due to the complexity of built environment, and the difficulty in quantifying psychological responses. A neuroscientific approach has the capacity to bridge this gap. This project developed and tested a neuroimaging experimental protocol, combined with VR technology, as a quantitative, repeatable framework that can be readily adopted by researchers in a wide variety of social science and design fields. Our approach provides a unique new utility to three (separately) validated
methodologies by combining (1) EEG with an emerging design technology, (2) VR to overcome the dual problems of confounding variables and participant bias during the measurement of elicited user responses to SB features in real time. VR allows three-dimensional, systematic design manipulations that are prohibitively expensive in real environments and EEG offers validated inferences regarding cognitive and affective processing. Our approach combines (3) continuous EEG approaches with neuroimaging to understand occupants' emotional responses. The in-depth understanding of mechanisms driving occupant behavioral differences between SB and CB virtual environments will provide designers and engineers with evidence to change, modify and propose new design solutions – pre-build. In the future, the integration of neuroscientific validated evidence in the design process may lead to a novel and impactful design framework for building industry adoption.

ACKNOWLEDGEMENTS

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PAPER #7.19

HOW MUCH DOES ZERO ENERGY BUILDING COST?

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ABSTRACT

Developers, building owners, and design teams often point to initial capital costs as the
primary obstacle hindering the uptake of net-zero buildings. In-depth research and an understanding of whether net-zero buildings cost more to design and construct are still scattered and non-systemic. Accordingly, this study provides the first comprehensive investigation into actual net-zero building construction costs in the United States, based on qualitative and quantitative research. The aims of this research are to: (1) provide a comprehensive survey of the existing body of literature to aggregate the findings and identify the consensus and pattern, (2) compare the results and analyze the evidence with a focus on quantitative studies, and (3) conduct a quantitative comparative analysis of twelve built zero energy buildings (ZEB) in order to understand whether there is enough evidence of cost differences between ZEB, conventional building (CB) and green building (GB). Statistical tests were performed, with the results showing no significant differences between actual ZEB costs and modeled CB costs. Further details investigated the cost difference between actual ZEB and modeled GB. The findings of this research provide initial detailed insights into net-zero building costs in the United States, which may benefit the promotion of ZEB practices.

KEYWORDS

Zero energy building; conventional building; construction cost; modeled cost.

INTRODUCTION

The building industry contributes significantly to global CO2 emissions as well as energy consumption. Global energy consumption is assumed to increase by 33% from 2010 to 2030 (Kim et al. 2014, Abdelaziz et al. 2011). The United Nations' Sustainable Buildings and Construction Programme published a report suggesting that building and construction sectors account for 40% of global energy use and 30% of energy-related GHG emissions. During 2016, the United States' building sector consumed 40% of primary energy, based on the U.S. Energy Information Administration's statics (EIA 2018). Primary energy, deriving mainly from fossil fuels, while limited, is a major contributor to CO2 emissions, which are rising globally at a rate of more than 2% per year (Kelso 2012). Consequently, building green is one of the most effective strategies for overall energy consumption reduction and CO2 emissions reductions. However, design teams and building owners often cite the incremental initial costs of green (energy efficient) building as significant barriers to building high-performance buildings with the ultimate goal of achieving net-zero energy. So far, there has been a large amount of research focusing on the benefits of green building (GB) for users, clients, and society. (Liu et al.) estimated that GB could create incremental economic benefits by saving energy and improving the environment (Eichholtz et al. 2010) while (Eihholtz et al.) pointed out how the green label affects the market rents and values of commercial space, potentially leading to the high resale value of a building (Gabay et

al. 2014). However, only a small portfolio of studies have investigated the cost obstacles; regarding costs related particularly to net-zero building, there is very limited literature and reports to date. Meanwhile, despite the widespread perception of GB as expensive, the empirical studies and evidence needed to support this claim are inadequate, and the issue of a high green-cost premium is still debatable. It is foreseeable, though, that the cost concern could become one of the major obstacles to the promotion of zero energy building (ZEB). Therefore, a study of ZEB as a separate building type independent from GB will provide an opportunity to investigate the differences between ZEB and GB and the related cost indications.

1.RESEARCH METHODOLOGY

1.1. Cost definition

This research project focuses on the construction cost of ZEB since the perception of ZEB having expensive initial costs has been recognized as one of the critical obstacles to promoting net-zero energy building, and they are paid by the developer and investors. The construction costs of building include direct (hard) costs and indirect (soft) costs. Direct costs are related to cost materials, labor, construction equipment, energy, water, and other costs directly related to the activities of constructing a building. Indirect costs include costs related to the design, commission, permitting fee, documentation fees, and other legal fees (Mapp et al. 2011; Yudelson 2010, Khoshbakht et al. 2017). The post-construction costs comprise the building operation costs: energy, water, maintenance, repair, and management (Khoshbakht et al. 2017). Some researchers have indicated that general misunderstandings of construction costs for building green stems from individuals having no experience in the construction of green and energy-efficient buildings (Shrestha & Pushpala 2012). The perceptions about the higher costs of GB has hindered the advancement of more energy-efficient building and construction.

1.2. Cost estimation and analysis method

There are several methods and techniques used for cost estimation in the building industry, including the traditional statistical analysis of detailed itemized costs, factor analysis of construction activities (Kaming et al. 1997, Ben-Arieh & Qian 2003) time-dependent cost trend projection, index number cost estimation
(Ashworth & Perera 2015), expert systems estimation (Brook 2016),integrated analysis of multi-objectives (Pettang et al. 1997, Zhang et al. 1998, Hwang 2016). and BIM and ontology-based cost estimation (Lee et al. 2014). In the building industry, the traditional statistical analysis of detailed itemized costs is the wider used method due to its simplicity and availability of multiple itemized cost database. The other methods are presented and analyzed in research and academic settings, and their application in the field and actual projects are very limited (Valentini et al. 2017). Since the primary goal of this research is to analyze the actual net-zero building cost and understand the perceptions from the field, the first traditional cost estimation method was selected. Two commercially available itemized cost databases are selected and used. The cost analysis of sustainable building can be categorized into two groups: paired comparison and unpaired comparison. An unpaired building cost comparison is a statistical analysis method based on a comparison of actual or simulated costs of unpaired GBs and conventional buildings (Khoshbakht et al. 2017). A paired building cost comparison involves comparing the costs of two identical buildings for the cost of conventional upgrades versus green upgrades (Hwang 2016). In this research project, paired comparison is used to compare the

costs of simulated net-zero building, GB, and conventional building. Two construction cost databases were selected and compared: the 2017 National Building Cost Manual (NBCM) and RSMeans's Square Foot Costs Book (RSFCB).

1.3. Case studies selection

Three major programs in the United States have influenced the promotion of green building and net zero building practices, and they all have rating systems or tools to measure and quantify building performance. These three programs are (1) LEED, managed by the U.S Green Building Council, which is a private nonprofit organization; (2) the Energy Star Label, jointly managed by Department of energy (DOE) and Environment Protection Agency (EPA); and (3) the zero energy building certification organized by the International Living Future Institute (ILFI). All three are volunteer programs.The largest database of zero net energy (ZEB) building is the online database that was created, organized, and managed by the New Building Institute (NBI).[1] In May 2017, the ILFI and NBI announced a partnership to track and certify ZEB building to drive a broader market adoption. Therefore, in this research project, that database was selected, and education buildings were chosen as the study types. Altogether, there are thirty-nine new constructed education buildings and four renovated education buildings, which is the largest building type group in the current database. The projects have a square footage ranging from 1,528 ft^2 (141 m2) to 286,212 ft^2 (26,590 m^2) and an energy use intensity (EUI) of 50 $kwh/m^2/yr$ to of 432 kwh/m2/yr. The author then matched the addresses of the buildings included in the database with those in the LEED project database to acquire additional information, such as energy consumption reduction, water conservation, and recycled and reused materials. The match yielded twelve buildings for which the construction cost, area, energy efficiency, water efficiency, and building mechanical system characteristics could be identified. Table 1 provides a breakdown of these projects by building system and costs. The selected buildings were net-zero energy buildings that consider the following two aspects: electrical energy production and thermal energy production (heating, cooling and DHW).

There are three steps in cost estimation: (1) create an itemized unit cost database based on RSMeans's book and the National Building Cost Manual (NBCM); (2) build a three-dimensional building information model (BIM) based on verified ZEB construction information and export the building material and system information to Excel format; and (3) used the database from (1) and building information from (2) to estimate the cost of CB and GB.

- Step 1: Cost estimation data collection

In this research project, a traditional itemized cost estimation method was used. The researcher initially sought to collect actual cost data of CBs or GBs with a compatible size and use it as a control group for comparison. However, since most building owners were reluctant to share cost information, this research was redesigned to compare actual net-zero building costs with modeled costs of CBs and GBs. Two construction cost databases were selected and compared: the 2017 National Building Cost Manual (NBCM) and RSMeans's Square Foot Costs Book (RSFCB).

- Steps 2 & 3: Itemized cost calculation using BIM model Based on available data from building floor plans, sections, elevations, detail drawings, and project descriptions, first, three-dimensional virtual models were created in Autodesk Revit for each case building, based on the information provided by building owners or found online (Hu et al.

[1] The New Buildings Institute (NBI) is a non-profit organization driving better energy performance in commercial buildings.

Project	City State	Use	Building Area (ft^2)	EUI (kwh/ m^2)	Cost ($)	Year	Net-Zero Energy Feature
Science House	St. Paul, MN	Education/ Museum	1,528	0	$650,000 ($425/ft^2 ≈$4250/$m^2$)	2013	• Total ventilation energy recovery • Multi-modal natural ventilation • Efficient lighting • High heat pump efficiency • High insulation • Energy-efficient windows and doors • Science House's total energy use, including plug and equipment loads, is 60% below that required by code, allowing its 8.8-kilowatt photovoltaic (PV) system to produce more energy than the building uses on an annual basis
Leslie Shao-Ming Sun Field Station	Woodside, CA	Education	13,197	9.46	4,785,000 ($362/$ft^2$ ≈$3620/$m^2$)	2002	• Energy-efficient windows and doors • PV system (A 22-kilowatt, grid-connected photovoltaic system makes the building a net producer of electricity
Omega Center for Sustainable Living	Rhinebeck, NY	Education	6,200	-25	2,800,000 ($451/$ft^2$ ≈$4510/$m^2$)	2009	• Geothermal wells and heat pumps • PV system
Environmental Technology Center	Rohnert Park, CA	Education	2,196	-3.1	1,116,000 ($508/$ft^2$ ≈$5080/$m^2$)	2001	• A 3-kW roof-integrated photovoltaic system • Insulated structural wall panel • Hydronic radiant heat
Adam Joseph Lewis Center	Oberlin, OH	Education	13,595	-34.7	4,854,600 ($375/$ft^2$ ≈$3750/$m^2$)	2000	• Living machine • PV system • Ground-loop heat pumps • Water-to-water heat pump
Hawaii Gateway Energy Center	Kailua-Kona, HI		5,597	-6.3	3,400,000 ($607/$ft^2$ ≈$6070/$m^2$)	2005	• A 20-kilowatt photovoltaic system • Seawater pump • High insulation
Living Learning Center	Eureka, MO	Education	2,917	-3.2	1,597,227 ($547/$ft^2$ ≈$5470/$m^2$)	2009	• High efficiency variable refrigerant HVAC system • High insulation • Evergreen Solar roof & pole-mounted photovoltaic, 23.1 kWh
Putney School Field House	Putney, VT	Education	16,802	0	6,036,000 ($318/$ft^2$ ≈$3180/$m^2$)	2009	• High insulation • 36.8 kW solar PV
Locust Trace Agriscience Campus	Lexington, KY	Education	69,998	0	15,620,000 ($234/$ft^2$ ≈$2340/$m^2$)	2011	• 175kW solar PV
Richarsbille Elementary School	Bowling Green, KY	Education	72,280	3.2	14,927,000 ($207/$ft^2$ ≈$2070/$m^2$)	2010	• 208 kW thin-film PV system
Hawaii Preparatory Academy Energy Lab	Waimea, HI	Education	5,889	-16	4,306,199 ($731 /$ft^2$ ≈$7310/$m^2$))	2010	• 27 Kw PV system
Bertschi School Science Wing	Seattle, WA	Education	1,421	0	935,000 ($658/$ft^2$ ≈$6580/$m^2$))	2011	• Energy recovery system • Hydronic radiant floor • High insulation • 20Kw PV system

Table 1. Case project details

2017). All building information was input in three-dimensional virtual models in a BIM environment so that users could extract and organize the cost-related information easily. The three-dimensional models include all primary building materials and systems to reflect the actual conditions of the case buildings. Some advanced materials and building systems, which are not included in the existing Revit library, were created and manually input in the models. Then, a material schedule was created within the Revit model, transferring three-dimensional data of materials into two-dimensional, quantitative itemized numbers, including volume, weight, dimensions, layers, and assemblies (Hu 2017). Afterward, the schedules were exported to an Excel-format file and used as a cost estimation sheet for calculating the CB and GB with the same area, building construction, material assemblies, and systems as the net-zero building. As shown in table 5, the primary categories included in the calculation were direct costs and indirect costs. The direct costs included the building substructure system (foundation), floor and roof system, exterior walls and windows/doors, interior walls and finish, ceilings, restroom fixtures and plumbing system, HVAC systems,
and vertical transportation system. The indirect costs included the designers' (architect and engineer) fee and contractors' fee. Instead of a rough per area cost estimation, which is often found in cost analysis in GB, in this study, the author conducted a detailed breakdown cost estimation by utilizing the advanced building information modeling software Autodesk Revit. In conventional methods, a cost estimator digitizes the architect's paper drawings or imports two-dimensional information of the building (data) into a cost estimation package. In either of these methods, human error could occur easily, and inaccuracies could propagate from the original data entry to the final cost number. Autodesk Revit, as a building information modeling (BIM) tool, allows the author to automate the task of quantification and then extract and transfer the data to an Excel format for a final cost estimation checkup.

2. STATISTICAL ANALYSIS

Null analysis is appropriate for this research project. From the literature review and ZEB actual cost information, there is no clear indication that ZEB has a higher premium than the national average for conventional building. Therefore, before analyzing the causes of a premium cost, understanding whether there is a cost difference is more important. This was conducted to determine if ZEB costs were indeed significantly different from the CB and GB. The Wilcoxon signed-rank test is commonly used to test for a difference in a paired observation, and a sign test is often used to test the null hypothesis.

The analysis considers two null hypotheses:
• H01:There is no significant cost difference between ZEB and CB.
• H02 There is no significance cost difference between ZEB and GB.
The two alternative hypotheses are:
• Ha1:There is significant cost difference between ZEB and CB.
• Ha2 There is significance cost difference between ZEB and GB.

Descriptive results
The results from the Wilcoxon matched pairs signed-rank test for ZEB, compared to CB, are illustrated in table 2 and the tests for ZEB and GB are shown in table 3. The overall results of the two null hypotheses are provided in table 7. The equation used to obtain the statistic W is:

$$W = \sum_{i=0}^{n'} R_i^{(+)},$$

where n' is the actual sample size, Ri is rank, and W is the Wilcoxon test score.

For null hypothesis number 1(H01), the model costs of six CB are higher than the actual ZEB cost, and the rest six CBs costs are lower than the actual ZEB cost. The Wilcoxon test score (W), 35, is higher than the critical value used for a two-tier test of 14. Based on this result, we could not reject null hypothesis 1(H01), instead, we should reject the alternative hypothesis (Ha1). As conclusion, we consider there is no difference between the actual ZEB and modeled CB building cost, based on RSFCB and NBCM datasets. For null hypothesis number 2 (H02), there are model costs of ten GBs that are higher than the actual ZEB cost, and model costs of two GBs that are lower than the actual cost. The Wilcoxon test score (W), 11, is less than the critical value used for a two-tier test of 14. Based on this result, we could reject null hypothesis 2, and we conclude alternative hypothesis (Ha1) can be supported: there is difference between the actual ZEB cost and modeled GB cost, based on the RSFCB dataset.

Project	Modeled Cost $/m^2 ($X_{1i}$)	Actual Cost $/sft ($X_{2i}$)	Difference ($D_i = X_{1i} - X_{2i}$))	Positive	[Diff] (D_i)	Rank (R_i)	Signed Rank	α = 0.05
Science House	4445.6	425	19.56	1	19.56	3	3	
Leslie Shao-Ming Sun	3369.6	362	-25.04	-1	25.04	5	-5	
Omega	4233.6	451	-27.64	-1	27.64	6	-6	
ETC	5286.7	508	20.67	1	20.67	4	4	
Adam Joseph Lewis Center (AJLC)	3940.2	375	19.02	1	19.02	2	2	
Hawaii Gateway	6058.3	607	-1.17	-1	1.17	1	-1	
Living Learning Center (LLC)	5044.7	547	-42.53	-1	42.53	8	-8	
Putney	3560.7	318	38.07	1	38.07	7	7	
Locust Trace Campus (LTC)	3977.5	234	163.75	1	163.75	9	9	
Richarsbille ES	3741.2	207	167.12	1	167.12	10	10	
Hawaii Preparatory Energy Lab (HPAEL)	5268.6	731	-204.14	-1	204.14	11	-11	
Bertschi	3677.6	658	-290.24	-1	290.24	12	-12	
							35	Positive sum
							-43	Negative sum
							35	Test statistic (W)

Table 2. Wilcoxon matched pairs signed-rank tests for ZEB cost compared to modeled CB cost

PROJECT	Modeled Cost (green)	Actual Cost	Difference	Positive	[Diff]	Rank	Signed Rank (W)	α = 0.05
Science House	569.04	425	144.04	1	144.04	7	7	
Leslie Shao-Ming Sun	431.31	362	69.31	1	69.31	2	2	
Omega	541.90	451	90.90	1	90.90	3	3	
ETC	676.70	508	168.70	1	168.70	9	9	
Adam Joseph Lewis Center(AJLC)	504.34	375	129.34	1	129.34	5	5	
Hawaii Gateway	775.46	607	168.46	1	168.46	8	8	
Living Learning Center (LLC)	645.72	547	98.72	1	98.72	4	4	
Putney	455.76	318	137.76	1	137.76	6	6	
Locust Trace Campus (LTC)	509.12	234	275.12	1	275.12	12	12	
Richarsbille ES	478.88	207	271.88	1	271.88	11	11	
Hawaii Preparatory Energy Lab (HPAEL)	674.38	731	-56.62	-1	56.62	1	-1	
Bertschi	470.73	658	-187.27	-1	187.27	10	-10	
							67	Positive sum
							-11	Negative sum
							11	Test statistic (W)

Table 3. Wilcoxon matched pairs signed-rank tests for ZEB cost compared to modeled GB cost

Hypotheses	N of Buildings	Below Actual Cost	Above Actual Cost	Test Statistic (W)	Critical Value (z)	Result
H_{01}	12	6	6	35	14	Cannot reject
H_{02}	12	10	2	11	14	Reject

Table 4. Summary results of Wilcoxon matched pairs signed-rank tests (based on statistical significance at an alpha level of 0.05)

3. FINDINGS

3.1. ZEB is not more expensive than CB

The first important findings is there is no significant cost difference between actual ZEB cost and modeled CBs cost. Regarding cost, 33.3% of ZEBs are equal to or 2% more expensive than CB, 33.3% of ZEBs cost 10–16% less than CBs, 16.7% of ZEBs cost 45–48% less than CB, and only 16.7% of ZEBs cost 45–68% more than CBs (refer to table 5).

3.2. Reasoning for higher modeled GBs cost than actual ZEBs cost

The rejection of null hypothesis 2 suggests a cost difference between the actual ZEBs and modeled GBs, so the author further investigated the cost difference between the actual ZEBs and modeled GBs, and which factors have correlation to the cost difference. The factors investigated are: location, year of completion, area and building types. Pearson correlation coefficient (r) was used to study the correlations factors and cost difference between ZEB and GB. Pearson's r

measures the linear relationship between two level variables. Table 6 shows the r value of those correlations. There is positive relation between the year of completion, total area of the building to the cost differences, and negative relation between building types, location to the cost differences. And among the four factors, building area (0.966) has the strongest correlation to the cost differences, year of completion has the weakest correlation to cost differences.

Project Name	Difference Between ZEB and CB
Science House	-10%
Leslie Shao-Ming Sun	1%
Omega	0%
ETC	-10%
Adam Joseph Lewis Center (AJLC)	-11%
Hawaii Gateway	0%
Living Learning Center (LLC)	2%
Putney	-16%
Locust Trace Campus (LTC)	-45%
Richarsbille ES	-48%
Hawaii Preparatory Energy Lab (HPAEL)	45%
Bertschi	68%

Table 5. Cost difference percentage between net-zero building and conventional non-green building

Building factors	Pearson correlation coefficient (r) to cost differences
Building Type	-0.536833324
Location	-0.612306625
Year of Completion	0.274831032
Building Area (size)	0.966356149

Table 6. Correlation between cost difference (ZEB to GB) and building factors

3.3. Building size as the primary factor affecting the unit (square footage) cost of the building

Next, author further examined the relationship between cost differences and building size(area). Figure 2 shows that there is some negative correlation between the construction cost and building size. Overall, buildings with a lower unit cost show a larger difference between the actual cost and modeled cost whereas a building with a higher unit cost shows less difference.

CONCLUSION

This study provides the first in-depth investigation into actual ZEB costs in the United States based on detailed information. With higher initial costs being perceived as major barriers to the uptake of ZEB, the findings from this research project could be critical to further understanding whether ZEB cost more. Based on the comparison of actual and modeled costs of twelve built and verified ZEBs, it can be
concluded that, in general, there is no significance between actual ZEB costs and modeled CB costs. Although the data shows several net-zero buildings as having substantially higher costs than the modeled costs, a sizable portion of net-zero buildings have been found to be below the modeled cost. Interestingly, the study also shows a significant difference between actual ZEB costs and modeled GB costs. The magnitude of difference between those two are primarily affected by the size of the building.
This study has several limitations as well. Firstly, future research using data with different building types is needed to verify these

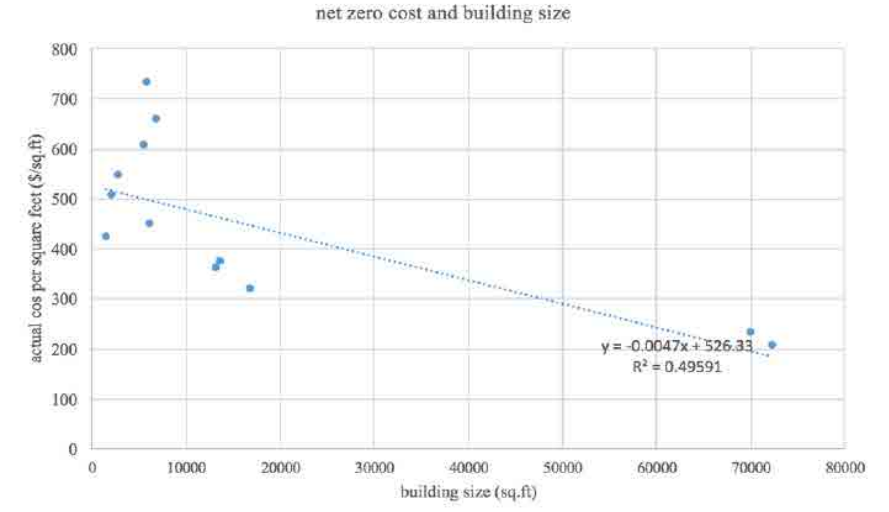

Figure 2. Correlation between cost and building size

findings and address the issue of variance within the building subgroups. Other building types should also be investigated, including commercial office and residential buildings. Secondly, out of the twelve case projects, four are more than ten years old. More recent projects and data should be used in future studies. The third limitation in this study was the small dataset of only twelve buildings; ideally, at least thirty buildings should be studied so that parametric statistical testing can be conducted, leading to a more detailed analysis. Furthermore, the collection of actual cost data from other sizable markets, such as the United Kingdom and EU member countries, could result in a considerably larger ZEB cost dataset 34 that would enable a more robust study and analysis.

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PAPER #7.20

BETWEEN RESEARCH AND TEACHING: IDENTIFYING NEW COMPETENCIES FOR HEALTHY CITIES

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ABSTRACT

Healthy Cities is one of the central themes addressed in the Sustainable Development Goals. The World Health Organization's new Urban Health Initiative creates a paradigm shift in health systems approaches by focusing on the urban environment as a prerequisite for healthy lifestyles - and disease prevention. In Europe, the Zagreb declaration pointed out its attention to strengthen and champion action on health through healthy cities networks. Architects and engineers play a strategic role in building this future and activating actions in key development sectors, like housing and transport, as well as in the settings where people live and work. This requires new professional figures with the hard and soft skills that stimulate urban transformation for healthier built environments.
The paper discusses a methodological approach to identify the competencies to be acquired by future practitioners. It is developed within an ongoing Erasmus+ project[1] that represents the contextual field for testing the method in three Bosnian Universities. The article describes the methodology and its application. It starts with designing analysis' grids to evaluate how the topic is currently addressed, and it builds questionnaires to evaluate the students' awareness. Moreover, the research investigates stakeholders through organized seminars and surveys to understand the labor market and social needs. The paper suggests a strategy for setting up new courses for future architects, urban planners, and engineers, experts of the healthy urban environment. Testing the method in the Bosnian context, one of the main indications is the importance of innovative teaching methodologies integrated with the use of practical experience and laboratories. The method proposed is replicable for curriculum development in Higher Education, and it highlights how the research is a fundamental base for designing and teaching academic courses.

KEYWORDS

Healthy city; architecture; engineering; competencies; higher dducation.

INTRODUCTION

Healthy City started to be a crucial topic in the last twenty years, because of the huge number of inhabitants in the urban area. All over the world statistical data confirms the growing trend: in 2018 55% of the world population lives in urban areas, and according to the last projection it is increasing to 68% by 2050. Europe is the continent with a high density of urban population, 74% in 2018 (UN 2019), despite its low rate fertility, population decline - it will decrease from 13 percent to 9 percent between 2018 and 2050 - and significant diversity in the urbanization levels of its countries.

[1] The Healthy URBan Environment Developing Higher Education in Architecture and Construction in Bosnia and Herzegovina - HURBE - is a CBHE project, co-funded by the Erasmus plus programme of the EU Union (2018-2021). The coordinators of each Universities are: Francesca Giofrè (lead coordinator), Sapienza University of Rome, Faculty of Architecture, Department Architecture and Design; Vesna Mikić, University of Zagreb, Faculty of Architecture; Milena Tasheva-Petrova, University of Architecture, Civil Engineering and Geodesy; Maja Popovac, Dzemal Bijedic University of Mostar; Senaida Halilović-Terzić, University of Sarajevo; Samir Lemeš, University of Zenica.

This scenario is having a strong impact in the city, in terms of consumption of resources, on the system of spaces, on the demand for services, on the health, and on social relations. At the global level among the Sustainable Development Goals, the 11th goal "Make cities and human settlements inclusive, safe, resilient and sustainable" stresses the importance of the planning and managing processes of the city. These processes can produce a significant difference and have effects on the health of their residents (Lancet 2012, 3), as confirmed by several scientific studies in the last 150 years (GNRUHE 2010). The European Healthy Cities Network launched in 1986 by the World Health Organization (WHO-EHCN), and now at its VI phases, plays a strategic role in promoting policy and plan in European urban areas, positioning in its core the notion of the 'health' of the inhabitants.

Health, according to the evolution of the concept, is defined as "a state of complete physical, mental, and social well-being" (WHO 1948) "and not merely the absence of disease or infirmity" (WHO 2005); it is a positive concept and it is a human right. Moreover, according to the Meikirch Model health "is a dynamic state of well-being emergent from conducive interactions between an individual's potentials, life's demands, and social and environmental determinants. Health results throughout the life course when an individual's potentials – and social and environmental determinants – suffice to respond satisfactorily to the demands of life. Life's demands can be physiological, psychosocial, or environmental and vary across individuals and contexts but, in every case, unsatisfactory responses lead to disease" (Bircher and Hahn 2017). In fact, the state of human health would be conditioned by 50% of their behaviors and lifestyles, but also environmental factors (20%), genetic factors (20%), and health care (10%) (Amara, Bodenhorn and Cain 2003).

The environmental determinants include the whole biosphere, in other words, the environment people need for their daily life as nutrition, recreation, work, move, etc.; the environment is made by water, air, soil, housing, buildings, streets, routes, greenery, and so on. In general term healthy city is defined by the Health Promotion Glossary the "one that is continually creating and improving those physical and social environments and expanding those community resources which enable people to mutually support each other in performing all the functions of life and developing to their maximum potential."(WHO 1998).

Analyzing the documents produced by the European Healthy Cities Network and in particular the Zagreb Declaration (WHO-EHCN 2003, 2009) it is possible to define the intervention areas for urban planners, architects, engineers, but not only for these professionals. These documents identified their space of action in creating and design the healthy urban environment, aiming to offer "a physical and built environment that supports health, recreation and well-being, safety, social interaction, easy mobility, a sense of pride and cultural identity and that is accessible to the needs of all its citizens" (WHO-EHCN 2003). The related issues that integrate the concept of health, and that interest those experts are: urban planning; housing and regeneration; transport; climate change and public emergencies; safety and security; exposure to noise and pollution; urban design and creativity and livability (WHO-EHCN 2009, 5-6).

The themes are several referring to disciplines involved and to various scales of interventions (citywide, neighborhood and local environment), and they are all strictly connected and influence each other. Furthermore, the cities are "the example par excellence of complex systems: emergent, far from equilibrium, requiring enormous energies to maintain themselves, displaying patterns of inequality and saturated flow systems

that use capacity in what appear to be barely sustainable but paradoxically resilient networks" (Hancock and Duhl 1986, 1988), and the scholars are still on researching a proper methodology for assessing the impact and outcome of actions to build a healthy city. There is a principle of interdependence between the various policies that can no longer be neglected, and the 'construction' of the Health City represents a long-term urban and territorial planning process (Giofrè and Đukanović, 2017).

In this framework, Sapienza University of Rome, Faculty of Architecture, is leading the European Project in the area of Capacity Building in Higher Education, co-founded by the Erasmus+ programme, titled 'HURBE - Healthy URBan Environment Developing Higher Education in Architecture and Construction in Bosnia and Herzegovina" with the Universities of Architecture and Civil Engineering of Zagreb, Sofia, Sarajevo, Zenica, and Mostar. Among the general aims of the project, there is to improve the quality of higher education in the universities of Bosnia and Herzegovina (BiH) by focusing on curriculum development in the topic of healthy urban environment. The project is still ongoing (2019-2021); it is the field of experimentation to discuss the topic of healthy city in an interdisciplinary vision, and to propose and apply a methodology to identify new competencies and how to transfer them, through innovative means, to urban planners, architects and engineers of the future, called to participate in the planning and design process of protecting and ensuring the health and wellbeing of people living in cities.

1. A METHODOLOGICAL APPROACH TO DEFINING NECESSARY COMPETENCIES IN HEALTHY URBAN ENVIRONMENT

The methodological approach was planned to identify the competencies to be acquired by future practitioners - urban planners, architects, and engineers - that design healthy environments from neighborhood to building scale, in order to design specific academic courses within the existing curricula in BiH's Faculties.

Therefore, the methodology aimed to reach these objectives:

1. Understand how the topic of 'healthy cities' is currently dealt with in current university curriculums.
2. Evaluate the student's awareness and perception of the theme.
3. Discuss stakeholders and local experts' opinions and potential of the topic development.

Necessary tools were developed to reach these objectives, and after their application, the results were compared to identify the necessary competencies. First, designing analysis' grids to evaluate the topic in curriculums, and workshops with the Bosnian project team to collect their opinion. Second, design and carry out questionnaires that investigate the Bosnian student's awareness. Third, organize Bosnian stakeholders' meetings and surveys to discuss the theme with the labor market and social needs.

1.1. Evaluation of the faculties' courses: grid questionnaire and workshop

A grid questionnaire on how the theme 'Healthy Urban Environment' (HURBE) is addressed within the existing teaching courses was elaborated. The grid aimed to analyze the whole syllabus studies and the teaching modalities in the degree programmes of the three Bosnian faculties. The grid was prepared by Sapienza University of Rome. It was composed of descriptive tables articulated in two sections. The first section collects general information about the typology of degrees (i.e. duration of the course, total number of university educational credits - CFU; number of students enrolled; methodology of enrollment and selection; main competencies acquired; scale of classes; grading and of final

thesis discussion; articulation of CFU between teaching, individual study, laboratory activities, traineeships, etc.). The second section provided specific information about each course in terms of CFU; scientific disciplinary sector; learning outcome; typology of course (i.e. compulsory or elective); typology of attendance (i.e. mandatory or not mandatory); teaching methodology and tools used (i.e. slides, video, oral lecture, reviewing design, etc.); evaluation method (i.e. final written test, mid-term, written test, oral evaluation, project evaluation); main literature and position of the course in the curricula.

Given that architecture and civil engineering share the same broader area (i.e. organizing building, space, and environment), all three faculties already offer courses that include some aspects of environmental sciences and/or courses on technological means to preserve our environment and create healthy urban settings. At the University of Sarajevo (UNSA),[2] Faculty of Architecture, there are 35 courses that contain topics that could be - in minor or major proportion – discussing issues related to the HURBE, distributed as follows: 7 out of 68 courses in the first cycle (Bachelor), and 28 out of 97 courses in the second cycle (Master). Within the Bachelor cycle, the number of CFU of the topic HURBE related courses is 20 CFU out of 180 CFU. Strangely, the number of HURBE related courses in the Master was estimated to be 145 CFU and the total university educational credits needed to obtain the degree are 120 CFU. This is due to the variety of elective courses at the Master level, many of them were considered to discuss issues related to the healthy urban environment in a minor or major proportion. In UNSA, HURBE related topics include bioclimatic architecture and urbanism, resilient architectural design, human-oriented city, green design, renewable energy, and low-energy housing.

At the University of Zenica (UNZE),[3] Faculty of Polytechnic, Civil Engineering, there are 7 courses (4 compulsory and 3 electives) which contain topics that might be -in minor or major proportion- related to HURBE. They are in the first cycle (Bachelor) courses. Within the Bachelor cycle, the number of CFU of HURBE related courses is 16 CFU out of 240 CFU. HURBE related topics include solving civil engineering problems as the design and dimension of structures, plan and supervise building operation, air pollution, management of water supply and drain of water waste, natural and energy efficiency and energy optimization.

Unlike the previous two universities, which have one Bachelor programme and one Master programme; the University of Mostar (UNMO),[4] Faculty of Civil Engineering has one Bachelor programme and three Master programmes – general, structural and hydro-technical. Only the general master programme includes 6 out of 36 courses that contain topics that could be -in minor or major proportion- related to HURBE. This represents 29 CFU out of 120 CFU. HURBE related topics include water and environmental protection, energy-conscious retrofit of historical objects and urban ecology. soil and water pollution control, waste management, energy efficiency in construction and alternative energy sources, traditional and new building materials.

The grid showed the potential proportion of courses - through the number and CFU - that might include and discuss aspects related to the healthy urban environment. The theme is quite broad, and many arguments can be considered related to healthy urban environment. This is probably the reason that UNSA's Master programme was considered to have a high number of courses related to

[2] UNSA's education process is conducted in three cycles (3+2+3): The first three-year cycle (180 CFU) leads to the title of Bachelor of Architecture. The second two-year cycle of studies (120 CFU) leads to the title Master of Architecture. The third three-year cycle of studies (180 CFU) leads to the title PhD in the Field of Architecture and Urban Planning.

[3] UNZE's education process is conducted in two cycles: The first cycle is 4-year Bachelor of Civil Engineering (240 ECTS). The second cycle is 1-year Master of Science in Civil Engineering (60 ECTS).

[4] UNMO's education process is conducted in three cycles (3+2+3): The first three-year cycle of studies is a Bachelor programme of 180 CFU. The second two-year cycle of studies is a Master programme of (120 CFU). They also have a PhD programme of 3 years (180 CFU)

the theme. Further analysis of each course content can help verify the actual proportion of the theme within these university courses.
The grid provided a general indication of the general themes that each faculty chooses to integrate into their educational path. The analyzed faculties share common aims of creating sustainable infrastructures and structures for healthy urban environments. The approach and topics of HURBE differ in each one depending on the faculty's educational mission and their fields of research. Even though the names of some courses can be similar (e.g. energy efficiency) in the three faculties, the teaching approach and content may significantly differ due to the various subjects and methods of different disciplines.
The results of the previous analysis' were presented to the project participants in a workshop,[5] and the main consideration was that the topic of 'health' and its relation and impact on the urban environment is vast and there is a lack of focus on the theme. It might be discussed within other courses, but it is not well identified or defined as a central topic. During the workshop participants discussed the topic and its content, having in mind the aim of setting up new courses in the existent degree programmes. They tried to identify the common competencies needed for future urban planners, architects, and engineers related to the subject - area, applying the matrix of Tuning with Dublin descriptors.[6] The first results were the identification of two typologies of competencies, 'basic' and 'advanced', that should be transferred in different phases of the degree programmes.

1.2. The students' awareness of HURBE: the questionnaire

The questionnaire on "Healthy Urban Environment: the Bosnian students' awareness" was prepared through a workshop of 18 project members, three of each faculty.[7] It aimed to investigate how the Bosnian students attending the universities perceive the topic of HURBE and evaluate the experience they made during the courses they attended. During the workshop, the attendees were divided into three groups and each group prepared a set of questions. A matrix was organized to compare all the questions and extract the ones everyone seemed to agree on - repeated and/or most significant questions - and elaborate the first draft of the survey. The survey's structure and content were developed and discussed jointly by email to elaborate the final version, using simple and 'familiar' words to facilitate the student's comprehension of the questions.
The questionnaire was articulated in 25 questions with different typologies of answers: closed, multiple responses, or on rating scale. It was divided into two sections. The first part provided general information about the participants' sample (6 questions). The second section investigated the general knowledge and opinions about of HURBE (19 questions).
Initially, the survey was prepared through Google Form to allow further communication via email with the students and facilitate the data elaboration and analysis. However, the three faculties had to translate and print the questionnaire to share it with their students in class. UNZE and UNMO filled a google form after, while UNSA filled an excel file. The sample interviewed consisted of 216 students distributed as follows: UNSA, UNMO, and UNZE filled 97, 53 and 66 surveys respectively. Most of the students that filled the questionnaires attended the third and the fourth years of their studies (75% of the sample) and only 8% of students had international study experience abroad. 63% of the sample were females, which is in line

[5] On the 'credit transfer meeting' hold in 13-17 May 2019, Sarajevo (Bosnia and Herzegovina) at University of Sarajevo.
[6] Tuning Educational Structures in Europe is a Guide to Formulating Degree Programme Profiles, but the project participants adapted it and applied it to the scope of the workshop, setting up courses.
[7] On the 'kick off meeting' hold in 11-13 February 2019, Rome (Italy) at Sapienza University of Rome
[8] According with EUROSTAT in 2017 women accounted for 54 % of all tertiary students in the EU-28.

with the general European trend in the tertiary education level.[8] 40% of students do not live in the city where they attend university, which highlights the importance of integrating new modalities of teaching as online courses.
The results of the survey on general knowledge and opinions about HURBE showed the following: 92% of the students did not hear about 'Zagreb declaration' and only 44% heard about the sustainable development goals, mostly through the internet. They answered that they were the ones responsible for their health (38%), after medical professionals (25%), family (20%), and the urban environment (11%). 48% believe that the environment's effect on their health is negative. 77% of the sample is aware that their future professions are linked to health urban environmental issues, and 77% believe that the building design is important for health. The elements identified to have an impact on health are natural elements: ventilation, light, and greenery, followed by the building materials respectively. 87% think that CO2 is a pollutant. Energy production followed by transport were voted the sectors that most contribute to pollution. 23% answered that the healthy urban environment was found to belong to planning and design, engineering and architecture; 9% voted that it belongs to healthcare services, 4% for economy and politics, and 63% voted that it belongs to all these factors together.
When having to choose up to two types of experts that could contribute to a healthy urban environment, 127 answers identified architects and engineers, 48 chose medical experts, 28 chose social workers and 108 chose all of them. 90% voted 'yes' that the topic is important for their future profession. All participants voted that technical architecture and urban planning are necessary for the architects and civil engineers to achieve a healthy urban environment is, 126 voted for social anthropological skills, and 35 chose medical skills.
When they had to choose their three preferred methods of learning about the topic, 174 votes were given to practice followed by 164 votes for laboratory activities. 73% believe that their future work is linked with ethical principles, 17% don't know and 10% do not think so. Most of the students feel they are not well informed on the impact of the building process on human health; 36 % of them are not sure and 27 % answered not at all and not enough. Also, 72% of students indicated that they would like to attend a course at university on this topic.

The results of the questionnaires highlighted that the students lack the awareness and knowledge of the theme. Almost all of them never heard about 'Zagreb declaration', even if they are aware that the environment could have a negative impact on their health. The positive aspect was the demonstrated interest by most of the students and their awareness of the importance of learning new HURBE skills; they are interested to learn about the topic and participate in the course. They also underlined that they need practice and laboratory activities to acquire all the skills for their professional future.
All the analysis's results were presented and discussed through open debates[9] among the academic staff member of HURBE project in order to the content of future courses.

1.3. The stakeholders' opinions: labour market and the social needs

The stakeholders' meetings aimed to provide indications and guidelines related to the labour market needs in the specific context of BiH; the public sector's tendencies, approaches, and strategies; and the community and social groups' needs. Moreover, it aimed to discuss the structure and topics, to be developed, in HURBE courses, increasing networking and creating agreements with stakeholders.
The strategy, structure, and content of the meetings were discussed during a workshop[10]

[9] On the 'Project meeting' hold in 5-7 September 2019, Zagreb (Croatia), at University of Zagreb.
[10] See note 9

among the academic members from the six project faculties. The stakeholders were identified: architecture/construction studios, companies, etc.; national public institutions (Ministry of Environment, Ministry of Housing/ Planning/Infrastructure, Ministry of Health, etc.); local public bodies (city administration representatives, etc.); international organizations (World Health Organization, EU agencies, etc.); labor market entities and others.

The project members decided to design a questionnaire for the stakeholders, to be filled at the beginning of each meeting, with ten multiple-choice questions. The first seven questions were general and common for everyone. Then, there were three questions that were specific for the representatives of the private enterprise, the representatives of the public sector, and the civil society representatives. Each Bosnian university was asked to include at least 10 stakeholders in the meeting. They prepared their lists of stakeholders to invite them via email, phone calls, and personal contact. It was decided to organize three meetings in three days, each day in a different Bosnian university - Sarajevo, Zenica, and Mostar – facilitating the participation and logistics for the stakeholders of each university's city.[11] In each meeting, a local academic representative coordinated the meeting's activities in their home institution. The total number of participants in the three meetings is 64 persons, including academics staff members; 25 of these were the actual external stakeholders that are not part of the project institutions.[12]

Each event started with the general presentation of the project objectives, followed by the discussion of the structure and topics for HURBE course, and then the questionnaires. After that, there were open discussions that focused on the results of the questionnaires and the potential of collaborations between the stakeholders and the Bosnian universities. The meetings also concentrated on the local experts' feedback regarding the importance of integrating HURBE topic in the Architecture and Civil Engineering curricula, the future contribution it could provide for the local labor markets, and the potential role of the laboratories services that Bosnian universities are installing with equipment dedicated to the theme of healthy urban environment.

Some of the questionnaires and discussions results were common in the three meetings and others were relevant to the specific contexts of reference. All stakeholders agreed on the importance of raising awareness of the healthy urban environment at the university level. They remarked the significance of the gap between the practical skills of recently graduated students and the needs of labour market. The structure of the proposed HURBE courses has to be pragmatic and has to provide content that would enable the graduates to link their acquired knowledge with other relevant influential sectors in the job market. With the inclusion of ethical issues as well as the practical experiences (visit to construction site, use laboratories' equipment, etc.), they believe that HURBE course can cover the various topics of healthy cities. Most of the stakeholders indicated the importance of the laboratories that can provide services for external entities and support the courses. Some have demonstrated interest in using the laboratories' services based on defined agreements with regulations and fees. Others offered their support to the academic staff and the students; they would provide objective observations and assist the teaching processes through the integration of their professional knowledge.

[11] The stakeholders' meetings took place as follow: on the 19 June 2019 at University of Sarajevo, on 20 June 2019 at University of Zenica, and on 21 June 2019 at University of Mostar.

[12] At University of Sarajevo, where 18 persons attended the meeting: 2 from private companies, 2 from public institutions and public utility companies and 11 from the University of Sarajevo. At University of Zenica, the meeting was attended by 21 persons: 2 from private companies, 7 from public institutions and public utility companies, 5 from other project partners, and 7 from the University of Zenica. At University of Mostar, the meeting was attended by 23 persons from following areas: 2 from private companies, 7 from public institutions and public utility companies, 3 form NGOs and 13 from education.

In each meeting, the stakeholder's contribution was also influenced by the given urban context where the meeting took place and the university's profile. In Sarajevo, the external participants recommended that HURBE courses focus on common problems of the metropolitan regions. They have to discuss the infrastructure and urban planning, traffic problems and the importance of bioclimatic architecture and public greenery. In Mostar, the stakeholders concentrated on climate change, urban pollution, water, and waste management issues which are evident there. In Zenica, the focus was on the importance of enhancing the city's nature, the impact of the industry and the air pollution it causes. These results provided necessary external feedback in relation to the course's proposed content. Some of them confirm the students' questionnaire results, others provide additional info. They confirmed the importance of the practical experience and the role of the laboratories to link the university with the job market.

2. MERGING THE RESULTS AND DISCUSSION

The methodology discussed shows how the used tools, including all the actors in the process, is necessary for defining new learning content and teaching methodologies to build up new courses in existing degree courses. It demonstrates the importance of integrating training and practical experiences for the development of well-prepared professional figures, increasing their employability.

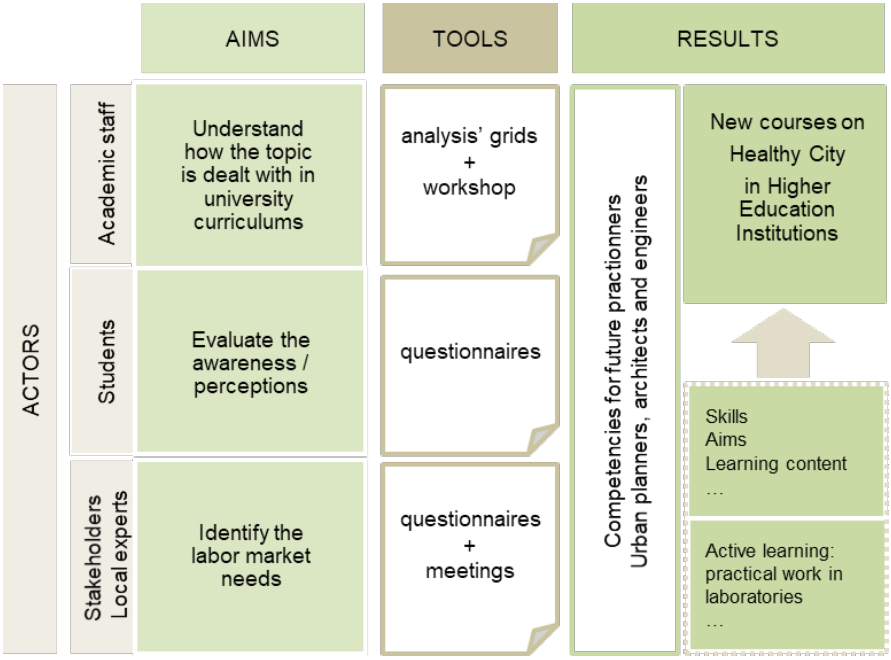

Figure 1. Methodology applied for developing course in Higher Education Institutions on Healthy Urban Environment: Actors, Aims, Tools, Results. Source: (Authors 2020)

Each tool provided an understanding of how the topic of Healthy Urban Environment is a transversal topic to all the disciplines taught in the existing degree courses and consequently diluted in different subjects, with different inflections.

The three tools' results provide a set of common indications. They all showed that there is an absence of a deep understanding of the topic including the concept of health and its effects on the built environment.

Although the students and stakeholders are aware of the importance of the theme on a professional, social and personal scale, the curriculum analysis has shown that the curriculums lack the in-depth recognition of the theme's content and knowledge. The positive aspect, however, is that students are aware of their lack of knowledge of the topic. They are interested in acquiring this knowledge and complementing it with practical training, as they believe it will play a strategic role in their future practices.

The stakeholders' meetings' outcomes stressed that each Bosnian faculty should be able to maintain the balance between the interdisciplinarity of the theme and their specific mission as architecture or civil engineering faculties. They also stated that it is important to link the university teaching curricula, and the new courses on HURBE with the needs of the labor market in the place/context where the universities are located. In fact, the cities of the Bosnian universities involved, even if the country is one of the smallest in Europe, have different urban environments and different problems.

All the stakeholders underlined the strategic role of the laboratories, as a space for active and practical learning, providing the possibility of applying academic research and other activities on the territory.

This role corresponds perfectly to the rising relevance of the universities 'Third Mission'[13] of generating knowledge outside academic environments to the benefit of the social, cultural and economic development, in dealing with the territory and the society, performing activities and projects to strengthen dialogue and interaction among university, industry, and society.

Based on the evaluation of the faculties' courses and the stakeholders' feedback, the academic members decided to divide HURBE course into two interdisciplinary modules with different aims to gain professionals soft and hard skills. The basic module, focusing on theoretical interdisciplinary knowledge and the advanced module, concentrating on practical and design activities. The basic module, HURBE I, will be common among Faculties, allowing the possibility to create an interdisciplinary space for intra-country students and academic staff mobility with the presence of practitioners as teachers too. The main learning outcome is understanding the impact of planning and designing on the urban healthy environment at the different scale; in a wide terms, the students develop the sensibility to put in the core of the actions the 'health of people' and the consciousness of the importance to including and empowering the people in the making process for a Healthy City.

The advanced module, HURBE II, will be specific for each faculty, concentrating on its urban environment context, and adopting the laboratories as a resource for practical teaching and design activities. The learning outcomes are specific in applying methods, instruments and tools to planning and design, starting from the population's health data, and in evaluating the impact on the health of people.

The methodology discussed and its results reconfirm the added value in maintaining a strict link between Education, Research and Third Mission activities. This connection enriches the learning process, and it is necessary for the success of the university courses.

[13] The University has three missions: the first mission is Teaching, the second is Education.

CONCLUSION

There is rapid evolution of the body of knowledge, teaching and teaching methodologies. Information and communication technologies have had a significant role in changing the whole system of processes to develop professional figures that are up to date and able to stimulate urban transformation. With the development of social needs and life demands, even the concept of "health" is modifying and becoming closely relevant to the profession of architects and engineers. The Faculties of Architecture and Civil Engineering are struggling to cope with these rapid changes and prepare professional figures that possess the necessary knowledge. In addition, universities need to follow the paradigm shift from the "Teacher-Centered model" to the "Learner-Centered model" (Bishop, Caston and King 2014).

This paper underlined the importance of various elements in developing a learning process. Future architects and engineers have to be able to deal with the evolution of 'hard changes' (i.e. new materials, methods of producing them, etc.) and 'soft change' (i.e. equipment and software as Building Information Modelling, etc.). It is important to update existing architecture and engineering curricula with new content, integrate practical experience like laboratories and develop links with the labor market and social needs.

By applying the indications and results of the proposed methodology, the new professional figures should develop a set of hard skills (knowledge of the topic, using laboratory equipment, etc.) and soft skills (communicating with the labor market representatives, decision making, etc.), filling a gap between education and relevant professional requirements. These future practitioners should be able to stimulate urban transformation for healthier built environments and capable of adapting to the continuously updating environmental and social changes.

Designing healthy urban environments is a challenge that requires the ability of critical thinking to position the concept of health of the inhabitants in the center, in accordance with a given context. It is an action of dreaming about the future of the city. It is a process of co-creating and co-dreaming that involves all actors (academic staff, researchers, stakeholders, inhabitants, etc.) and, in a broader meaning, the whole sectors of civil and political society. The article aspired to participate in that action, its actors and results are representative of the Bosnian context - within the framework of the European Commission's co-funded Erasmus+ project - however, the methodological approach provides guidance and can be replicable for other curriculum development projects for a healthy urban environment and/or other topics in Higher Education.

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PAPER #7.21

NATURAL VENTILATION IN THE TRADITIONAL COUNTRYSIDE CONSTRUCTIONS IN VALENCIA. CFD & PPD ANALYSIS.

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ABSTRACT

Local Valencian architecture has evolved over the centuries adapting to the region's climate conditions. Orientation is one of its fundamental aspects to guarantee the perfect amount of sunlight and natural ventilation. Thanks to the proximity to the Mediterranean Sea and the relative position to the Garbi mountain, the stable wind conditions ensure a good ventilation in the countryside, commonly called "Horta".
The main objectives of the study are divided into two parts. The first phase is focused on the typological and historical study of the popular buildings on Valencia's "Horta", located at the "L'horta Nord" region. A second part will be focused on virtual CFD models (Computational Fluid Dynamics). Natural ventilation inside the buildings is analysed with different local winds configurations. Also, the benefits of this ventilation are studied with reference to interior comfort, using PPD analysis (Predicted Percentage of Dissatisfied). This study shows how the case study adapts itself to the microclimatic region conditions.

KEYWORDS

Natural ventilation; CFD models; popular architecture; interior comfort; PPD models.

INTRODUCTION

Sustainable architecture has been gaining relevance in recent decades. In order to move closer to the sustainable goal, it is necessary to work on a local approach that allows the adaptability of different architectural solutions, like the use of local materials or morphological conditions such as the type of roof, orientation, shape of the windows, symmetry conditions (Neila González, 2004). Therefore, it is interesting to study popular architecture to find the core elements of their design strategies. In this case study, we will focus on analysing the natural ventilation in the popular buildings of the Valencia countryside using CFD & PPD analysis. (Mora-Pérez et al., 2016)
Valencia is located on one of the few coastlines of the Mediterranean with an eastern slope. Thence, it is leeward the normal atmospheric airflow in this hemisphere. The proximity to the different mountain ranges, such as the Betica and Iberica, causes a strong pressure differential. Also, many of these mountains are perpendicular to the coast, thence the air from north to south is blocked. These peculiar geographical conditions protect and intensify by the thermal differential between land and sea that cause the natural breeze. Daily stable east-west or west-east wind routines are established, depending on the Atlantic influence. (A. J. Pérez Cuevas, 1994)
The stable winds and mild temperatures, typical of maritime region, provide ideal conditions for natural ventilation.(Alonso Monterde et al., 2016). To demonstrate this fact, we will use the Climate Consultant application, which is capable of interpreting data from climate files. The climate files of a region contain essential climate information, such as temperature, humidity, irradiation, airspeed, and direction. With this

information, the application represents us within a welfare bioclimatic chart, based on the Givoni's bioclimatic chart (Olgyay, 1998), all the hours of the year with their respective hygrothermal conditions. Also, it allows us to quantify the number of hours that are in each zone of the bioclimatic chart of well-being. Therefore, from a designer point of view, it allows us to evaluate which should be the project measures to adopt for a specific climate.

In figure 1, we can see the representation of all hours of the year (green dots) with their respective hygrothermal conditions for the climate of Valencia. The Mediterranean climate is quite mild, so we can find a comfortable situation for 1173 hours a year, which represents almost 14% of the year. Also, an adequate sun protection system for the windows could increase the comfort to 1366 hours, almost 16% of the year. However, these protection systems must be adaptable to achieve up to 2924 hours (33,4% of the year), because solar gains are needed in order to increase the internal temperature. Finally, natural ventilation can generate a total of 1434 hours of comfort (16,4% of the year). Without the contribution of natural ventilation, we would have to solve the comfort conditions using air conditioning. That would mean using this system 24,6% of the year. Thanks to natural ventilation,

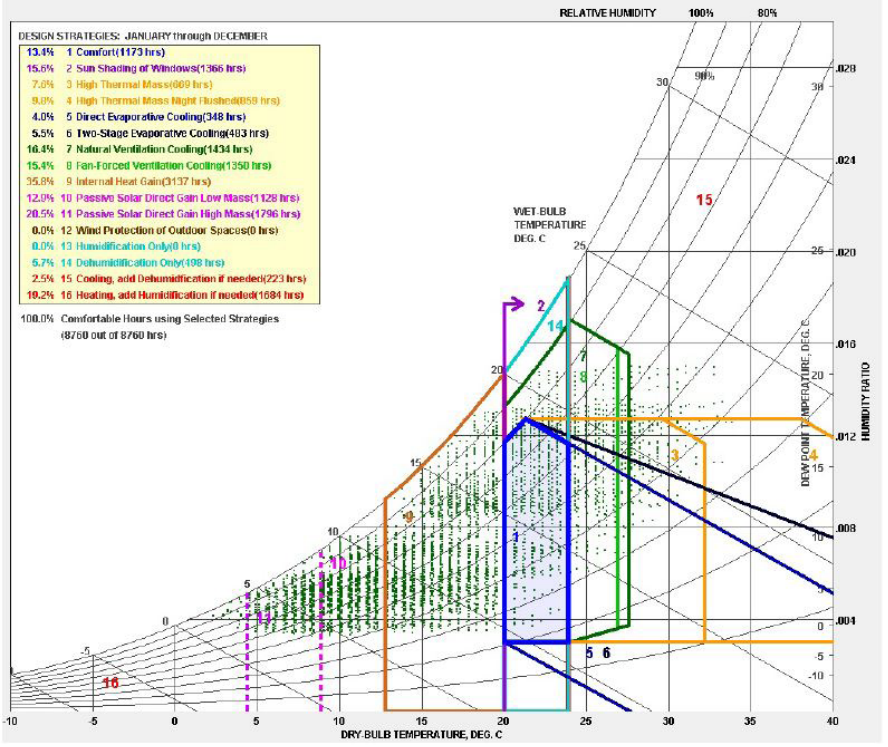

Figure 1. Bioclimatic Chart for Valencia's climate (Climate Consultant Application).

only 8,2% of the year. Therefore, we can save energy by reducing the operating hours of air conditioning. That's the reason why natural ventilation is an adequate strategy in this region.

1. CASE STUDY

There are two main kinds of traditional rural constructions in Valencia: *Alqueria* and *Barraca* (Rey Aynat, 2002). *Barraca* is a basic type of construction based on a gable roof with a steep slope that almost touches the ground. It's humble construction, characteristic of the southern area of Valencia, known for its rice fields surrounding a coastal wetland called Albufera. On the other hand, the *Alquería* is a more elaborate construction, consisting of two or three stories. Its name derives from the Arabic "al-qarïa" and refers to a group of small isolated villages. Currently, the word refers to those isolated houses built surrounding farmland.
Alqueria is a rural house normally composed of two levels. On the ground floor, we can find the bedrooms and dining room. In case they have a kitchen or bathrooms of any kind, they are located outside the construction. The purpose of the first floor was drying vegetable products, like xufa, a local kind of ground nut used for the production of orxata, straw and even tobacco. *Alqueria* has a gable roof made of tiles and its brick walls have a whitewashed finish. Structurally the constructions have two naves divided by a central portico made of solid brick. The facades are load-bearing walls. These constructions are usually symmetrical in two directions. For this reason, the facades have a symmetrical composition. Also, both the east and west facades have their windows aligned. Because of their agriculture function, the houses are oriented to the east to capture the sea breezes. Therefore, these houses are a very interesting case study to analyse natural ventilation in popular architecture.

Figure 2. Case study

The selected *Alquería* is located in the municipal district of Alboraya, more specifically in the *Partida de Saboia* in a sector of the *L'horta Nord* area between the *Carraixet* ravine and the CV-311. It is isolated, surrounded by fields destined to the orchard, with the nearest houses appearing at 115 meters, and it is considered a free environment exposed to the wind. On an architectural level, this *Alquería* is of a compact type with two naves parallel to the main façade. The house as such is arranged on the lower floor, while the upper floor houses the drying and storage area. The house has on its two sides two "porxadas" that served as corrals access to one of them is through a particularly wide door, which is necessary for a car to enter. The main façade has partial symmetry, due to the construction phases of *Alquería*.

2. METHODOLOGY

To analyse ventilation, we must be able to quantify it on the one hand and assess it on the other. To quantify it, we will carry out CFD analysis, Computer Flow Dynamics. (Hajdukiewicz et al., 2013) We can define CFD like a methodology of calculation based on different parts: discretization of a continuous flow defining its calculations domains; discretization of the equations

of the movement, from integral equations to algebraic equations; and solve these algebraic equations through reiterative calculations method. These specific CFD simulations provide valuable information about the environmental conditions of the construction, as much from outdoors as from indoors. These simulations will depend on many boundary conditions, which we must predefine before each analysis. Therefore, CFD analyses consist of simulations of fluid dynamics through or between objects, like in a virtual wind tunnel. These techniques allow us to evaluate the effect of the air on the constructions and can take into a count different conditions that the same environment. Also, we will be able to obtain Air age results. The Air age is a parameter expressed in seconds and counts the time that the air needs to renew one calculation cell. This parameter allows us to evaluate the natural ventilation and air renewal capacity of the system. On the other hand, to evaluate the natural ventilation, we will carry out PPD analysis, Predicted Percentage Dissatisfied. This index is a percentage value of the number of people who would feel uncomfortable in certain hygrothermal conditions. This percentage value is a mathematical relationship based on statistical values. We can assume as an indicative value that the PPD shouldn't exceed 20% of dissatisfied people in an indoor space. (ISO, 2005)

We will divide the CFD analysis into three parts. First, an exterior analysis, where we will be able to study the behaviour of the air in the construction environment, observe its pressures, speeds, and directions. Secondly, an internal analysis whose data we will use for the third step, the PPD analysis.(Mora-Pérez et al., 2015)

To perform CFD and PPD analysis, we must define the environmental conditions. In this study, the software we will use, DesingBuilder, consists of reading weather files, so we will only focus on air direction and speed conditions for CFD configuration. The reference station is at the Manises Airport, the level above sea level is considered 62 meters. With this climate data, we can represent the wind chart that you can see in Figure 4. We can identify six representing cases, expose into the Table 1.

	Air Speed m/s	Air Temperature °C	Air Humidity %
East 80 degrees	12	27	80
	6	24	80
	3	20	80
West 270 degrees	12	18	45
	6	15	60
	3	15	60

Table 1. Wind conditions study

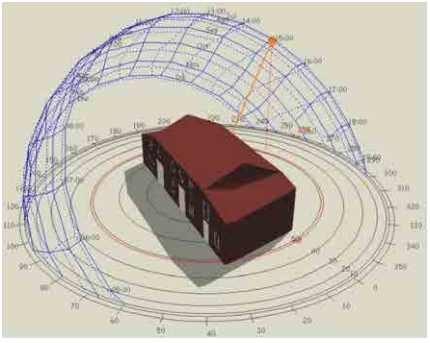

Figure 3. Climate configurations. (DesignBuilder software)

The first step is to perform external analyses. We will be able to observe the performance of the construction in terms of the surrounding airflow in the different wind configurations. From these external analyses, we extract information about the wind, such as direction, flow or temperature. With this data, we can set up CFD surfaces for internal analysis. The CFD surfaces are elements of the DesignBuilder software that allow us to configure extracting and impulsing air according to the air balance configuration. Also, we can modify these surfaces to introduce the input and output

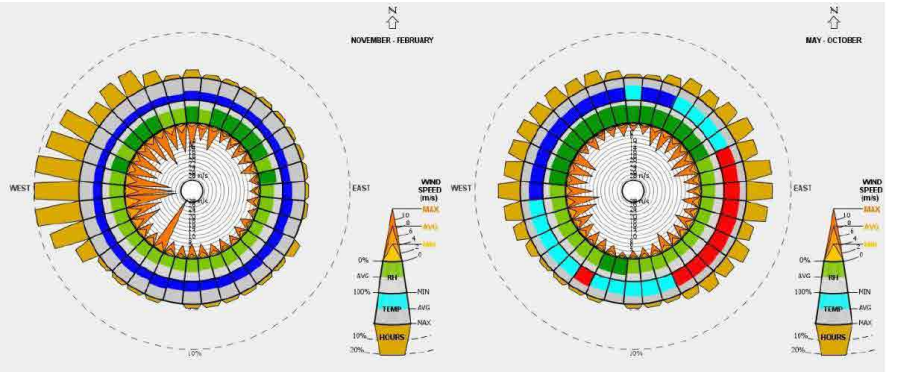

Figure 4. Wind chart. November-February. May-October. (Climate Consultant Application)

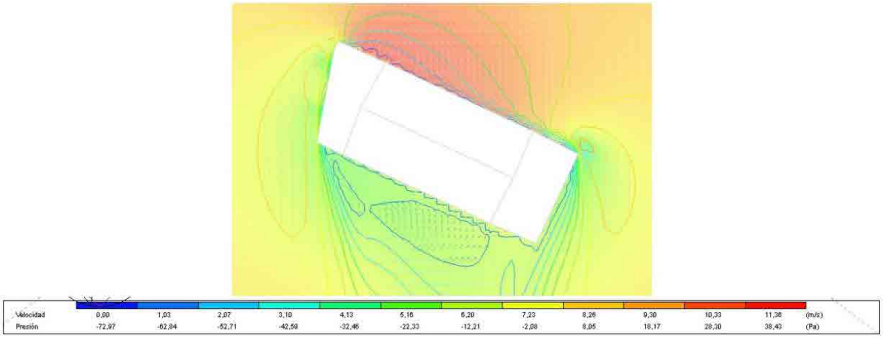

Figure 5. External CFD analysis. (DesignBuilder software)

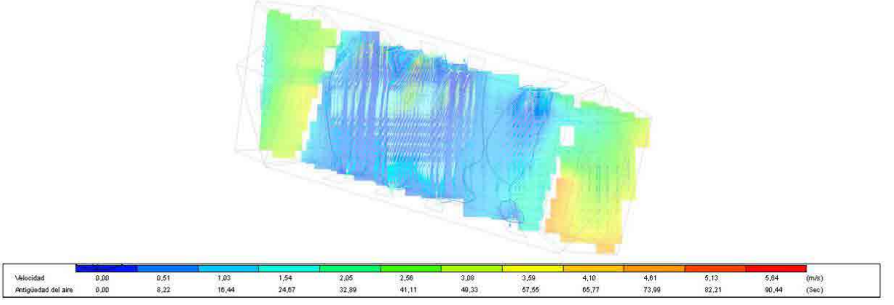

Figure 6. Internal CFD analysis. (DesignBuilder software)

conditions that we obtain in the external analyses. We can see one example in Figure 5. In the second step, we will perform the internal analysis that will report data like airspeed, direction, and age. These values allow us to quantify the effectiveness of the ventilation. For example, in Figure 6, we can see the vectors of airspeed and the age of air for the east wind whit 3 m/s airspeed. Regarding the airspeed, we observe speed peaks at the entrance or exit of 2 m/s airspeed, this is due to the Venturi effect caused by the façade openings. We must distinguish two different zones in the interior space. The first zone there is just inside of the airflow that througing the building. The second zone there is outside this airflow. Inside the airflow, we observe velocities of approximately 1.54 m/s and an air age of 8.22 s. Outside the main flow zones, the air moves at a speed of approximately 0.5 to 1 m/s, with the age of the air being between 10 and 30 seconds.

With the results of the internal simulation, we can perform the PPD analysis. In this third step, we will need to define some parameters like metabolic conditions (0.7) or clothing indices (0.5). Continuing with the example, Figure 7, we can see that in the airflow areas the percentage of dissatisfied people is around 23.7 %. However, in the zones outside this airflow, we find a percentage of dissatisfied around 5% or 11.06 %.

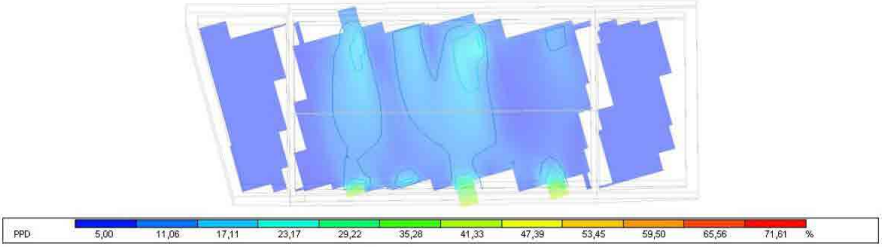

Figure 7. PPD analysis. (DesignBuilder software)

			Airflow area			No affect by airflow area		
			Speed m/s	Age of Air s	PPD %	Speed m/s	Age of Air s	PPD %
East 80 degrees	12	F1	10	0	12,3	6	0	19,5
	m/s	F2	12	0	10,04	6	0	18,7
	3	F1	4	4,24	24,6	1,37	12,71	11,08
	m/s	F2	5	4,24	23,17	2,73	8,47	8,1
	1,6	F1	1,54	8,22	41	0,51	24,67	12
	m/s	F2	2,5	8,22	48	0,51	16,44	20
West 270 degrees	12	F1	7,75	0	90	5,17	11,97	43
	m/s	F2	16,8	0	98	7,75	15,89	56
	3	F1	3,87	7,46	50	2,32	18,64	21
	m/s	F2	4,55	3,73	60	2,32	14,91	29
	1,6	F1	1,25	15,33	33	0,42	45,99	6
	m/s	F2	2,51	7,07	47	0,84	30,06	13

Table 2. Table of internal CFD results

3. DISCUSSION

Based on the results we can analyse two phenomena. Firstly, if we observe the airspeed, we note important variations between the first and second floor, around 1 m/s and 2 m/s airspeed. This fact has a direct effect on the PPD percentage. In all cases, the PPD percentage of the first plant is higher than the second plant. We can explain this effect with several factors. On the one hand, the dragging effect of the land causes a speed differential between the facades of the first floor and the second floor. On the other hand, according to the characteristics of the case study, the ground floor has unaligned windows that disturb the airflow. However, on the second floor, there are windows aligned due to the symmetry of the east-west facades. For that reason, the airflow isn't blocked by static air masses. Therefore, natural ventilation is more effective on the second floor thanks to its higher height above the ground, which allows it to capture winds at greater speed. Also, its distribution of symmetrical windows on the perpendicular facades the wind direction. Note that the purpose of this floor is drying agricultural products. Therefore, it isn't surprising that we find better natural ventilation results, since it was precisely designed for that objective.

Secondly, there are significant differences between the PPD results of the eastbound wind and the westbound wind. This is mainly due to the seasonal regime to which these winds belong. The wind from the West is more frequent during the autumn and winter season. Therefore, associated temperatures are too cold to be comfortable. Furthermore, if the west wind occurs in summer, we can associate it with the characteristics of a *terral* wind. Terral is a dry and warm wind originated by the pressure difference between mountain ranges and flatlands near the seacoast. *Terral* wind does not have the necessary characteristics to guarantee thermal comfort through natural ventilation. However, the capture of this dry west wind is essential for the drying process of agricultural products. As said in previous paragraphs, the main objective of this kind of building is to be used for agricultural purposes. And in this case, the building efficiently uses natural ventilation for this function.

Unlike the wind from the West, the East wind, is better suited for natural ventilation. This is a thermal wind; therefore, its intensity increases proportionally to the inland temperature. This phenomenon is ideal, due to the fact that the more the temperature increases the more airflow its needed to reach comfort conditions. As we can see, in *Olgyay's* (Olgyay, 1998) hygrothermal comfort chart. As a result, the PPD analyses of the east wind combinations practically guarantee comfort conditions. The *ASHRAE 55* recommends PPD values of around 10 percent. However, the results obtained in many PPD analyses far exceed this value. This is because, usually, comfort statistical data is collected from northern regions. *Victor Olgyay* states (Olgyay, 1998) that humans are capable of varying our comfort temperature to adapt to the climate in which we are.

Indeed, if we adjust the thermal comfort values in the Climate Consultant application, we can obtain results that are closer to the reality of the local population. We can increase the thermal comfort up to 2 degrees, reaching 25.9 degrees. The relative humidity could increase up to 5 points, reaching 85%. Finally, the airspeed could change, from 1.5 m/s to 2.5 m/s, with high temperatures and high humidity air conditions. With these comfort parameters, the comfort hours obtained in the hygrothermal chart increase by 4%, and 3.7 % the ones related to natural ventilation. Also, the need for cooling decreases to 0.6%, which represents only 56 hours a year. This last datum does not consider the needs of air dehumidification. Therefore, the comfort conditions would likely reach the values required by ASHRAE if there were statistical data collected from the region of study.

CONCLUSIONS

- We can confirm that the orientation of the traditional constructions in Valencia is perfectly oriented to capture the wind of the region in the most efficient way.

- The type of openings and their arrangement on the façade, that is, high and narrow windows, are very useful for compressing and therefore accelerating the air as it goes through them.

- The symmetrical façade arrangement facilitates airflow through the construction, minimizing the number of turbulences and air pockets at different speeds.

- With the climatic data presented and verified with the CFD & PPD simulations, we can state that the region of Valencia has an ideal wind regime for natural ventilation as a bioclimatic design strategy.

- The CFD & PPD analyses are a relatively simple and useful tool to be used also in new projects. It would be interesting to implement this work dynamic in the initial phases of a project.

- Natural ventilation is one of the most useful bioclimatic design tools in almost all the Mediterranean arc, almost in the territories near the coast. It would be interesting to transfer this experience of study on natural ventilation to more exhaustive analysis conditions based on Indoor Air Quality, IAQ. With this methodology, we could analyse if quality of air and its pollutions is adequate for natural ventilation.

- It is necessary to carry out a deep analysis of the tools to obtain PPD results, specifically their databases, to adjust the analysis parameters to the real comfort conditions of the population in the latitudes and regions of study.

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PAPER #7.22

ECOMIMETICS: THE MAXIMUM POWER PRINCIPLE FOR RETHINKING URBAN SUSTAINABILITY

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ABSTRACT

Despite their numerous achievements, mainstream approaches to sustainable design have failed to address global environmental challenges from a complex systems perspective. For some critics this is rooted on a reductionist understanding of design solutions that gravitates towards the first law of thermodynamics (energy efficiency); whereas buildings, neighborhoods, and cities should be comprehended as self-organizing complex systems. As Lotka pointed out, the first and second law of thermodynamics alone cannot unravel the energy dynamics of these type of organizations, and a system thinking approach is required. Mimicking ecosystems' self-organizing structures provides an alternative pathway to design cities as complex, resilient structures. Ecosystems exist at many scales, inside the stomach of a ruminant or as an entire rainforest and, through evolution, have adapted to extreme conditions that in many cases involve limitation of resources, daily and/or seasonal increase or decrease of temperatures, overpopulation, or catastrophic events. More interestingly, ecosystems adhere to the maximum power principle as re-defined by H. Odum, which states that systems that maximize their flows of energy tend to persist over time. This principle suggests that, counterintuitively to our beliefs, systems that use more resources can be more effective in the long term. Cities, like ecosystems, are self-organizing complex systems. Their complexity arises from the flows of energy, matter and information through the multiple components that maintain the whole city system in a steady state, away from thermodynamic equilibrium. Here it is proposed that for cities to prevail and be resilient in the context of a changing climate they need to maximize renewable energy flows and minimize entropy generation.

KEYWORDS

Biomimetic design; ecomimetics; ecosystem biomimetics; systems thinking; maximum power principle.

INTRODUCTION

Unrestrained anthropogenic development causes environmental changes at a global scale. Long-term impacts in human and non-human systems are expected and only mitigation and adaptation measures will help to manage these impacts (Rajendra et al. 2014). Rokstrom et al. (2009) introduced the idea of planetary boundaries and argued that operating within these boundaries could assure a stable global environment, but anthropogenic development is estimated to have already transgressed three of these boundaries: climate change, biodiversity loss and nitrogen cycle disruption.

The consequences of crossing one or more boundaries are unpredictable because the Earth is a complex self-regulating system as described in Lovelock's Gaia theory (Lovelock 1972), and the interdependency between variables implies that changes in one variable or system might provoke the transgression of one or more other boundaries. One variable that controls climate change is atmospheric CO_2 concentration. The increase in CO_2 levels is directly connected to the building industry (due to energy use) and indirectly to architectural

design choices (which affect energy use). In addition, resource scarcity is also a critical topic on a finite planet where buildings and the building industry are accountable for 30% of raw material use and 40% of energy use globally (Huovila et al. 2010). The problem of resource scarcity is more evident when the Earth is characterized as a thermodynamic system, closed to matter and open to solar energy. The first reflections on scarcity in connection to population growth were documented in Malthus' seminal paper (Malthus 1798). Later on, Jevons studied the negative and counterintuitive results of improving technology and increasing energy efficiency in the context of coal mines (Jevons and Flux 1906). According to the so-called 'Jevons' paradox', increased efficiency stimulates more resource use due to relatively lower costs associated with the more advanced technology. Similar conflicting aspects regarding energy efficiency were also observed in physical and non-physical systems, and described as the maximum power principle (Odum and Pinkerton 1955). This principle states that, in a context of abundant resources, all living and non-living systems tend to capture as much energy as possible to produce maximum power output, and only when resources are scarce do systems tend to favor efficiency. These ideas align with the observed evolution in human made systems where augmented access to energy sources, (e.g. development of agriculture, the Industrial Revolution) triggered important technological and scientific advances that increased exponentially the use of resources, but also increased the complexity of human systems. According to the maximum power principle, this unrelenting capture of high quality energy is common to all living systems. This document will discuss how the maximum power principle can help support counterintuitive ideas for complex systems centered environmental design

Architects and urban planners have traditionally reflected on the relationship between buildings, energy and the city (Geddes 1950, Mumford 1963), but these ideas had little repercussion in the built environment until the oil crisis in 1973. During this period of relative 'energy scarcity' efficiency measures took preference over maximum power strategies, and the foundations of sustainable design where established around matter and energy use concerns.

The approach to environmental design represented by sustainable architecture has been very successful in raising awareness of limited resources and climate change challenges. It also has provided global but reductionist tools to assess the environmental performance of buildings (e.g. LEED, BREEAM); however, sustainable design has failed to address the environmental challenge from a complex systems perspective. Whether the study is focused on a building, a neighborhood or a region, these are self-organizing complex systems and the first and second laws of thermodynamics alone cannot unravel their energy dynamics.

Mimicking nature appears to be an inspiring approach to environmental design capable of conceiving buildings as complex systems. Although there are many angles to the definition and characterization of biomimetic design, a central idea is that biological systems have accumulated countless successful design solutions through millions of years of evolution and adaptation (Benyus 1997). In that regard, biomimetics refers to the study, understanding, abstraction, and modeling of biological systems with the purpose of solving technological and design problems (ISO 2015). The term has also been defined as "learning from nature" in contrast to trying to copy nature, meaning that a deep understanding of biological functions and processes is necessary for successful developments. Biomimetic design argues that humans can learn from nature's vast experience and, when intended, environmental goals can guide the design process. Among the possible biological systems that can interest designers are ecological systems. Mimicking ecosystems is

also known as ecomimetic design and refers to biomimetic research that learns from and emulates ecosystem processes and functions in design exercises (Garcia-Holguera et al. 2015b). Cities and buildings, like ecosystems, are complex systems; and their complexity arises from the variety of their components, both biotic and abiotic, and from the flows of energy, matter and information that connect their elements and maintain the system in a steady state, away from thermodynamic equilibrium. Ecosystems exist at many scales, inside the stomach of a ruminant or as an entire rainforest and, through evolution, ecosystems have adapted to extreme conditions that in many cases involve limitation of resources, daily and/or seasonal increase or decrease of temperatures, overpopulation, or catastrophic events, for example. Persistent ecosystems have a complex network of interactions among their components that ensures their resiliency and maintains essential energy flows in the system even in adverse conditions. These characteristics suggest that mimicking ecosystems' complexity and energy dynamics might have great potential both for innovative urban and building design and for optimization of buildings' environmental performance.

1. ECOSYSTEMS INFORMING CITY PLANNING / CITIES MIMICKING ECOSYSTEMS

There are multiple definitions that try to grasp the nuances of the term "ecosystem". One definition commonly accepted is the one given by the Convention on Biological Diversity: "a dynamic complex of plant, animal and microorganism communities, and their non-living environment interacting as a functional unit" (United Nations 1992). Another similar definition is the one by H. Odum (1994) that describes an ecosystem as "an organized system of land, water, mineral cycles, living organisms, and their programmatic behavioural control mechanisms". The study of ecosystems is presented by some researchers as a holistic discipline (Odum 1977, Jørgensen 2002) in which ecological systems are described as hierarchical structures of nested levels that increase in complexity and self-organization through time (Kay 2004). Also it has been established that mature ecosystems with more complex structures (i.e. more elements, more food chains, etc.) are more efficient in their biomass to energy use ratio (Margalef 1963), and the same author stated that a similar correlation could be found in human systems; where urban centers could be compared to mature and more efficient ecosystems whereas rural areas would correspond to less mature ecosystems. Other authors agree in recognizing that both building and ecological systems can be characterized as open thermodynamic complex systems (Allen 2001, Fernandez-Galiano 1991, Kibert, Sendzimir, and Guy 2000), but it is the correlation between energetic flows in cities and living systems that has drawn more attention (Allen 1998, Purvis, Mao, and Robinson 2019, Marchettini, Pulselli, and Tiezzi 2006). Three characteristics of ecosystems are particularly relevant in the context of ecomimetic and environmental design of cities: Ecosystems are complex systems that function as thermodynamic open systems and follow the maximum power principle.

1.1. Cities characterized as complex systems

Cities and ecosystems behave like complex systems in that their outputs do not stem from linear interactions but are rather the result of multiple feedback loops. Feedback loops are pathways that reinforce or suppress the processes that characterize a system (Odum 2004). A system is made of components, their interconnections and a number of particular functions or purposes (Meadows and Wright 2008). Components or elements in a system are easy to identify, interconnections (such as feedback loops) might be harder to find, and are essential when trying to understand or

restructure a system. The purpose of a system can be deduced from its behavior, and a system might be formed by multiple subsystems with different purposes. Changing the elements in a system can keep the system unaltered; however, changing their interactions or the purpose can significantly modify the system. In an urban system, the interactions between the city components and their reinforcing feedback loops generate specific patterns through time. Some of these behaviors respond to purposes that have defined our cities as residential, economic and socio-cultural spaces. It is crucial to modify these purposes and interactions so that anthropocentric urban systems can evolve into biocentric ones. An urban system whose success is measured by its capacity to provide clean air will be very different from one that aims to provide fast vehicular access to its citizens.

Furthermore, systems theory has shown that urban planners and architects can learn from ecosystems' organization and structure. It appears that complex systems tend to share structural features (Anand et al. 2010) and that there are general common principles to many systems that are independent of its components or the local interactions among those components (Von Bertalanffy, 2008). It is also known that systems that seem to be completely dissimilar can generate similar dynamic behaviors (Meadows and Wright, 2008). These ideas are especially relevant when thinking of cities and ecosystems which are two types of systems with apparently few things in common. It makes sense then that mimicking ecosystems' feedback structures might guide designers towards repurposed urban systems.

1.2. Cities characterized as open thermodynamic systems

The thermodynamic field is another link between urban systems and ecological systems as both system types have to deal with variation and regulation of their energetic inflows and outflows. However, one interesting difference is that in the built environment the first law has mostly ruled the approach to thermodynamics. Kay (2004) points out that while the first law of thermodynamics is a description of energy flows in terms of their quantities, the second law has to do with their energy quality. In other words, with the first law we measure efficiency whereas with the second law we describe the effectiveness of the flows. Kay argues that, historically, technology and engineering have concentrated on the quantifiable aspects of energy exchanges, rather than focusing on the quality of those exchanges.

Fernandez-Galiano (1991) compares the "culture of energy", which is represented by a society that seeks increased production and resource consumption, with the "culture of entropy" that focuses on conserving resource, and values energy quality. The second law of thermodynamics and the concept of entropy bring out the notion of irreversibility in all processes and the inevitable decay of systems through time. Cities, however, like ecological systems, perform as dissipative structures that maintain their structure and/or morphology thanks to the constant inflow of high quality energy. This high quality energy that is able to perform work is called exergy. Exergy is always lost during the lifetime of any system, in stark contrast with the conservation of energy guaranteed by the first law of thermodynamics. When all exergy is consumed and there are no inflows of exergy, the system tends to reach thermodynamic equilibrium which in ecological systems is equivalent to death.

The concept of exergy is also very helpful in understanding self-organization processes of ecological systems. When the internal exergy in a system is greater than the exergy needed for the maintenance of the system, then the system uses that excess to create new order; these types of organizational structures are Prigogine's (1968) dissipative structures. Kay et al. (1999) restates the work of Prigogine who pointed out that open systems receiving exergy are moved away from equilibrium and

Kay adds that, despite this, Nature still tends toward equilibrium. Within this framework, Kay (1999) defined what he called the Self-Organized Hierarchical Open systems or SOHO systems and argued that ecosystems have to be understood as SOHO systems in order to develop an ecosystem approach. Analogously we could say that cities also have to be understood as self-organized open systems in order to develop a design approach that mimics ecosystems: ecomimetics.

In addition, there is another interesting concept in terms of energy accounting for ecological systems and buildings. The concept of "emergy" or embedded energy was first coined by Odum (Odum 1994, 2004, Odum 1996) and refers to the amount of energy of just one type that is necessary to make one unit of another type of energy. The idea is based on the notion of energy hierarchy in ecological systems; that is, in ecological processes "at each step much of the energy is used in the transformation, and only a small amount is transformed to a higher quality, one that is more concentrated and in a form capable of special actions when fed back" (Odum, 1994). The ratio of emergy vs. energy is called the "transformity" ratio, and Odum states that emergy analysis can be used to place cities and buildings in their energy hierarchy level. Comparing ecological systems with human systems in terms of emergy/exergy ratio shows that natural systems have a lower ratio than man-made systems; which in other words means that, when referring to solar radiation, ecological systems are more effective in capturing exergy; that is, natural systems have evolved to maximize the useful work that they can perform with incoming energy flows. Emergy has been used to analyze the energy hierarchy of ecological systems and it has been proposed as a means to assess the energy hierarchy of buildings and cities (Odum, 1994). Emergy analysis has also been implemented to maximize renewable resource use in buildings (Srinivasan, et al. 2012), to conduct life cycle assessment (LCA) in buildings (Srinivasan, et al., 2014), to optimize urban design (Lee and Braham 2017), and to evaluate eco-efficiency of building manufacturing (Li, et al., 2011). The use of thermodynamic approaches in ecological systems and urban studies is not new. In the past, researchers have stated similar interpretations of the second law of thermodynamics in the context of resource use of buildings (Fernandez-Galiano 1991, Mumford 1934), and urban systems (Wilson 2010, Kapur† 1982, Balocco et al. 2004, Nielsen and Jørgensen 2015, Purvis, Mao, and Robinson 2017, Fistola 2011, Pelorosso, Gobattoni, and Leone 2017, Wilson 2009). This extensive work supports the idea that thermodynamics is an appropriate means to convey relevant concepts from ecology to architecture and urban design in the context of ecosystem biomimetics.

1.3. Cities and the Maximum Power Principle

Advancing further in the similarities between ecosystems and urban systems, the Maximum Power Principle (MPP) may appear as a disruptive concept when associated to the practice of environmental design. Lotka was the first to discuss the idea of a maximum-energy-flow governing principle in an effort to explain the thermodynamics of living systems in the light of Darwin's natural selection theory (Lotka 1922b, a). This principle expresses that living systems compete for available energy and aim to maximize the capture of useful energy (i.e. exergy); the type of energy that allows these systems to sustain their structures first, and increase their complexity subsequently (i.e. evolve). Odum, reformulated this principle incorporating the idea of energy hierarchy or emergy (Odum 1996); and stated that systems that prevail tend to use all available emergy sources in whatever form they exist (Odum 2004). When translated to man-made systems, such as urban areas, Odum's MPP suggests that, in times of resources scarcity, successful systems would be complex, high-quality, and diverse structures in opposition to more temporary and delicate constructions (Odum 2004). Sciubba confronted Lotka's and Odum's ideas with Prigogine's theories

on far-from equilibrium dissipative systems to reformulate the MPP: prevailing systems tap maximum exergy with minimum entropy generation, in stable boundary conditions for the time period considered (Sciubba 2011). Sciubba's reformulation of the MPP could be reinterpreted as follows in the context of urban systems: in extended time periods, during which the environment surrounding a number of urban areas remains stable, the urban systems that prevail are those capable of capturing maximum useful energy sources with minimum waste production.

These ideas are in conflict with some accepted viewpoints on sustainable design that rely on the first and second law of thermodynamics. According to the maximum power law, as stated by Lotka and Odum, an urban system would tend to maximize its power output, independent of the efficiency of the system's individual parts. The output of an urban system might consist of products (e.g. items produced in a factory), services (e.g. health services in a hospital), information (e.g. designs in an engineering firm), or energy (e.g. electricity from a gas power plant). When these outputs become inputs to another system, the overall complexity of the larger man-made system is increased. However, when part of the output is labelled as waste it means that the system is not capable of further transformation or use of the energy that is still embedded in that output (e.g. food leftovers sent to a landfill instead of a biodigestor). Describing cities as thermodynamic complex systems implies that inflows and outflows of energy, matter and information are accounted for across components, and that outcomes capable of performing useful work can be redirected towards another system or be fed back to internal sub-systems rather than be discarded as waste. In some aspects, these aspirations align with the ones proposed by Cradle to Cradle or circular economy design approaches. The maximum power principle moves beyond these theories and suggests that urban systems that capture more resources can be beneficial by providing more high-quality energy outcomes, but only if they are capable of minimizing the entropy that is generated by the system. This parallel between ecological and human-made systems in the management of energy resources offers a framework for understanding and pursuing environmental design that diverges from the one traditionally adopted in sustainable architecture.

2. IMPLICATIONS OF THE MAXIMUM POWER PRINCIPLE FOR URBAN ECOMIMETIC DESIGN

An ecomimetic design approach that stems from the features described above (i.e. complexity, thermodynamics, maximum power principle), has more opportunities for finding meaningful correlations between ecology and design. Such design approach has also more possibilities of engaging in environmental urban design that is regenerative and resilient.

The idea of understanding urban systems as complex thermodynamic open systems has been discussed in the literature to some extent; however, the discussion of the Maximum Power Principle as a relevant topic for architectural and urban design has not been explored until recently (Braham 2016, Yi et al. 2017b) and deserves more exhaustive investigation. There are two pathways that would need detailed research. One refers to qualitative implications of the MPP for urban and architectural design, and the second has to do with the quantitative tools that would be required to advance research in this topic. A brief introduction to these two pathways is presented with the purpose of beginning a conversation among the design community.

2.1. Qualitative implications

At least, two qualitative properties are key for characterization of urban or architectural systems under the MPP. The first one requires to design buildings and cities prepared to capture all available exergy sources, whereas the second property entails minimum entropy

generation by these systems. This is in direct contradiction to the postulations of sustainable design that aim for maximum efficiency through resource use reduction. At the core of the 'maximum efficiency' paradigm is the non-renewable condition of most energy sources used in human-made systems and the generation of by-products that pollute the overall ecosphere. If open systems, like the Earth system, rely only on non-renewable sources they will head towards thermodynamic equilibrium or extinction; however, if renewable sources are included in the equation, systems can prevail if the consumption rate is adjusted to availability of resources (Sciubba and Zullo 2011). Projections for global renewable energy use suggest a steady increase overall, potentially reaching 80% of energy use by 2100 (Demirbas 2009); although recent studies are less optimistic based on actual performance reported from developed countries (al Irsyad, Halog, and Nepal 2019). Nonetheless, even the most promising scenarios would not be enough to explain why any system should aim for maximum power use in a context of climate change and resources scarcity. However, if the emphasis is put not just on the amount of energy flowing through the system, but instead on the quality and hierarchy of the energy flows, then the discussion can be examined from a complex system perspective. This means that cities using maximum exergy power would be expected to develop a wider network of subsystems (e.g. transportation systems, food production systems, public spaces, educational institutions, etc.) with increased functions capability and increased interconnectivity. These specialized sub-systems would generate higher quality outputs or energy outflows, that in the long term would make the overall system more efficient (Odum and Pinkerton 1955). This means that efficiency would be achieved by increased complexity of the urban system, rather than through energy use reduction. Another important aspect is the cyclical behavior of systems as described by Holling (1992). According to Holling, a system grows and evolves to become an efficient structure, after which some sort of decay will follow before the system can reorganize itself into a more complex, evolved system, or else move into degeneration or devolution. Urban systems also go through cyclical changes that fit within Holling's theory of ecosystems' dynamics. For example, the city of Detroit illustrates the case of an urban system experimenting decline and facing a reorganizational stage that will define if the city evolves into a new prosperous structure or if instead it goes deeper into decay and degeneration (Apel 2015).

As mentioned above, maximum power use is to be complemented with minimum entropy generation. Minimum entropy generation entails that the outputs of the system are in balance, or almost in balance, with the surrounding environment. This means that successive transformations of energy flows follow a hierarchical pathway through multiple subsystems until the final outflow's energy gradient is minimal in relationship to the external environment. Pollutants, floods, or thermal radiation are examples of entropy outputs of a city or thermodynamic waste. These outputs are an opportunity to increase the complexity of the urban system by processing the useful energy still present in these flows. Again, increased complexity of the system is crucial to allow such a refined conversion of energy flows to happen. Researchers have studied and recommended strategies that promote higher urban complexity and minimum entropy generation (Pelorosso, Gobattoni, and Leone 2017). Pelorosso et.al., prepared a list that proposed rain gardens, infiltration basins, green roofs, phytoremediation plants, wetlands, or parks, as low-entropy-nature-based solutions. However, the challenge is not so much in identifying, designing or implementing these strategies, but rather in planning the interconnectedness and feedback loops of these and similar strategies to the overall system. Traditional approaches to urban design, budgetary and

time constraints might explain the inclination to design cities in fragments and pieces, whereas a complex system approach would require that even small modifications should be considered opportunities to enhance the overall system.

2.2. Quantitative implications

In order to design cities that mimic ecosystems' complexity and energy dynamics, reassessment of existing tools and incorporation of transdisciplinary tools is necessary. Emergy analysis is one method to comprehensively assess global energy use in urban and building systems (Pulselli et al. 2007, Srinivasan et al. 2012, Srinivasan et al. 2014, Li et al. 2011, Lee and Braham 2017, Yi et al. 2017a). The majority of the emergy analysis exercises use solar energy as the baseline to evaluate system's energy hierarchy, since the Sun's irradiated energy is the renewable source that is at the bottom of most ecological and human-made systems. Emergy analysis supports a more transparent representation of energy pathways in urban systems and improves energy accountability. Critics to the method argue that calculation of solar embedded energy and transformity ratios tends to be oversimplified, although this is common to most holistic approaches, such as Life Cycle Assessment methods (Wang and Zhang 2011)

System modeling tools are another useful means to design complex urban systems that mimic ecological systems. These tools are especially relevant for their capability to represent the dynamic behavior of the system under study, as well as the positive and negative feedback loops that explain its performance. System modeling tools have been used in several fields including environmental modeling (Ford 2010), but also in the representation and characterization of buildings and cities (Dyner, Smith, and Peña 1995, Thompson and Bank 2010, Shen et al. 2005, Oladokun, Motawa, and Banfill 2013, Garcia-Holguera et al. 2015a) Integrating these tools at the beginning of urban and architectural design exercises would advance qualitative and quantitative research that aspires to mimic ecological systems.

CONCLUSION

Biomimetic design suggests that lessons can be transferred from biological systems to optimize technological systems. Cities can emulate ecosystems and be designed as complex open thermodynamic systems that adhere to the Maximum Power Principle as defined by Lotka and redefined by Odum and Sciubba. An urban system planned according to these principles is one that captures maximum amounts of renewable sources to increase its structure and complexity. Such a city relies on a strong network of interconnected sub-systems that are capable of minimizing waste outputs from the overall urban system by reusing and recycling most of its flows. The more renewable resources the urban system captures, the more its structure becomes resilient and diversified, prepared to face unexpected changes and regenerate when external conditions become stable. In the light of the Maximum Power Principle energy use reduction strategies would weaken the urban system and reduce its complexity; whereas the MPP suggests that, similarly to the phases observed in ecosystems' cycles, a mature urban system would ultimately develop efficiency based strategies and support entropy reduction approaches. Therefore, it is proposed here that maximization of energy flows (i.e. renewable) for increased complexity of urban systems will promote robust and resilient cities for climate change adaptation and mitigation.

Next steps will include the development of urban models using the above proposed tools to test the dynamic behavior of an urban system designed for MPP.

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PAPER #7.23

RSM ADJUSTMENT IN ABSORPTION COEFFICIENT DETERMINATION OF MATERIALS IN ROOM ACOUSTICS

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ABSTRACT

Theaters and auditoriums are one of the most important equipment in a city.

The main parameter which determines the adaptation of theaters and halls to their intended activity is the reverberation time. It depends on the shape and size of the enclosure, the materials used in the construction of the enclosure and the way they are built. The absorption coefficient of the materials of a room will be needed either to design it or to analyze its behavior.

The absorption coefficient of the materials in a theater or hall can be determined using the response surface methodology. Its application can be very adequate in such cases in which the functioning of more than one surface is unknown.

This approach can be very inefficient when the unknown material has an extreme behavior (i.e.: very reflective or very absorbent). The reason is the limited range of the increment when coefficients are very small, as the generated response surface area may not contain the target (that would be the reverberation time).

Extreme cases can be better handled with a new approach to assess the real behavior of these surfaces, and therefore of the room, in an effective manner. The adjustment performed will be illustrated through a case study in this paper.

KEYWORDS

Response surface methodology; room acoustics; reverberation time; simulation; modelling.

INTRODUCTION

The adaptation of a theater or music hall to their intended activity is mainly determined by the value of the reverberation time (RT. Reverberation time is the time Sound Pressure Level takes to decay 60dB from the initial value. (Beranek,1996). To recommend an RT value for a specific space, it is used the $RT_{mid,}$ (the mean of RT for the octave bands of 500Hz and 1000Hz). The recommended values of the RT_{mid} of a room depend on the activity that will be held inside. Some RTmid recommendations are shown in Table 1.

Room type	RT_{mid}, occupied seats [s]
Conference room	0,7-1,0
Theater	1,0-1,2
Opera	1,2-1,5
Concert Hall (chamber music)	1,3-1,7
Concert Hall (symphonic music)	1,8-2,0
Church (organ and chorus)	2,0-3,0

Table 1. RT_{mid} recommended values for different type of rooms. Source: (Carrión 1998)

The acoustical analysis of a room can be made by using simulation software. In this study, we have analyzed an Autocad 3D model of the theater of the *Banda Primitiva of Llíria* (Fig. 1) using Odeon acoustic software and Surface Response Methodology (Llinares,2012). This theater is located in the

town of Llíria (Valencia, Spain). It houses the *Banda Primitiva* headquarters and has 1000 seats. The *Banda Primitiva of Llíria* is a musical society with more than 200 years of history; its theater was built in 1951 by J. Rieta architect, and it was refurbished in 1991. First, an on site RT30 measurement has been conducted. Then, a model of the theater has been drawn using 3D CAD and exported to Odeon software. Based on the construction details, blueprints and visual information, we have assigned an absorption coefficient to each surface. The value of the absorption coefficient of a surface varies from 0 (very reflective) to 1 (very absorbent), and it is influenced by the way the material is set in place. Then RSM has been used to adjust the coefficients of the model, in order to make it behave as the real space.

The purposes of the present work are as follows:

• First, to show the possible problems that can appear in the application of the RSM in the analysis of a room, when the surfaces with unknown behavior have extreme absorption coefficient values (near 0 or 1).

• Second, to propose a variation in the RSM application, in order to solve the problem above.

1. METHODS

1.1. Measurement points

This study can be divided into two parts, an on site measurement of the acoustical parameters of the impulse response of the theater and a ray tracing acoustic simulation using a 3D model.

To conduct the on site measurement we have set 20 reception receivers points in the audience plane (non symmetrical in relation to the room axis) (Table 2). The sound source was set in the middle of the apron. There was no audience during tests. Measurements were registered with DIRAC software (DIRAC, 2009); after a file treatment room acoustic parameters were obtained. The mean RT 30 is shown in Table 3.

Centre of coordinates (0) was set in the lower point of the apron, where it meets the audience plane floor (as shown in Fig. 2).

The 3D Autocad model was set inside of a completely absorbent box and then imported to Odeon software (Odeon, 2009). Parameters such as the data of the source, the location of the receiver, the absorption coefficients of the surfaces of the enclosure and the scatter has been typed in.

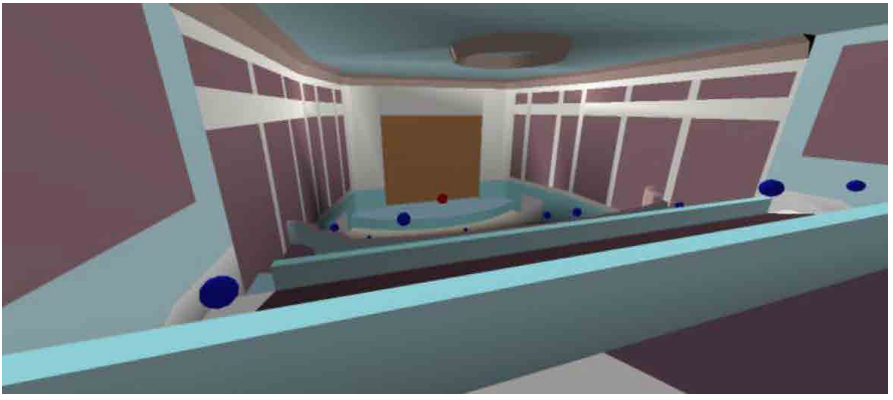

Figure 1. 3D model of the Theater of the Banda Primitiva of Llíria from receiver number 17 position.

Receiver number	X	Y	Z	Receiver number	X	Y	Z
Source	0,57	0,20	2,64				
1	-4,74	-0,03	1,74	11	15,23	-5,4	6,58
2	-10,50	-0,03	2,28	12	-19,30	-5,35	8,47
3	-17,24	0,03	2,92	13	-15,62	0,21	7,02
4	-20,84	-7,00	3,27	14	-17,39	6,51	8,15
5	-13,66	-7,22	2,58	15	-20,21	0,49	9,11
6	-7,65	-6,32	2,01	16	-20,34	8,71	8,79
7	-3,74	7,00	1,64	17	-23,12	7,37	10,42
8	-16,82	7,34	2,88	18	-25,61	4,19	11,11
9	-12,87	8,36	6,33	19	-22,23	0,05	10,42
10	-14,03	0,17	6,33	20	-24,86	-7,56	10,76

Table 2. Coordinates of the source and microphones.

Frequency	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz
On site measurement	1,451	1,206	1,112	1,184	1,148	1,016

Table 3. Mean RT 30 measured on site

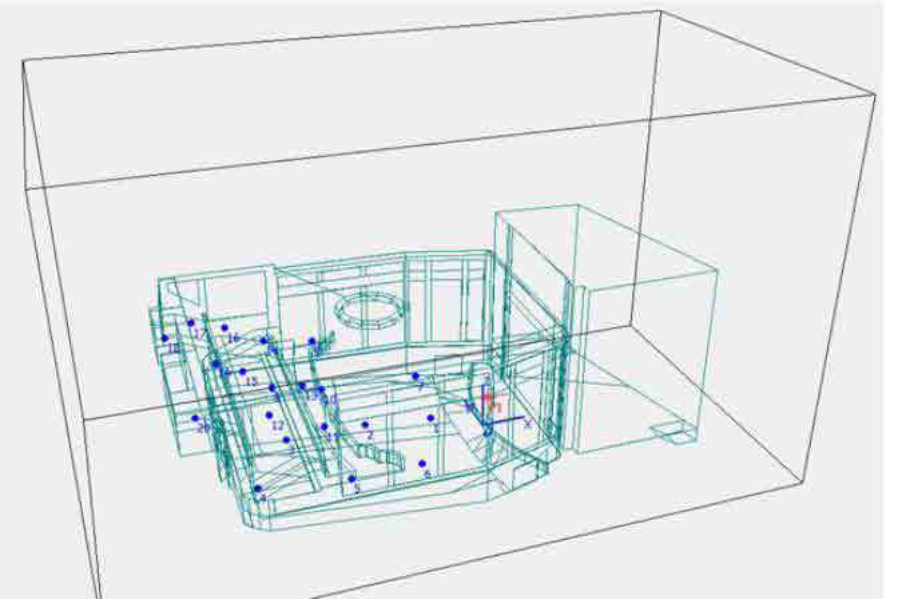

Figure 2. Sound source and microphones situation.

1.2. RSM in acoustical room analysis

The definition of the variables which define the acoustic behavior of a room can be made by an iterative adjustment process or by the Response Surface Method (RSM) (Llinares, 2012). The first one proves to be useful when studying small rooms or when the researcher is experienced. The second one is a very systematic method, which helps the detection of influential and non-influential variables in the reverberation time of the room. It also allows to obtain data of non-superficial elements. (Pérez et al., 2018). The RSM explores the relationships between several explanatory variables, and one or more response variables. The goal is to use a sequence of designed experiments to obtain an optimal response using a second-degree polynomial. The response, in rooms conditioning, is the reverberation time of the enclosure. To apply this method the absorption coefficient of every surface of the space must be known except for two, the independent variables, whose values determine the response.
RSM can be applied to obtain a study region per surface. Then they are combined to get 9 absorption spectrum combinations.

Study region definition in the RSM application:

$$X_{1i} = N_{1i} \pm R_{1i}$$

Being:
$B_{1i,}$ values taken from the bibliography,
$R_{1i,}$ increments which vary from 0 to 0,5

Analogously X_{2i}

The new absorption spectrum couples are introduced in Odeon to calculate the reverberation time of each combination. The combinations are acceptable when they fit between the maximum and minimum values of the on site measured reverberation time.
Obtained reverberation times are grouped by frequencies, creating 9 combinations of three points by frequency. The response surfaces which fit with those combinations are drawn. We obtain new couples of points from each surface which satisfy the target. We make a Table of the pairs by frequency, and we create new absorption spectrum coefficients combinations of the unknown surfaces. We calculate the reverberation time of each combination, and then we compare the results with the on site measurement.

Zone	Materials	Surface No.
Decorations and curve zones	Plaster frame	1
Stage ceiling, 1st & 2nd floor parapet	Plaster over brick	2
Stage pavement, 1st floor amphitheater	Floorboards over concrete	3
Ground floor pavement	Floorboards w/c	4
Ground floor carpet	Carpet over floorboards	5
1st floor amphitheater pavement	Linoleum	6
2nd floor amphitheater pavement	Enameled concrete	7
1st and 2nd floor stairs pavement	Marble	8
Vertical walls (w/cavity)	Plasterboard w/cavity	9
Vertical walls	Plaster over brick	10
1st floor parapet, ground floor baseboard	Thin wood panel w/cavity	11
Doors	Solid wood	12
Stage opening	Drapes heavy velour	13
1st & 2nd Amphitheatre seats	Medium upholstered chairs	14
Main floor seats	Chairs heavily upholstered	15
Ceiling	13mm plaster on 25mm studs (with mineral wool)	16
Upholstered wall frames	Fabric w/fibers & polyurethane foam	17

Table 4. Materials used in the simulation and number assignment.

1.3. Model settings

Materials used in the simulation are shown in Table 4; a number was assigned to each surface to work with them. Table 5 details the absorption coefficient of the materials described above. They have been taken from bibliography (Arau, 1999; Beranek,2004; Llinares et al., 2012) and from laboratory tests.

Next, the model was proceeded to validation. Parameters of calculation: number of rays: 8221, and impulse response length: 2000ms.

2. RESULTS

2.1. First adjustment

We have taken as unknown surfaces 16 (X_1) and 17 (X_2) (ceiling and upholstered wall frames) (Tables 6 and 7), because they are the surfaces that have a more unpredictable behavior, due to its composition and the way they are built.

Combining the two study regions we obtain absorption coefficient spectrum pairs (Table 8). We will run them in the model to get 9 reverberation time spectrums (Table 9). Note that combination number 5 (tr5) corresponds with the starting values of the model.

With these combinations and increments, combinations are outside acceptable limits (10%), as it can be seen in Figure 3.

2.2. RSM adjustment for extreme absorption coefficient values application

The absorption coefficient of the selected surfaces, has values close to 0 or 1. Due to the way RSM works, the increments we apply are not able to be very high, so we obtain pairs of points which are not very far from the initial considered value. Therefore, the reverberation time of the nine combinations does not get to the target at some frequencies. In this case

Surface No.	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz
1	0,130	0,130	0,250	0,280	0,300	0,300
2	0,160	0,160	0,100	0,060	0,040	0,040
3	0,400	0,400	0,300	0,200	0,170	0,150
4	0,050	0,050	0,030	0,060	0,090	0,100
5	0,110	0,110	0,140	0,370	0,430	0,270
6	0,020	0,020	0,020	0,030	0,040	0,040
7	0,010	0,010	0,010	0,010	0,020	0,020
8	0,010	0,010	0,010	0,010	0,010	0,020
9	0,290	0,290	0,100	0,050	0,040	0,070
10	0,013	0,013	0,015	0,020	0,028	0,040
11	0,420	0,420	0,210	0,060	0,050	0,050
12	0,010	0,010	0,050	0,050	0,040	0,040
13	0,140	0,140	0,350	0,550	0,720	0,700
14	0,560	0,560	0,640	0,700	0,720	0,680
15	0,720	0,720	0,790	0,830	0,840	0,830
16	0,260	0,260	0,200	0,100	0,070	0,040
17	0,050	0,050	0,190	0,350	0,840	0,980

Table 5. Absorption coefficient of the surfaces used in the simulation

X_1	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz
B_{1i}-R_{1i}	0,21	0,15	0,05	0,02	0,02	0,02
B_{1i}	0,26	0,20	0,10	0,07	0,04	0,07
B_{1i}+R_{1i}	0,31	0,25	0,15	0,12	0,06	0,12
INCREMENT R_1	0,05	0,05	0,05	0,05	0,02	0,05

Table 6. Study region of the unknown surface 16.

X_2	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz
B_{2i}-R_{2i}	0,01	0,15	0,30	0,79	0,98	0,84
B_{2i}	0,05	0,19	0,35	0,84	0,98	0,89
B_{2i}+R_{2i}	0,09	0,23	0,40	0,89	0,98	0,94
INCREMENT R_2	0,04	0,04	0,05	0,05	0,00	0,05

Table 7. Study region of the unknown surface 17.

combination	points	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz	
1	B_{1i}-R_{1i}	0,210	0,150	0,050	0,020	0,020	0,020	X_{11}
	B_{2i}-R_{2i}	0,010	0,150	0,300	0,790	0,980	0,840	X_{21}
2	B_{1i}-R_{1i}	0,210	0,150	0,050	0,020	0,020	0,020	X_{11}
	B_{2i}	0,050	0,190	0,350	0,840	0,980	0,890	X_{22}
3	B_{1i}-R_{1i}	0,210	0,150	0,050	0,020	0,020	0,020	X_{11}
	B_{2i}+R_{2i}	0,230	0,400	0,890	0,980	0,940	0,890	X_{23}
4	B_{1i}	0,200	0,100	0,070	0,040	0,070	0,070	X_{12}
	B_{2i}-R_{2i}	0,010	0,150	0,300	0,790	0,980	0,840	X_{21}
5	B_{1i}	0,200	0,100	0,070	0,040	0,070	0,070	X_{12}
	B_{2i}	0,050	0,190	0,350	0,840	0,980	0,890	X_{22}
6	B_{1i}	0,200	0,100	0,070	0,040	0,070	0,070	X_{12}
	B_{2i}+R_{2i}	0,230	0,400	0,890	0,980	0,940	0,890	X_{23}
7	B_{1i}+R_{1i}	0,310	0,250	0,150	0,120	0,060	0,120	X_{13}
	B2i-R2i	0,010	0,150	0,300	0,790	0,980	0,840	X_{21}
8	B_{1i}+R_{1i}	0,310	0,250	0,150	0,120	0,060	0,120	X_{13}
	B_{2i}	0,050	0,190	0,350	0,840	0,980	0,890	X_{22}
9	B_{1i}+R_{1i}	0,310	0,250	0,150	0,120	0,060	0,120	X_{13}
	B_{2i}+R_{2i}	0,230	0,400	0,890	0,980	0,940	0,890	X_{23}

Table 8. Obtained absorption spectrum pairs.

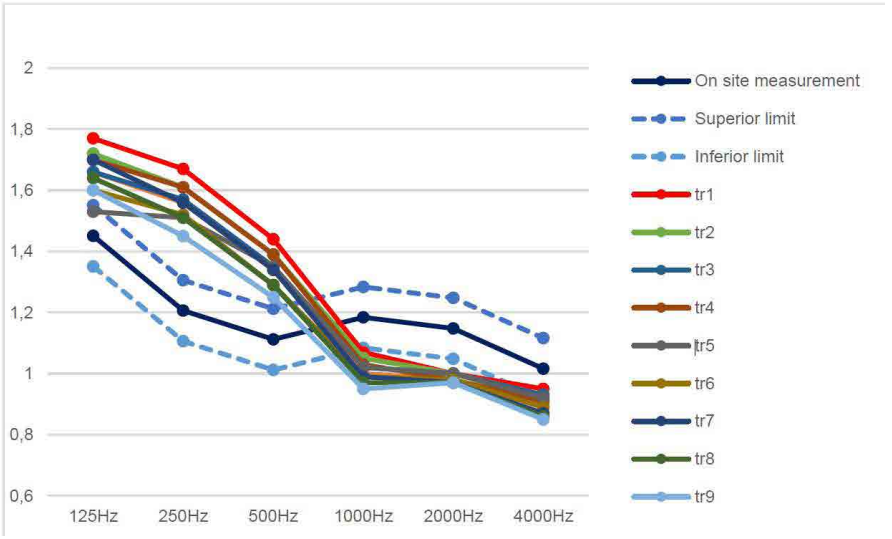

Figure 3. Reverberation time. Adjusted values, compared to on site measurement, initial model, and superior and inferior limits.

tr 30 average	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz
tr1	1,77	1,67	1,44	1,07	1,00	0,95
tr2	1,72	1,61	1,39	1,05	1,00	0,93
tr3	1,66	1,57	1,35	1,02	1,00	0,93
tr4	1,70	1,61	1,39	1,03	0,98	0,91
tr5	1,53	1,51	1,35	1,02	1,00	0,92
tr6	1,60	1,52	1,29	0,99	0,98	0,89
tr7	1,70	1,56	1,34	0,99	0,97	0,87
tr8	1,64	1,51	1,29	0,97	0,97	0,86
tr9	1,60	1,45	1,25	0,95	0,97	0,85

Table 9. Obtained reverberation mean time RT30 per combination.

we observed that it was necessary to find a way to obtain the pair of points of absorption combinations of the unknown materials in a more effective way. We decided to start in medium values for the upholstered wall frames (due to its composition, it has the more undefined behavior). We applied RSM again. As these values are 0,5, we could give wide increments (above and below) and study their effect in the nine TR30 combinations obtained.

This way we could visualize which was the influence that a higher or lower absorption coefficient of the unknown materials had in the reverberation times (TR30) obtained for each of them, and how they get close to the on site measurement. If the target it is not contained in the reverberation time combinations, that means the surfaces we have used to combine are not suitable for adjusting the room. Thus, we should choose other surfaces.

After the analysis of the previous adjustment (Fig.4) we have modified increments of the upholstered wall frames at 125 Hz and 500 Hz (Table 10). We have reduced absorption at 125 Hz to make surfaces more reflective, and we have increased it at 500 Hz to make it more absorbent.

With this combination and increments, the values of tr2, tr5 and tr8 for this model are inside the superior and inferior limits at every frequency (Fig. 5). These reverberation times correspond to combinations X11, X12, X13 of surface 16(ceiling) and X22 (upholstered wall frames) of surface 17. We have chosen tr5, as the one that fits better. This combination is shown in Table 11.

CONCLUSION

Some conclusions can be drawn on the basis of the present study. The use of RSM to fit the absorption spectrums of the surfaces of a room can be very useful. It let us work with two unknown behavior surfaces simultaneously. Moreover, it helps us to detect if the surfaces we are considering as unknown, certainly are. In other words, if those surfaces have an influence in accommodating the reverberation time of the room or not. The graphic results provide visual information on which of the combinations, if any, is closer to the real behavior of the room. If not, we can study a different pair of surfaces. Nevertheless,

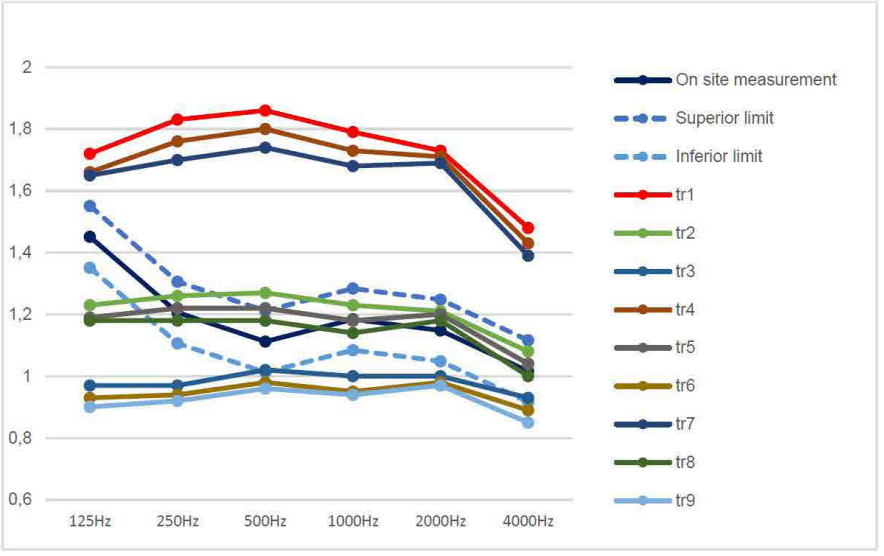

Figure 4. Reverberation time. Adjusted values, compared to on site measurement, initial model (equivalent to tr5), and superior and inferior limits.

Frequency	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz
Absorption	0,2	0,5	0,6	0,5	0,5	0,5

Table 10. Absorption coefficient spectrum of the material 17 (Upholstered wall frames).

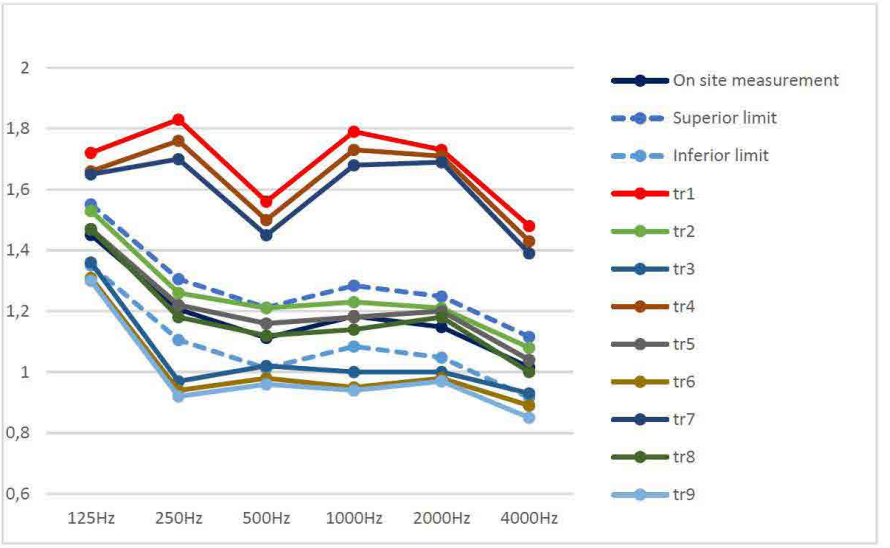

Figure 5. Reverberation time. Adjusted values, compared to on site measurement, initial model (tr5), and superior and inferior limits.

	125Hz	250Hz	500Hz	1000Hz	2000Hz	4000Hz
Surface 16	0,26	0,20	0,10	0,07	0,04	0,07
Surface 17	0,20	0,50	0,60	0,50	0,50	0,50

Table 11. Absorption coefficient spectrum of the materials 16(ceiling) and 17 (upholstered wall frames) that get tr5.

Figure 6. Absorption coefficient spectrum of the upholstered wall frames (before -green- and after -pink- RSM application).

sometimes when the absorption coefficient values of the surfaces are close to 0 or 1, its application could be limited by the own characteristics of the method.

With the adjustment of the method herein proposed, we can adjust accurately the absorption coefficient of very reflective or absorbent surfaces in a more effective manner. It allows to work systematically with the data. It also has a visual representation, which makes interpretations and decisions more precise. The implementation of this adjustment makes it easier to calculate or design a room.

This is a work in progress, so further analysis will provide more conclusions. We have measured acoustical parameters of several theatres, old ones as well as new ones. We will implement this methodology in some of them to check the functionality of the method in practical cases which have different features. Also, archeological acoustic studies could be held in order to find out how those theaters sounded in the past.

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PAPER #7.24

PARALLELISMS BETWEEN ARCHITECTURE AND PAINTING; THE REUNITING OF SUBJECTIVITY AND OBJECTIVITY

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ABSTRACT

The architecture of the last third of the 20th century was forged in close relation with the main socio-economic and cultural changes. Through it we can represent its conceptualization. Following Simón Marchan's 1972 book, "From Object Art to Concept Art", we have carried out a research project where we have compared how the main keys of the different movements were transferred to architectural experimentation. We have at the same time represented how the objective and subjective trends were developing, representing a map of their evolution. This paper is the result of that research. At a certain moment, both sequences interfere: it is 'as if' objectivity and subjectivity and other antinomies have a common framework in representative arts and architecture. Identifying this point of confluence, the *symptoms* and, if possible, the keys on which we are working, would allow us to recognize a scenario of opportunity, where there is "a certain possibility to overcome the historic dualities." The critical analysis of this opportunity will permit us to delve into the keys of the split in contemporary thought, the social fracture and the return to the dialectic of confronted worlds that we revive. While we analysis the symptoms, we will also try to present some bases for the reunion.

KEYWORDS

Subjectivity; objectivity; opportunity; possible; impossible.

INTRODUCTION

Architectural inquiry is sometimes exhausted by its very heterogeneity. There are times when the production does not accompany the deliberations, and the nature of objects does not correspond to social, political or economic debates. In other cases the inquiries and proposals are drawn up only graphically or on other plastic supports, with little production, but nevertheless are crucial for their understanding and evolution. There are quite a few authors in different disciplines that have opted for the transversality of sources and knowledge to specify certain shifts or substantive changes in their own. Some cases resort to texts based on transliterations, or analogue, aporetic, metaphorical, metonymic or fixed synecdoche, which make it possible to approach problems in a different way. In others, intervening characters are used that, when they unfold, illustrate a self-referential allocation; Benjamin (like Mercier, Janin, Baudelaire or Larra) focuses on "capturing the picture of history in the most insignificant appearances of reality, in its waste, so to speak", appealing to the passers-by, the ragman (with his hook and basket), the costumbrist, the collector of erotic postcards like Eduard Fuchs, the bookseller, the small tradesmen, the *chiffonnier*, the voyeur, the dregs, "because the dreg of society or poet, both are concerned with trash, both pursue their trade alone in hours when citizens abandon themselves to sleep, even the gesture in both is the same", because "their kind of talent is the same: search, poke around, own what belongs to others". And in other cases, the precise study moves to other activities

of parallel route; how Benjamin articulates his aesthetic proposal, around the dialectical gaze; Aby Warburg's *Atlas Mnemosine* which, managing images organized according to small details, allows the reconstruction of culture from the parts to the whole; the proposal of *factography* or *operating* author illustrated in Tretyakov, which encourages action and the work involved in the project; the *dialectic in a state of detention*, or the *principle of Interruption* and *estrangement* deduced from Bertolt Brecht's "Epic Theater" that Benjamin will recompose from a social perspective as a *re-functionalization* of art and that he will understand as chosen from the *montage* praxis that allows going into the scene of the *gaze of the outsider*[1]. In addition, the graphic-poetic proposal of Mallarmé (2016) (for whom "saying is not only expression, but the development of thought") continued -among others- by Octavio Paz and that from the graphic design of the text a priori induces reading to the subject's unconscious, predisposing meaning (Benjamin 1992, 141). Or the transformation of Soviet art in its second stage, shown in the figure of Lizzitsky, against the aestheticism of politics, starting from the politicization of art as Paul Valery pointed out; but it also shows participation in the work and the breakdown of the aesthetic residence framework.

1. THE PRODUCTIVE LIMITATIONS.

As Lord Chandos (Hugo von Hofmannsthal) confessed in a letter to Francis Bacon in 1902, the impossibility of language to communicate, in the emergence of postmodernity perhaps the same thing happened to us; the impossibility of seeing in the production of the architecture itself and all its unfolding, having to go to other references of images, while these *open the revealing event of the transit of history*, in a clearer and more explicit way than in that. And this is precisely at the moment of entering the most textual period of this history that took place in the 70s, when Bernard Tschumi used it in "Joyce's Garden" his urban project in London in 1977, based on the novel "Finnegan's Wake" by James Joyce; or Peter Eisenman in his Even Odd House , working in forms of "L" that challenge the concept of subject centrality and security; or in Cannaregio in Venice in 1978, where the text as overlapping layers justifies the work, or the Long Beach University Museum of Arts, where he uses a fragment of the George Orwell film, "1984", imagining three simultaneous time periods: 1849, inspired in the race for gold, 1949 on the occasion of the creation of the Campus, and 2049, when the campus would be archaeologically rediscovered from its ruins by a successor culture, explaining vestiges of different times, because there is no history except for the unrecognizable scattered objects. Also John Hejduk experiences it with the masks, and his references to Benjamin (Hejduk 1986). These complexities become architectural objects or devices, sometimes surreal, others fictitious, others very particular or intimate. They are mental constructs, recurrent as important themes (Hejduk 1986; 1985); others call *densifiers.* Solà-Morales (1990, 85) already puts forth this problem: "the linear conception of history as unlimited progress of humanity was destroyed by structuralist thought". Such transformation and affirmations could infer that everything went the same way in any discipline. Given the difficulty of seeing their transformations in the same production and to verify the accuracy of this statement, we approach another discipline: the text by Simón Marchán (1986), because it details a total of 24 consecutive pictorial movements in a scarce time span of three decades 50s, 60s and 70s; descriptive rigor hardly visible in the architectural field that will allow us to unravel the problem.

[1] Estrangement is equivalent to showing a subject his face in a mirror, but where such an image can now be detached from him and transported.

2. OBJECTIVE

To carry out the research in parallel with both disciplines, conceptually review the period of transition from structuralism to post-structuralism, representing on various cartographies the parallelism between painting and architecture at this time. Detail will be given where determining circumstances occur, outlining novel records, so that we can pinpoint their precise circumstances and check whether certain claims by critics and historians about this time of change are consistent.

3. PROCESS

To address the specific period where this dissent arises, we elaborated a concept evolution map. We take the pictorial field for being the widest, most susceptible and experimental, where this modulation is visualized most effectively in its transits. In it we observe that the two main lines of work that take shape before and after the Second World War, the objective and the subjective, present a point of union that could have meant a reuniting or dialectical balance between opposites but that was finally divided with a more emphatic distancing. In what follows we address the two numbered lines by temporary sequence, although in art history these impeded delimitations in evolution are mistaken for their amplitude and interconnections with others, except for the origin of their statement.

4. METHODOLOGY OF WORK

Creating work records that relate concepts of painting and architecture and the comparative analysis of conceptual cartographies of painting and architecture, and of these with: a) cartography of philosophical currents of the second half of the 20th century; b) objectivity-subjectivity mapping. The process is the following:

4.1.

Each of the 25 participants in the two courses have identified each pictorial

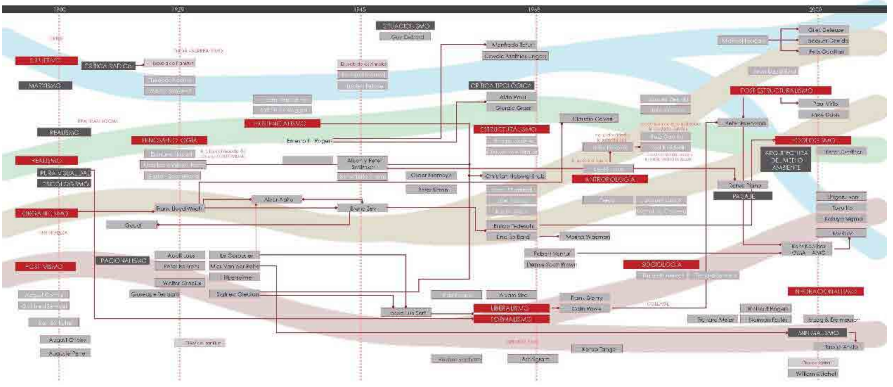

Figure 1. Mapping of evolution of philosophical currents in relation to architecture. Source: Master Degree in Barcelona from Josep Maria Montaner, updated and reviewed by the author.

[2] (1) new figuration, (2) pop art, (3) neo-surrealism or fantastic imagining, (4) psychedelic art, (5) surrealism and hyperrealism, (6) social realism, (7) neo-Dada to shocker pop, (8) narrative imagining and critical social reporting, (9) overcoming informalism, (10) concrete art, (11) new abstraction, (12) minimal art, (13) optical art, (14) kinetic, lighting and real movement art, (15) computer art, (16) collage and object art, (17) art of ludic spaces, (18) happening, (19) Fluxus, (20) arte povera, (21) land art, (22) mythology, (23) art of behavior, (24) conceptual art.

movement[2]. In each file the specific variables are highlighted and establish a relationship with the architecture in a way that the architectural project selected responds to the same variables highlighted in visual arts. As they are all different, we have a sample of 600 files from the 1,200 carried out. We find a period between 1965 and 1980 where certain movements cross since their revisionist objectives concur. Some with more participatory approaches, others more ludic-ironic, but they coincide in showing a change and transformation with respect to the established socio-institutional parameters. We take as guide the subjectivity-objectivity relation that guides the rest of the antinomies.

4.2.

We confirm the unfolding conceptual philosophical underlying each example, provided there is relevant data to clarify it. Starting from the cartography of the Master Degree of Josep Maria Montaner (fig. 1), revised with different updates, we differentiate its proximity or belonging to four basic conceptual bodies in the relation between architecture and philosophy: subjectivity, realism, organicism, and positivism, existing in the 20th century. These evolve as follows:

- *Subjectivity* articulates critical materialism, it contaminates with situationism, a certain typological criticism, environmentalism and post-structuralism. Since the 70s it has been divided into two lines: criticism of the critique or *kulturkritik* (cultural criticism) and the more subtle line, neo-structuralist and environmental, creating atmospheres that cut off all other movements. Currently, certain central European neo-constructivism attests to this.
- *Realism* connects with phenomenology, existentialism, structuralism and ends connecting with a certain ecology or environmental architecture. It remains unified and constant, with periods closer to subjectivity and others to objectivity, depending on their representatives. Its

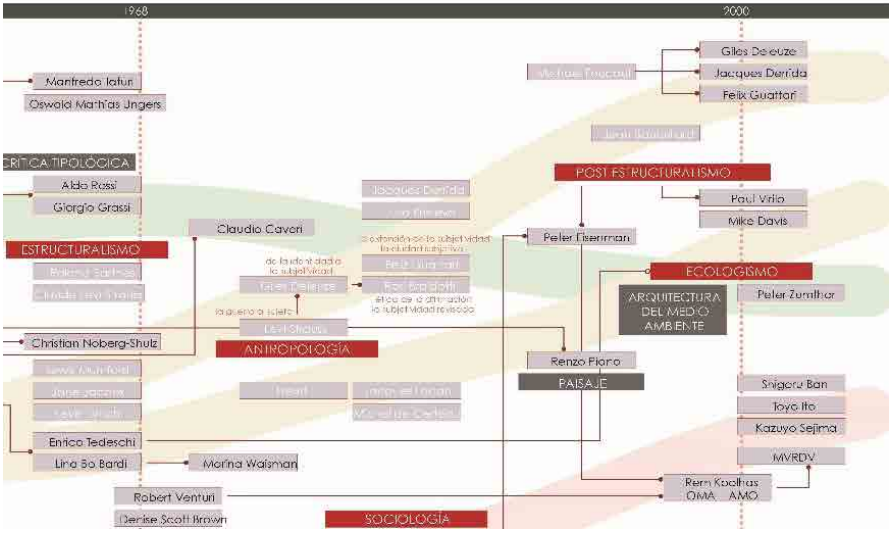

Figure 2. Detail of the study period together with the 24 pictorial movements described by Simón Marchán. Source: author.

journey is cut short by the fluctuations of the others.

- *Organicism* has a parallel evolution to the previous one, but it shows a split in the 1960s: an anthropomorphic and anthropological line that becomes critical and coincides in the critical premises of subjectivity, and another more ecological, feminist and continuist.
- *Positivism* connects with rationalism, technique, science, liberalism and formalism. But around the 1960s it divides, a continuist line on the primacy of science stands out with minimalism, and another somewhat more critical current, which approaches conceptual positions of subjectivism that separate. All this is visible in fig. 2.

We discover in the same period that the area of study 1965-75; various overlaps and crossovers of the continuous lines occur, making various concentrated dualism in this period clear: structuralism-post-structuralism; identity and autonomy; subjectivity-objectivity; formalism-interpretation; realistic evidence-abstraction; presence of the other-absence; instrumental reason-dialogical reason.

4.3.

Later in the group work we select the most relevant concepts of each movement, creating a synthetic matrix. From this and in view of the 25 examples of each movement we identify the objective and subjective priority character of the samples, both plastic and architectural. In the lower graph we identify in grey the process of the most objective movements and in orange the most subjective. They barely coincide with each other in their development, except in a brief period, since their distinction is relevant to start with.

On the one hand, the objectivist, formal and figurative line integrate it: (1) new figuration, (4) psychedelic art, (8) narrative imagining and critical social reporting, (9) overcoming informalism, until reaching (15) computer art. It is at this moment that the limits between objectivity and subjectivity are no longer precisely defined and their margins are interrelated: with (16) collage and object art, (17) art of ludic spaces, (18) *happening* and (19) Fluxus, where progressively in these four subjective designations in origin the objectivity is implemented to the detriment of the assortment of previous subjectivity. It continues (20) *povera arte*, (21) land art, and (23) art of behavior, where despite its statements in its praxis, a dominant objectivity is sought.

On the other hand we highlight the most subjective line; (2) Pop art or the art of popular image, (3) neo-surrealism or fantastic imagining, (5) surrealism and hyperrealism, (6) social realism, (7) the transition from neo-dadaism to pop shocker, (10) neo concrete art and European structuralism, (11) the new abstraction, (12) minimal art or primary structures, (13) optical art as visual provocation, (14) kinetic-light art and real movement, up to (15) art and the computer, where the objectivist contamination begins. They are followed by (16) collage and object art, (17) ludic spaces, (18) the happening and

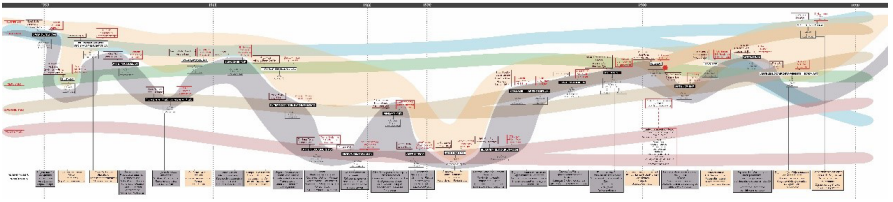

Figure 3. The mapping of objectivity and subjectivity, in the period of study. Source: author.

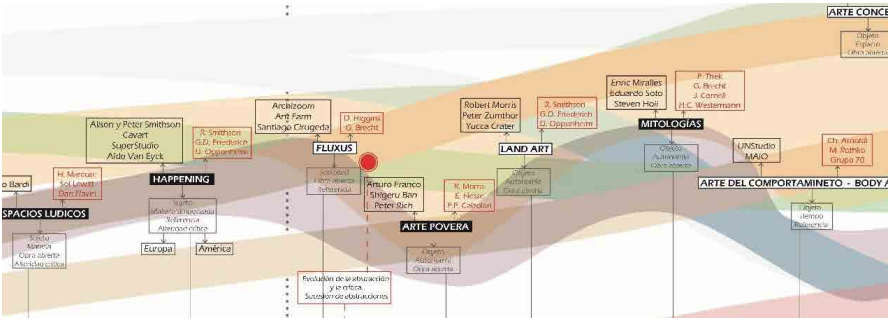

Figure 4. Detail of the overlaps between objectivity and subjectivity in the study period, overlapped with the mapping of philosophical trends and outstanding creative and cultural events Source: author.

(19) Fluxus, where the subjective tendency in favor of the objective gradually declines. It continues, (22) the art of mythologies and new reductionism, until reaching (24) conceptual art.

We find in the same period a concentration of social and political upheavals where objectivity and subjectivity merge, like the other antinomies, because they are not the priority objectives of representation or architectural formalization. Around the movements (16) to (22) there is an overlap, which is later separated in conceptual art (24). In these movements, art is used as a critical conceptual display tool with the intention of covering new registers and experimental territories, avoiding previous debates. Architecture assumes artistic assumptions, even promotes them by championing trends. In this way the dragged dualisms and antinomies are displaced to their irrelevant place. Performance, activism, participation, socio-political-economic discourse, including debates on gender and feminism, are given preference. The need for desire, experience, experimentalism, the sensitive to the sense.

This sociopolitical-cultural scenario in the interlacing period was dominated by the rise in sociopolitical activism: the debates on multiculturalism, the feminism of "the women's building", and the problems of AIDS, or sex workers, etc. In this context, identity activist proposals that are key in these political analyses dominate, based on the awareness of the identity of origin and the identity of the public, examining the ways of personal representation from fractional perspectives: personal relationships/roles; narration/autobiography; body/beauty; daily life/costume; community identity/forms of power. On the other hand, multiculturalism provokes a participative dynamic with art, where minority groups and associations achieve an excessive prevalence (Gran Fury, WAC, Guerrillas Girls, etc.). They are verified in: great organizational activity, collective and impersonal practices, with mass media techniques: as a stimulus through interpretation, or as provocation, controversy and public debate. With the borrowing of public space and topological occupation by community movements or community-based art (Lippard 1984, 34). In an effort to encourage collaboration with the community, sometimes seizing their space-time, with protesting techniques, mural pickets, graffiti, etc. with theoretical supports such as Freire (1972), Dewey (1994) and Connor (1996)[3] who encouraged day-to-day experimentation with their environment, criticizing marginalization, taking a gamble on neighborhood centers, challenging violence and extreme poverty promoting the re-socialization of marginal sectors, interventionist intentions and

[3] From the conceptualist critique of art institutions.

appropriating themes such as environmental, ecology, social justice, neighborhoods or democracy. In them, society participates as co-authors ("Culture in Action" 1992, Chicago).

4.4.

Mapping the overlap: we try to look into what content is relevant in the specific overlap period that we have identified. We check the following conceptual sequence (fig. 5):

a) The interventions of the Smithson, Cavart, Superstudio and some of Aldo van Eyck parallel to the visuals of Smithson, Friederich or Opponheim, who promote the *happening* coincide in focusing attention on the subject, the symbolized matter and a certain critical alterity, but this comes from his political assignment, as a parallel decision of the author. This prescribes a matrix with the following terms; the work elements constitute actions; the artistic product is isolated; it is necessary to make it visible in the political context; the approach is social, material, responding to the premise of art and life and generating symbolic criticism.

b) And this scenario converges in other interventions by Archizoom, Ant Fram or those integrated in Radical Architecture (Celant 1972), with plastic works such as that of Higgins or Brecht. It is these actions that connect with radical position of **Fluxus**, centered on the primacy of society, the loss of individualism, the complete development of the Open Work, and the reference to the previous as well as distant. Its objectives were the creation of *improvised events,* as well as the elimination of the traditional concept of fine arts, replaced by showing the ways of social life. Also the search for participation in the work, so that the viewer clarifies it, or acts as an author redefining it, thus showing a certain anti-art character, and putting the emphasis on the artist's training, not on its cataloguing by critics of the institutional *status quo.*

c) It is followed by **povera arte**, with interventions by Arturo Franco, Shigeru Ban and Peter Rich, and visuals by Morris, Hesse and Calzolari. Its aim is the search for a residual object exemplified as criticism, without reaching the formalist "objectualism", from the autonomy of the work and displaying the content of the open work, while the user enters and penetrates the work clarifying it, but also in its abstraction, taking over as an interpreting artist. Its ultimate aim is the loss of culture of the image, poor or low-income art, ecology, the introduction of social connotations, the reaction against the technological world, and working with the surplus of society, recycling while consumerism is challenged. All art from this period is political.

d) In line with this, **Land Art** is developed, which occupies a similar place, but in territorial terms. This increase of scale assumes the implications of sustainability, environment, criticism of productivism and naturalistic return. With interventions by Robert Morris,

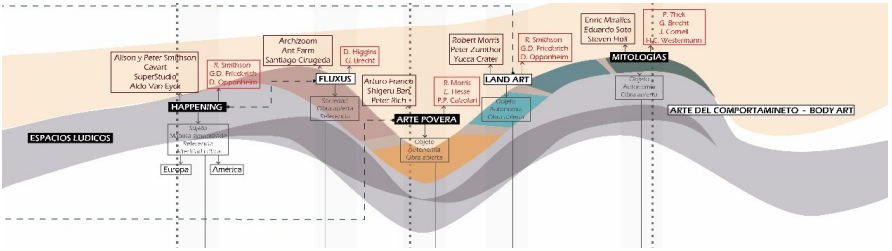

Figure 5. Concept map and its evolution in the period of overlap between objectivity and subjectivity. Source: author.

Peter Zumpthor and Yucca Carter, and plays by Smithson, Friederich and Opponheim, with similar objectives as the previous one. However, the context is natural, fitted around the physical-mental axis, through an illusory image, sometimes temporary, with a metaphorical proximity, about the statement of time as a basic condition of the work and as an exhibition of a slight durability, as a metaphor for the destruction of the planet. A critical underlying layer that link to the previous one.

e) They follow in the **mythological** direction, hand in hand with interventions such as that of Miralles, Soto de Moura, or Holl, and plastic works such as Thenk, Brecht, Cornell, and Westermann. Their objective is the search for a symbolic object, from autonomy and open work, similar to the previous two and whose purposes are: the search for experiences in relation to knowledge, apply personal ideas, the creation of a particular creative world, through instrumental individualism, of a plastic-pictorial nature, with a multiplicity of chromatic *experiences*, for the sake of a psychic constitution.

5. IDENTIFICATION OF OVERLAP

From the perspective of thought (fig. 4) the overlapping figure is a rhomboid that is located between the two branches of organicism at its intersection between realism on the left and one of the branches of subjectivity on the other Kristeva, the lower vertex the most anthropological up-to-date with Strauss and Gilles the Munford, Jacobs, or Lynch and the right vertex of ecology-feminism, with Derrida, Jean Baudrillard, and Guattari. The figure supporting psychoanalysis is with Freud, Lacan and Certeau. Thus we see a horizontal transition from structuralism to post-structuralism and vertically the transition from ethnography and anthropology to environmentalism and feminism. In the middle, three factors link these proposals: (1) The different approach to hermeneutics from the open work, (2) the different reading of alterity, (3) the different reading of ethics and social-ethics (Navone and Orlandoni 1974; Tafuri 1972; Koenig 1971, 19).

From the aesthetic conceptual perspective the following meeting points are appreciated: a common evolution of abstraction and criticism as a linked discourse, through a succession of abstractions and overlaps that make a cryptic discourse about time that enriches it in a manifest way. Linked in three textual resources:

1. Shift from semantic primacy to syntax: it is the beginning of the questioning of the process of revelation, work and unfolding of content; due to the difficulty of understanding meta-languages compared to the subtlety of the poetic approach to constructive syntax; by introducing new work processes from the action, or prioritizing the activism that can be carried out with the work, taking hermeneutic, interpretive and transcendent action as ideal.

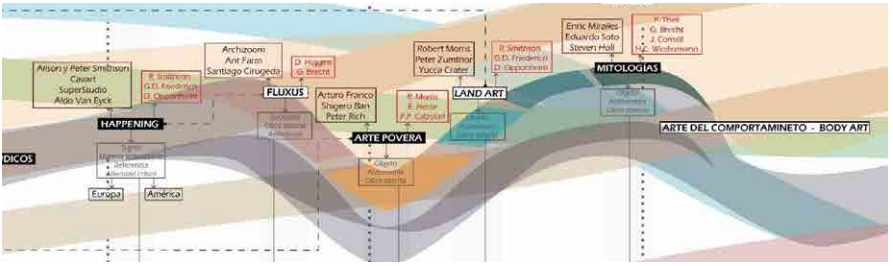

Figure 6. Detail of the previous figure on the map of philosophical trends of the period. Source: author.

The introduction of the temporary twist that better channels the syntax of the hypertext.
2. Semantics aims at a morphology that is directed towards meaning and results in *repertoire*. The incidence of other people's discourses trivializes the ethical-social achievements.
3. The syntax does not claim morphology, it is polysemic like poetics, it uses other logics of meaning from the alternative, by introducing alterity, and it is based on the *systems of connections*; references, experiences, interactions, energies, flows, establishing prevalence to *relational systems* that foster inter-subjectivity, synergies, links, agreements, the basis of a new non-capitalist modality of the collective. Here culture continues to have an articulating, critical and art-related role, without prejudice to its contemporary reading of showing ways of life.
From the architectural perspective we find works such as: on the left vertex Lina Bo Bardi, Marina Waisman and Claudio Caveri. The centre is held by Eisenman with his entire repertoire, Libetskind, Coop Himemblau. Diller and Scofidio. The top vertex is Yunga Ishigami, Souto de Moura, or SANAA in their most inventive contributions. On the right is Peter Zumpthor, Lacaton and Vassal and more to the right Shigeru Ban, Toyo Ito and other works by SANAA. Below MVRDV, Rem Koolhaas, Nouvel and Piano.

6. ANALYSIS AND KEYS TO THE FIGURE BETWEEN 1965-75

This period links six transformations that articulate in their incomprehension or deformation, a paradoxical occurrence: (6.1) culture, as an abstract of the representative arts becomes the demonstration of the way of life of society. Culture and society were united and with *mass media*, only society is shown, without entering into its criticism, showing the superficiality, which is enough to become real. This leads to alienation, simulation, phantasmagoria, vulgarization, and loss of judgment. (6.2) The personal is political (Hanisch 1970), proceeding to the sexual is political, the private is political, creative particularities are public and political. With this, the micro-stories become political. This leads to personalisms, identity, their weak history, fallacies, and the substitution of reality for personal stories, not useful for society as a whole. (6.3) Activist art becomes activism as art. This stifles the ability of art to establish signs, because it refers them to group demands and with it to inorganic multiplicity. On the other hand, activism generates aesthetical signs that make cruel speeches full of ignorance. Thus the aestheticization of the masses is art and every collective act establishes culture. This converges in micro-stories, paradoxically based heterogeneity, subjectivism, politicized participation, absence, dispersion, hypertext, parataxis, and desire. (6.4) Postcolonial theory brings with it ethnography, fetishism, cosmopolitanism, methodological nationalism, a cosmopolitan reconstruction of history, and a new nation-state theory. And with it, comes evanescence, destructuring, ghettos, multiculturalism, urban tribes, multiple identities, the glocal, the anti-form and the process. (6.5) The break with state institutions, power and productive systems, through a misunderstood materialism. This gives rise to radical architecture and Fluxus. It causes a transition from the search for meaning to experience, and when experience is sensed, reality is replaced. This brings with it the disintegration, fragmentation, rupture of the order, overlapping of layers, the fungible, the transitory, the surprising, the performance, the event, the imaginary and the aesthetic anarchy. (6.6) The separation between culture and society, which leaves a gap and is occupied by politics. This leads to a superficial approach to real problems, thanks to opinion-makers, moving this political predominance to ideology. In this way everything becomes a cause for struggle, with a loss of overall vision.

[4] In the debate at the Goethe Institute of Paris (April 1981), between J. Derrida and H. G. Gadamer (1977), on the scope, the limits and the perspectives on interpretation.

This brings the primacy of inconsequential stories, relativism, empty transversality, death, loss of reference, loss of meaning and disproportion between causes and effects.

All this converges in the hermeneutical differences of both synthesized lines (Santiago 1999), in that debate between Gadamer and Derrida[4],, with the following signs: 1) inter-subjectivity in the face of textuality, 2) dismantling versus disassembly, 3) the conjugation of the "we" as a result of social agreement, aimed at consensus, versus conjugating the "we" as teleology. This dual understanding of interpretation goes hand in hand with differences in **alterity**[5]. Alterity, or introspective thinking of the other, stands against the search for the unity of being or to affirm the totality that denies becoming, the difference and the appearance. Both general hermeneutics and deconstruction start from a common basis: they either deny the immutable and stable character of thought that excludes the other or rather are inclined to think about it; but it in two directions as we pointed out:

1. The *dialogical* based on "inter-subjective" relationships to understand and reach consensus, which leads to integrating the other, as I understand it. The alterity, being the relationship with the other, is and happens in language: therefore, it is not consumed in language, but preserved. This is its **ethical** dimension. The interaction with the other in questions and answers, establishes a negative experience that allows understanding to happen. Understanding is experience in language, where the question transforms the meaning of the world that we have. It is self-understanding, a rational reconstruction under the sign of the conditions of acceptability that finds in the confrontation with alterity the impulse that prevents it from being precise and that maintains it in transformation. The conversation was related to language and tradition, which pave the way to unraveling it. A conversation as the development of understanding is the relationship with the other, where face to face with alterity introduces us into it, renewing our assumptions. This is how the idea of the world is unraveled, since there is only a world in language, in which both are bound together from the beginning. Permanent tension between the intangible other in unity and understanding.

2. For Derrida the occlusive manifestation of logocentrism and the revelation of the metaphysics of its presence is the same. For *deconstruction*, by making an effort to integrate the other into my significant registers, I fold it into my personal comprehensive structure; and this, because I nullify the "difference" irreducible between subjects, questioning it, since it starts from the impossibility of integration; that is, it is an other that does not enclose me. For this reason, alterity is singular and heterogeneous, it is difference and a non-presence that is not welcomed in the language that seems rather to be contrary to it; its emergence is an event that creates the concept, but it is not included in that way, it always remains heterogeneous. Thus, the event is the impulse that calls for the recognition of the other, it is justice. For justice is the impossible event, (the force of which is *differance*) in which alterity transgresses and creates the concept without including itself in it, it is the impulse of the other that strives for its recognition, but whose introduction into language will be nothing but the attempt to welcome it and limit it by excluding it.

Thus their differences are irreconcilable; the dialogical position of understanding or consensus, and the deconstructive, where the tension between the intangible other in unity remains; or also, *the difference between the language of the event and the event of language*. Which implies two readings of hermeneutics

[5] Its root alter (other) and suffix -dad (quality) = condition of being another, discovery of the conception of the world (formed by "us" and "them"), specially the interests of the other, to introduce the perspective of the others in their own. "From the perspective of the other, the self that in each case is mine or yours, is also another" (Ruiz 2007). Pedro Laín Entralgo (1966, 396), points out that the pronoun "we" is a key term that integrates the themes of ethics (justice, love, friendship and communication), social philosophy (history, civilization, tradition, community), epistemology (conditions of possibility of the encounter or discovery of the other), anthropology (theory of the self), etc. Levinas (1995, 67), points out in 1971 regarding the otherness: "the estrangement of the other –his irreducibility to the self, to my thoughts and to my possessions– is carried out as a questioning of my spontaneity, as ethics".

and open work: (1) the prefigured (in its functional order) that leads to consensual solutions within a tradition of typological schemes, providing systemic resources waiting for an unsuspected but homologable solution to come ; and (II) -the not prefigured, which obviates the a priori consensuses rejecting the types of history, which subverts the established order to accommodate other forms of inhabiting, erasing the pre-constituted relational sense and allowing the unsuspected, the contamination. Three types of alterity are given:

1. Instrumental alterity (Frankfurt school), restrictive position of the interpretation limited to the world of the author's life and his knowledge. It empowers the pragmatic social agreement, and is based on "it knows that it knows" and "does not know that it knows", where causes and effects are proportional.
2. Ethical alterity (Umberto Eco), open position limited to the author's significant context and with ethical reference. It empowers the renewed social agreement and is based on the "does not know that it knows" where causes and effects remain proportional.
3. Ethical and socio-political alterity (Derrida), position that admits contamination of an unlimited nature, where forbidden or grafted meanings may concur. It empowers a new social agreement limited to what is possible, and is based on 'does not know that it knows', where on the one hand the effects are superior to the causes, the emerging of the event (also fantasy); and on the other hand, the causes are superior to the effects, where the event is forced, achieving the anti-event. In the first ones, the real is enriched with fantasies and in the second, reality is equated with fantasies, creating a virtuality of meaning, or an emotional experience taken as reality.

CONCLUSION

The reunification between subjectivity and objectivity occurs in architecture within the field of ethical alterity, in its two variables, especially in its socio-political, not necessarily ideological dimension. Their chance reunion implies to ethically face the paradoxes previously stated to break them up, modulating the unification between culture and society with the integration of the Other. This articulation is integrated with the *experiential and temporary architecture,* in a social poetic key, where syntax prevails over semantics, which in its pointless eagerness derives in activist political discourses. These would be the keys to return to disappearance of dualities and opposites, while we weave not only an art that is inclusive, sustainable and protective but also an equal society.

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PAPER #7.25

VIRTUAL ARCHITECTS: ANALYSIS OF DYSTOPIAN ENVIRONMENTS IN VIDEO GAMES

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ABSTRACT

In the last forty years, video games have undergone an important development and are set to become one of the most important cultural phenomenons in the 21st century. This work will analyse the role of the so-called *"virtual architects",* in the creation of video games and in the design of the virtual worlds through the study of six video games. Three of these games are representative of the main contributions in the immersion of the player as the regulatory principle between the real and virtual world; a study of the video game as an artefact outside itself will be carried out from an aesthetic perspective. The remaining three, as examples of the creation of dystopian virtual worlds full of symbolism and able to adhere to the collective imaginary; the video game as a virtual world of the player or for itself will be studied.

KEYWORDS

Virtual architects; video games; immersion; dystopia; aesthetic.

INTRODUCTION

On the 3rd of November 2018, the world Championship of League of Legends registered a peak of more than 205 million viewers. It became the most watched eSport event in history, almost doubling the sporting event *par excellence* in America: *Super bowl* (110 million viewers). That same year, the video game industry exceeded 140 billion dollars. In the free market it reached almost 30 billion dollars, three times more that the cinema and six times more than the music industry. [1]

These data are used as indicators of a reality that we have the opportunity to witness: the video game, a contemporary cultural artifact, a generator of experiences and pleasure, a developer of meanings and ideologies and narrator of theories and stories, on the way to becoming the most important cultural phenomenon of the 21st century. Perhaps for this reason, on the occasion of the publication of Alfie Bown's *Playstation Dreamworld*, Zizek states:

> The universe of video games and the action they involve us in render perfectly the illusions and antagonisms of our ideological predicament: the popularity of post-apocalyptic games tells it all. But perhaps even more important is the type of subjectivity a gamer has to adopt when immersed in a game: a mixture of extreme engagement and loss of reality, a universe of immortality where actions are indefinitely repeatable. So is not that we can understand the impact of these games only thought the analysis of our social reality, it´s also the other way around: to understand how our societies work you have to know video games.

Although in its relative infancy, this cultural phenomenon with just over 40 years of experience, has not yet explored its full potential. It is the most complex and elaborate manufactured world among those existing in relation to the creation of virtual environments. As a result, it has already been

[1] According to eSports Charts; consulted on 19 October 2019.

an incipient object of study from different perspectives.

Along this line, the aim of this article is to approach the study of the video game as an artistic artifact, taking the role of the virtual architect as its central point. In order to do this, two paths will be taken: first, the regulatory principles of the game will be considered as a virtual world outside itself, its physis; a task that will be developed from the aesthetic perspective, that is, through the dialectical relationship between subject, object and aesthetic experience; and later, the praxiological principles of the game will be studied, as a virtual world of the player, or for itself; its *praxis*. Or, to put it another way, and paying attention to the architectural key: firstly, the video game will be studied as an artifact through different titles already considered classic and were pioneers in the use of virtual space. We will see the decisive role of virtual architects in the immersion of the subject as a condition of possibility of aesthetic experience. Secondly, the mechanisms of power in the biopolitical sense that the video game incorporates as a virtual world will be identified, through the analysis of the cities created by virtual architects as possible horizons that shape the mechanized imagination, also from titles that are typified by the incorporation of virtual urban environments or dystopian cities. In both cases, single player video games will be taken as the object of study, since the interpersonal ones exceed the capacity of analysis given the extension of this format.

Before delving into the two approaches, it is necessary to explain what we mean by *virtual architects*. In general terms, the game design consists in processing design content (characters, scenery and surroundings), the storyline (background, plot…) and the rules (the do's and don'ts and what the programmed response is to such effects) of the videogame. Due to the complexity of current productions, this is clearly not a one-man task, not just one game designer; it is a process in which dozens of multidisciplinary teams come together. The area in design teams that interests us for the case are those who design the levels; embodied in the figure of *level designer*. This is the area of available space for the player in order to reach his objective. Starting at a level, the player interacts with the game in question, being faced with a series of objectives and challenges, which determines the degree of immersion in the experience. Virtual architects are those professional team members who are responsible for designing virtual sceneries for video games, paying special attention to the design of urban surroundings. It goes without saying that strictly speaking not all virtual architects are architects, although there are many and well known examples on the subject.[2] This however, is not of interest to us: the issue here is that the tools of some and others and consequently, their mechanics are usually the same (computer-aided design, 3D modelling or rendering and therefore operations of addition, subtraction and repetition…). Therefore, the video game industry has become a possible future for many young architects to consider. This could be the reason why virtual architecture is an object of analysis from the discipline and assess which architectural mechanisms are available when creating video games. Furthermore, the difference that separates those who design in the real world and those who design in the virtual; some are affected by all kinds of conditions and for others; the only obstacle is their imagination. This turns video games into a very fertile ground for materialising other possible worlds, dystopias and utopias steeped in symbolism and able to become part of the collective imaginary.

[2] María Elisa Navarro in the development of Assassins Creed 2 or José Sánchez in the development of Block´Hood

1. AN ACCESS TO THE VIDEO GAME FROM AESTHETICS: REGULATORY PRINCIPALS

1.1. The immersion: regulatory mechanism of the player's experience between the real and virtual world.

The analysis of the video game is carried out from an aesthetic perspective since it will allow us to understand the particular relationship between the subject of the aesthetic experience and the work of art or artifact (subject and object), to later examine the role of the virtual architect in this relationship. In this way, we will be supported by the genealogical-transcendental research done by the philosopher Joaquin Siabra Fraile of noticeable *Hegelian* influence. If the question that arises next is, whether the video game can be effectively considered as an art form but providing an answer is not the task to be addressed by this work (although *MoMA*'s decision in 2012 to add a selection of 14 video games to its permanent collection could be mentioned). The question is quite the opposite: it is whether or not the video game can allow the player to have an aesthetic experience.

To that end, it is of interest to clarify the terms in which the question is formulated, as has been pointed out, when we talk about object or work, we speak of the video game and when we speak of subject, we do not refer to anything other than the player. Although, when we refer to the possibility of an *aesthetic experience*, we refer to the simultaniety of two conditions: the first is that there is a *psychogogical* component, and the second is that there is a certain distance between the subject and the object that allows understanding, the amazement or merely the appreciation of the work by the subject.

In this case, the *psychogogical* component is the storyline, that is, the ability of a video game to tell a story, to relate a series of events that occurred with a certain timeframe, and in a specific setting.

Regarding the relationship or distance that takes places between player and video game, we observe something particular: the player is not a mere spectator of the work, as might be the case in a theatrical performance. In fact, he participates in the evolution of events, his decisions mark the storyline, therefore, and he is not strictly outside the work. But he is neither an actor nor a dancer, there is no *libretto,* that is, the decisions he makes, he makes freely, he does not try to represent a scene that is written anywhere or follow a choreography. In this way, the work is no longer set and closed to be represented, but the player's actions have consequences in the plot and are being developed: it is, in effect, an open work. What articulates this mechanic is the model: a series of rules that allow or restrict player actions and determine the responses from the video game that are given to such decisions. Is the player, therefore, strictly within the work? Is there any distance between them?

So far we have seen two basic components that define the video game: the storyline, and the model. But it could certainly be argued that they are not exclusive to it. We could talk then about role-playing games, or about the choose *your own adventure* books. In both, there is a system of rules with consequences (model) and also some events over a period of time in which the character is involved (storyline) being able to alter his course by making decisions. However, it is clear that in neither case a degree of aesthetic experience like that achieved in video games is reached. While in role-playing games, the director of the game can introduce an interesting story and through a roll of the dice the subject's decisions have an impact on the world of the story. It is precisely the figure of the director and the figure of the dice that make it clear to the player over and over again that everything is a simulation. On the other hand, the number of different possibilities in the story that a book allows is limited by its format. Synthetically: in the first case, we see the storytelling of

the model, in the second, the modelling of a storyline. The video game increases the complexity of the second case due to the technology it incorporates, that is, the model as a computer program. But the way in which it resolves the conflict of the first, is the one that leads us to the role of the virtual architect, and the one that, somehow, answers the questions that were asked before. What is the relationship between subject and object that takes place in the video game?

The particular relationship that exists between the two is what is referred to as *immersion:* this being the relationship between subject and object by which the subject is presented within the work, but without integrating with it. He is not, in short, an actor, neither spectator, but both at the same time. In other words, the subject is within, but is capable of recognizing itself, since he also recognizes the work. In the immersion the subject lives the experience that his actions appear to him as belonging to an autonomous artistic *physis* (or virtual nature with its own laws). Through an interface, he is introduced, not into the virtualization of a world, but *in* a virtual world. It involves the reconciliation of the traditional figures of the aesthetic subject like an actor (participation in the work) and spectator (identification with the work). And for all this to be experienced with intensity, the design of the virtual world as the setting for the narration becomes a fundamental piece.

Summarizing, therefore, virtual architects are ke for an aesthetic experience on behalf the subject, the player, in the work, the video game, and that, therefore, it can become as such. It is this way because through their design, they allow the subject to be immersed in the work. The creation of a good scenario allows for true simulation: the player takes the place of the character of the video game and can enter the storyline that occurs in the play. In this way, the storyline of the video game is no longer a mere representation of events like in the theatre, on the one hand, since the subject makes decisions that are answered by the work and determine the course of events. A prefigured story is no longer represented, but an event is developed. On the other hand, and this is the decisive moment, the player is able to effectively feel within the story thanks to a series of simulation regulatory mechanisms, which in a decisive way, have as their author the virtual architect.

At this point we can say synthetically: a video game is the computer realization of a game. For this reason, it is capable of making, not representing, a closed and consistent virtual world in which the actions freely chosen by the player have a coherent response. And the task of building spaces that occurs in it ceases to be, as it had been in traditional arts, that of representing a space, to become that of creating a *space of representation* where the open work is developed.

1.2. Regulatory mechanisms of the immersion: relation between real and imaginary

As it has already been mentioned, when a model is applied to a storyline, or its inverse, a storyline on a model and, above all, when carried out successfully, the so-called immersion occurs by decontextualizing the player's actions in a virtual world. Since its first productions, advances in technology and the expertise of designers have been increasing the complexity of video games and their immersive capabilities. In this section, we will present three key moments of that evolution, by way of three video games that have become classics for *gamers* and their corresponding contributions. In all of them, the enhancements of the game scenario by virtual architects are highlighted.

1. *Metal Gear Solid* (1999).[3] The scenery becomes the *environment*

What interests us in this first case of a video game, which, in its approach could be

[3] Metal Gear Solid, 1999, Konami

considered as a shooter, is that it included subplots that could be classified as infiltration or stealth (Fig. 1). Later these game mechanics have become a genre in them. The protagonist is a secret agent who carries out a series of missions that are nested together to form a plot. And in order to complete them, he must infiltrate and avoid being discovered by the enemy. This circumstance gives way to a more intense connection between the player and the game scenario, in such a way that the experience becomes much more immersive. You must be permanently alert to everything around you; elements that allow you to hide, a place with good views to observe the terrain and the position of the enemies, but also a metallic surface or a puddle that, when stepped on makes a noise, raising the alarm and warning the enemies of your presence. In short, the stage becomes an *environment*.

Figure 1. Screenshot from the game: Metal Gear Solid. Source: (Playstation 1999).

2. *Silent Hill 2* (2001).[4] The scenery gathers presence

The video game Survival horror in which the protagonist receives a letter from his wife asking him to meet her in the city of Silent Hill. He is met with a sinister panorama, and he has to deal with monstrous beings, while he looks for clues, solves puzzles and understands the fatal destiny of the city and also of his late wife. At that moment, the technical difficulty of virtual architects to introduce into the game engine large spaces with great detail was solved in two ways. In interior scenes (Fig. 2), such as a hospital for the mentally ill, the spaces appear compartmentalized, the succession of each one of the spaces acquires the quality of success, and the poor lighting does not allow to glimpse anything at a long distance, since it generates disturbing shadows. In the outer spaces, everything seems wrapped in thick fog. The game's maddening setting is at the service of the psychological horror story it is telling. All this makes the places where the character is located express themselves: not only as a physical environment but also as an emotional one.

Figure 2. Screenshot from the game: Silent Hill 2. Source: (Playstation 2001)

3. Ico (2001).[5] The scene as an additional character

In this three-dimensional platform game, a young man named Ico is taken inside a castle, where he meets another young woman named Yorda and together will try to escape the castle by facing the evil queen and the shadows. For the design of the game, the developers used the technique of *subtracting design*, a kind of minimalism that consists of reducing all the elements to a minimum in order to provide them with greater complexity and importance. In this line, the only setting in which the game takes place, that is, the

[4] Silent Hill 2, Team Silent, 2001, Konami
[5] Ico, Sony, 2001 Computer Entertainment

castle (Fig.3), while imaginary is a realistic environment with a very careful architectural design and recreation. The camera follows the characters on their journey through the castle, changing their focus to highlight certain important parts to be able to advance, or Yorda herself, who does not communicate verbally with Ico, points out certain points that allow us to discover the solution to get out of a room and access another. A simple plot, and reducing the characters to a bare minimum elevates the role of the castle.

Figure 3. Screenshot from the game: Ico. Source: (Playstation 2001).

2. THE VIRTUAL WORLD AS A BIOPOLITICAL MECHANISM

So far, we have discussed the relationship between the player and the video game, in order to focus on the regulatory mechanisms that allowed immersion and aesthetic experience between them. We have taken the video game artifact to study and in this regard we have seen how it was determined by its designers. In this second part, we will analyze how the video game as a virtual world can determine the player.

It has also been explained that, the video game, in so far as a game, has certain characteristics that define it: a beginning and an end, in other words, an objective; some rules governed by the model and the actions of the characters determined by the player. So, the objective as well as the rules and limits of the decisions are determined by the video game itself. The conditions are presented to the player as given and in such a way that he has to abide by them. This is easy to understand in terms of the specified objective and once reached, ends the game just like the rules, which are programmed in the model. And the actions?

With this in mind, it is worth giving an example for which we will use the three video games previously discussed. The same object, in this case, a box, can vary its meaning depending on the virtual world in which it is presented to the player. Thus, a box in *Metal Gear Solid* may be ammunition or something that if fired will cause an explosion, in *Silent Hill 2* the hiding place of a clue that allows the plot to advance and in Ico, an object that placed in a certain position allows and that from it allows the character to reach a balcony and flee from the shadows. That is, the meaning of the same object is determined in different ways depending on the world in which the player is. Thus, if the player relates to objects as essential parts of the coherent unity of meaning that is the video game, it seems logical that the actions are also determined to some degree from the video game itself. Or, in other words, an external planning intervenes in the player's experience with the video game.

From a biopolitical perspective, if we can understand the player as an object of power within the scope of the virtual world, this would be relatively limited in range. However, we will soon realize the potential that this fact has given the moment we are in. We live in an era of the virtual, we are surrounded by interfaces, mobiles, Tablet, PC ... These interfaces are present in many of facets of our lives: they influence the way we communicate, spend our free time and help us in the workplace. The innocent *Pokémon Go,* brings us face to face with the issue of augmented reality, in which it is not strictly reality that is increased, but its meanings, *big data* and the *Smart city* are a good indication if it. Within this network of meanings, the same body can be understood as one more sign, unfolding in different ways

depending on the social network in which it is shown.

But this virtual alignment to which the subject is exposed: the distance between its real and imaginary conditions, occurs at this period, within the field of the symbolic. Remembering Chaplin's *film Modern Times,* where the subject was overwhelmed by the assembly system in the factory, today, this pressure is subtler. As in the model, the rules do not directly govern the actions of the subject; it is about promoting the conditions for the subject to take certain actions for himself. In other words, in the virtual age, the actions of the subject as an object of power are not directly determined, but properly laid out for the field of the symbolic; the conditions are given to carry out certain actions. This battle, as Abel Gance, and, of course, Walter Benjamin well advanced, takes place in the world of images and redlines the question:

> The language of images is not yet ready, because we are not yet made for them. For now, there is not enough respect, enough regard for what they express.
>
> In the dream in which, in images, the following takes place before each stage, the latter appears linked to elements of prehistory, that is, of a classless society. Society whose experiences, which have their place in the collective unconscious, produce, by intermingling with the new, a utopia, which has left its mark on thousands of configurations of life, from permanent constructions to fleeting fashion.

In effect, this path leads us to examine images in video games due to their symbolic power. The player, where possible, processes the images that are transferred to him and the *ideology* they imply. Thus, video games that propose alternative realities, that invent virtual worlds set in dystopian cities question the player, through images, about their role in an alternative socio-political system. The cognitive processes provoked and the ideological doubts that arise are especially complex given their particular form of interaction. Meanwhile, thanks to immersion, the player is both and "*I*" and an "*Other*"; not with respect to the invented polis, but with respect to his own.

In this sense, there is no doubt about the relevance that virtual architects acquire, as urban planners, and builders of the images that configure alternative realities. The task that follows, analysing three examples of dystopian cities from three video games is quite complex. As the cultural theorist Frederic Jameson explains well, drawing a *cognitive mapping* as an attempt to understand causes and effects in artistic and cultural phenomena, is almost impossible given the complexity and infinity of relationships that exist between all agents. We will therefore focus on showing the images of these imaginary and virtual cities and explaining their implications and the mechanisms used through the aesthetics they present:

1.Persona 5 (2016).[6] The city as a prison

Role-playing game with turn-based combat mechanics that develops its plot in a recreated city of Tokyo (Fig. 4). The city is presented through a chromatic selection with a contact base in which black and white predominate, and red as the protagonist in contrast to the other two colours. It presents an interesting example for the analysis since it focuses on a real city, but through a particular optic it becomes a *dystopian environment*, assimilating it to a kind of prison. The player remains "trapped" in it between different commitments to which he is forced to deal with as a way of socializing the character. On the other hand, the reality of the city is intermingled with another level that is called the *Metaverse* an unfolding of reality, in the form of palaces that symbolize the hidden desires of the characters. In some

[6] Persona 5, 2015, Atlus

way, representing the city as oppressive can be a subversive path, although the flight to a virtual world, within the virtual world of the video game itself in which to fulfil fantasies, can be taken as a way of complying with the status quo. A clear example of alienation: while the reality of the subject is oppressive, the illusion of the realization of his fantasies allows him to escape, while preventing him from facing reality or analysing the causes of the oppression he is going through.

Figure 4. Screenshot from the trailer of the game: Persona 5. Source: (Playstation 2016)

2. *Bloodborne* (2015).[7] The celebration of the *sublime*

Action role-playing video game set in the fictional city of *Yharnam*. The city is full of spectacular buildings that make up a Gothic urban orgy (Fig. 5). This city does not try to imitate or represent, with greater or lesser accuracy, a style or a way of life from some historical period, but rather aims to fascinate the player. It is not an isolated premise; there are many other titles along the same line; from the de-contextualization of Gothic buildings that seem to be taken from old engravings. Here the strategy is to operate on the player through the sublime, to provoke his outburst through majesty, making rational assimilation impossible and reducing his abilities through an avalanche of *self-referential images*. The scene wants to dominate the player; it is, therefore, absolute ideology without content.

Figure 5. Screenshot from the game: Bloodborne. Source: (Playstation 2015)

3. Arkham City (2011).[8] The collapse of a civilization

Action and adventure video game set in the city of the same name. *Arkhan City* is a sort of evolution of the virtual Gotham *City*, for which it offers a panorama of *cyberpunk* aesthetics, in which the remains of a functional old city can be perceived, which have tuned into a kind of sinister theme park (Fig. 6). As in the previous case, it is a very common and widespread aesthetic in many other video games. The panorama consists of a dystopia that shows a corrupted city after a collapse of the capitalist, consumerist and technological civilization. It can be understood as critical speech, cautioning that cyberspace could create a type of totalitarian society connected in unison under one central authority.

Figure 6. Screenshot from the game Arkham city. Source: (Playstation 2011)

[7] Bloodborne, 2015, SCE Japan Studio Sony Interactive Enterteinment
[8] Arkham City, 2011, Warner Bros, Interactive Entertainment

CONCLUSION

Virtual architects have played an essential role in the development of the video game, increasingly promoting the total immersion of the player in the virtual world of the video game. On the other hand, their impact on the creation of new *dystopian worlds* is filled with potential since they are capable of influencing the collective imaginary. However, as has already been pointed out, video game as a cultural phenomenon is in its relative infancy, and is still beginning its development. After everything mentioned above, it is worth venturing a future in which video games, together with virtual architects, pay attention to the critical and liberating ways to inhabit spaces: this would be the possibility of resisting an alienation a trend in alienation of a System that wants to close itself off in the pure immanence of what is and in a certain way for no other reason than just that.

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8

BLOCK 8: PARTICIPATION PROCESSES, DIVERSITY AND INCLUSIVENESS

PAPER #8.01

DESIGNING A BETTER WORLD TOGETHER: GLOBAL INTER-UNIVERSITY PARTNERSHIP ADDRESSING UN 2030 SDG

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ABSTRACT

The United Nations' 2030 Agenda for Sustainable Development proclaims, "Children and young women and men are critical agents of change and will find in the new Goals a platform to channel their infinite capacities for activism into the creation of a better world." (United Nations 2015) This paper investigates the potential of a trans-national design studio to empower architecture students to tackle
the UN's Sustainable Development Goals (SDGs). One pedagogical example, Bridging the Gap studio, connects Iraqi and US architecture students through a global inter-university partnership. In this collaborative virtual studio, student teams propose urban redevelopment strategies for parallel sites in one another's capital cities. Alternating between activities of informing, questioning, proposing, critiquing, and iterating based upon growing cultural knowledge, students discover empathy as the foundation of design. In the context of sustainable development, learning in a shared virtual space offers the key benefit of carbon-neutrality, contrasting with the prevailing model of the traveling studio whose
air travel adds to the global carbon footprint. The authors, Iraqi and US architecture studio faculty, together with a PhD student in international education, use the UN agenda as a critical lens for formulating and assessing studio learning outcomes, focusing on the following goals: SDG4. quality education, SDG8. decent work and economic growth, SDG11. sustainable cities and communities, SDG16. Peace, justice and strong institutions, SDG17.partnerships for the goals. We propose this virtual global learning environment and a set of learning outcomes as a model that can leverage students' shared discipline of architecture to address society's big challenges in a global context, incorporating multiple cultural perspectives, and stressing how everyone and everything are deeply interconnected.

KEYWORDS

International education; design studio; UN 2030 sustainable Ddvelopment goals; virtual classroom; cultural competence.

INTRODUCTION

The United Nations' 2030 Agenda for Sustainable Development proclaims, "Children and young women and men are critical agents of change and will find in the new Goals a platform to channel their infinite capacities for activism into the creation of a better world" (United Nations 2015). The United Nations 2030 Sustainable Development Goals (SDGs) were adopted by all of the UN member states in 2015. The seventeen goals were intended to serve as "a universal call to action to end poverty, protect the planet and improve the lives and prospects of everyone, everywhere" (UN Sustainable Goals website). Architecture students, practicing design thinking to envision the future, can play a changemaker role in implementing this agenda. This paper investigates the potential of a trans-national

virtual design studio to empower architecture students to tackle the SDGs. This model for educational collaboration is well-aligned with the agenda's "pledge to foster inter-cultural understanding, tolerance, mutual respect and an ethic of global citizenship and shared responsibility." The agenda states that, "The spread of information and communications technology and global interconnectedness has great potential to accelerate human progress, to bridge the digital divide and to develop knowledge societies…" The virtual studio became viable in this era of digital connection, with the potential to advance the internationalization of architectural education and promote a sustainable future for the planet.

The paper situates the virtual international studio model within the history of architectural design studio education abroad. It introduces as a case study example Bridging the Gap studio, a virtual classroom connecting Iraqi and US architecture students through a global inter-university partnership. Then the authors, Iraqi and US architecture studio faculty, together with a PhD student in international education,

use the UN agenda as a critical lens for formulating and assessing learning outcomes, focusing on the five goals most relevant to the studio: SDG4. quality education, SDG8. decent work and economic growth, SDG11. sustainable cities and communities, SDG16. Peace, justice and strong institutions,

SDG17. partnerships for the goals.

1. CASE STUDY: VIRTUAL STUDIO CONNECTING STUDENTS ACROSS CULTURE AND GEOGRAPHY

1.1. Internationalization of American architectural studio education

Before the growth of architectural schools in the United States, well-to-do young men and one woman, Julia Morgan, traveled to Paris to study at the Ecole des Beaux-Arts, where they joined ateliers, or studios, and learned alongside their French peers. They absorbed French language, etiquette, and culture along with professional knowledge and expertise. These American students of the Ecole influenced the development of the architecture profession and architectural education in the United States. With the growth of American schools of architecture, it was no longer a necessity to travel abroad in order to gain an post-secondary school architectural education. However, a few American winners of the Paris Prize continued to study at the Ecole des Beaux-Arts each year until 1963 (Schwarzman 1964).

As the discipline of architecture moved into major universities in the latter half of the nineteenth century, the studio was adopted as the locus of design education. American university students were now able to learn to design side by side in the studio setting without the need to travel abroad for this aspect of their

education. The romance of international travel, mainly to Europe, however, was a feature of the culture of architecture dating back to the late sixteenth century when young aristocrats began to venture abroad on the Grand Tour (Sorabella, 2003). The Rotch Traveling Scholarship, founded in 1883, recognized high-achieving architecture students with the opportunity for extended travel abroad. In the second half of the twentieth century, architecture schools began to develop institutionalized study abroad opportunities for students (Costanza 2012). These educational opportunities came to include studio experiences abroad, ranging from brief visits to sites in other countries to semester-long studios in international locations. In recognition of the significance of this development, the Rotch Trustees established the Rotch Traveling Studio Grant in 2002, expanding their funding to focus specifically on studio education that took

Americans abroad. The internationalization of the studio experience runs along a spectrum from minimum engagement to maximum immersion. At the less-engaged end is a group of American students visiting a site abroad with their American faculty. At the highly engaged end is American students studying collaboratively with local students and taught by local faculty in an international setting. With the advent of digital communications technologies, it is possible to realize the benefits of high engagement without physical immersion in an overseas context.

1.2. Blended learning model for international education

The blended learning approach to international education is an emerging pedagogy that engages students with overseas peers without the need for physical travel. This pedagogical model utilizes a variety of digital communications technologies to connect students in coursework both synchronously and asynchronously. Educational modes are considered blended because some learning takes place online and some face-to-face in a traditional classroom setting. When applying blended learning to international education, culture and cultural differences are an important factor to be planned for (Mathur & Oliver 2015). Some benefits of learning globally are job creation, leadership team support in global contexts, and helping students successfully navigate towards their career paths (Hilliard 2015). Blended learning is expanding globally (Vaughn 2007). There is a need for universities to put resources into these programs to prepare students for a global workforce (Morrill, 2007). The blended learning model affords access that students would not otherwise have (Dziuban, Graham, Moskal, Norberg, Sicilia 2018).
Cross-global collaborations and competencies can lead to virtual mobility, increasing educational exchange, and sharing common practices with outside groups (Barajas, 2003). Virtual mobility creates a Community of Inquiry, where physical connection or mobility would otherwise be impossible due to conflict (Garrison, Anderson, Archer, 2000). The blending of asynchronous and synchronous learning environments in the virtual classroom enables students to build diplomacy towards peace in post-conflict environments (Kinder, Fardon, & Yasmeen, 1999).

1.3. Global virtual studio - applying blended learning strategy for internationalization of design education

The global virtual studio is an application of the blended learning strategy. This emerging model for international architectural design education leverages digital communication technology to enable collaborative learning among students in remote locations. There are several potential benefits to this approach. Since learning takes place at students' home institutions, there is no need for air travel, so this model reduces the carbon footprint of international architectural education. Additionally, the no-travel model promotes equity by eliminating cost and accessibility barriers that might otherwise prevent low-income students, students with disabilities, students with family responsibilities, and others who might be unable to travel, from realizing the benefits of international experience in their architectural education.
The concept of blended learning began to be applied to the design studio with the enhancement of design and communications technologies at the very end of the 20th century. The first example the authors have found of a blended learning design studio was a case study of an urban design course that brought together students and faculty in Chicago and Urbana-Champaign (Al-Kodmany et al 1999) - not an international collaboration, but nonetheless a collaboration between somewhat geographically separated groups. The first international design studio collaboration we discovered was a joint

landscape architecture studio linking the University of Washington in the US with Chiba University in Japan (Hou 2003). The earliest application we found of the virtual studio to the architectural curriculum was a 2006 collaboration among design studios at several Turkish universities, an in-country, rather than international collaboration (Tokman 2007). In 2018, a journal article discusses the application of current networking technologies to the architectural design studio and reports on an application of this theory to a virtual architectural design studio in Athens, Greece, another in-country example (Ioannou 2018). The first virtual international architectural design studios that we are aware of are the authors' Bridging the Gap studio, initiated in 2016, connecting an American University, the University of Maryland, with an Iraqi University, Al-Nahrain University in Baghdad (Simon 2017) and a studio linking the University of Los Andes, Columbia with the University of Nottingham, UK, published online in 2016 (Rodriguez, Hudson, Niblock 2018).

1.4. Bridging the gap studio - a case study virtual studio

Bridging the Gap (BTG) studio brings 25 students and two professors from an American university and an Iraqi university together in a collaborative studio designed to develop cross-cultural understanding and the capacity to practice globally. Each studio group serves as information sources, eyes on-the-ground, cultural informants, fact-checkers, and design critics for their counterparts overseas. We share information, hold meetings, and offer critiques through multiple electronic means including WebEx video conferences, Google Drive, Messenger, and a private Facebook group that grows every year to include alumni of the ongoing studio collaboration plus practitioner mentors. The studio collaboration began in 2016, incubated by a multinational architecture firm that has continued to provide advisors and critics to the studio and host our workshops and reviews. They offered internships to two students from each country, further building cross-cultural relationships. The architect mentors serve as role models for global practice, reinforcing for students the real-world application of their studio education. Students tackle parallel sites in the capital cities of each other's countries. Both sites are linear districts focused on commercial streets that are major thoroughfares.

Figure 1. Al-Nahrain University architecture students and faculty

Located in the historically most diverse district of Baghdad, Karrada Dakhil is a lively marketplace night and day with people strolling, shopping, eating, drinking tea, and smoking hookahs. This district experienced the worst sectarian violence in Baghdad with devastating loss of life; it is still rebuilding from the destruction of the bombed mall and mourning the dead. K Street spans different wards of Washington, DC. It is known as a prime location where business and politics comes alive from 9am to 5pm on weekdays but shuts down on evenings and weekends. Both Karrada and K Street would benefit from new visions.

Each team researched their local site and exchanged information with the team abroad. Students next proposed tactical urbanism projects for each other's sites, quick studies to begin to get to know the places and their

Figure 2. University of Maryland students and professional mentors.

problems, raise questions, and elicit rapid responses. Students next launched into a set of research projects on topics including climate, geography, demographics, history, sustainable traditions, urban planning, and architectural history. Based on the new cross- cultural knowledge of people and place, student teams worked on proposals for urban redevelopment. Finally, individual students selected sites within their study districts for architectural design of an urban institution. Students were encouraged to propose urban strategies that would unfold over time, freeing their thinking from the constraints of present-day feasibility to imagine how incremental change could lead to improved futures. The primary constraint was the focus on sustainable design broadly conceived to include social and economic as well as environmental resilience.

Figure 3. UMD student proposal for Baghdad urban redevelopment. Source (Gijoon Paris Sim 2019)

Figure 4. Al-Nahrain University student proposal for Washington, DC urban redevelopment. Source (Heba Amer Dawood, Aisha Alaa Salih, and Kabas Abdul Hameed Salman)

This international collaboration has been made possible by support by the University of Maryland's Global Classrooms Initiative (GCI) and Gensler, a multi-national design firm. GCI supports the studio with both funding and a faculty learning community dedicated to the internationalization of university education through virtual collaboration. Gensler contributes employee time and expertise and their facilities to support this project that prepares students for the global action that characterizes their practice. The Iraqi- American architects and designers who initiated the studio concept at Gensler have provided access that the US and Iraqi students and faculty would not otherwise have, creating collaboration between countries whose people typically learn about one another through the media rather than in person. Since the Iraq war began in 2003 there have been no international students studying at Iraqi universities (WES 2017), isolating Iraqi students from international contact. The recent political situation has resulted in barriers to Iraqi student and faculty mobility to the United States since President Trump

signed Executive Order 13769 including Iraq in the Travel Ban (Federal Register 2017, NAFSA 2018). Without a virtual learning environment, educational collaboration between Iraq and the United States would be impossible.

2. UN 2030 SDGS AS FRAMEWORK FOR CASE STUDY ANALYSIS

In 2015 the United Nations Member States called for action for people, planet, and prosperity with the 2030 Agenda for Sustainable Development (UN, 2016). This global partnership seeks to reduce inequalities, increase economic grow th, health, and education through 17 Sustainable Development Goals (SDGS) (UN, 2016). The Bridging the Gap Studio (BTG) utilises five of the 17 SDGs in assessing studio learning outcomes. Through our virtual partnership we focus on SDG4 Quality Education, SDG8 Decent Work and Economic Growth, SDG11 Sustainable Cities and Communities, SDG16 Peace, Justice and Strong Institutions, SDG17
Partnership for the Goals. In the following section we will expand on our approach to each of the five relevant SDGs and the learning outcomes from each.

3. DISCUSSION OF LEARNING OUTCOMES

3.1. SDG4: Quality education

> *Goal 4. Ensure inclusive and equitable quality education and promote lifelong learning opportunities for all. 4.7 By 2030, ensure that all learners acquire the knowledge and skills needed to promote sustainable development, including, among others, through education for sustainable development and sustainable lifestyles, human rights, gender equality, promotion of a culture of peace and non-violence, global citizenship and appreciation of cultural diversity and of culture's contribution to sustainable development, 4.7.1 Extent to which (i) global citizenship education and (ii) education for sustainable development, including gender equality and human rights, are mainstreamed at all levels in: (a) national education policies, (b) curricula, (c) teacher education and (d) student assessment, 4.C By 2030, substantially increase the supply of qualified teachers, including through international cooperation for teacher training in developing countries…* (United Nations Sustainable Development Agenda website)

Iraq seeks to achieve the UN 2030 SDGs, especially as their announcement came during the Iraq war against ISIS terrorism, so it was imperative to overcome this gap. In the fourth goal, Iraq seeks to obtain a good education for its youth, so international cooperation was an appropriate method for that, the cooperation of Iraqi universities, including the University of Al-Nahrain with international institutions and universities, provided an important impact. Through BTG, Al-Nahrain University's collaboration with the University of Maryland played a role in the students' acquaintance with technical and scientific methods for solving urban problems including achieving sustainable development. The shared virtual classroom provides students the opportunity to see the capital cities of Iraq and the US through each other's eyes, thereby broadening their education with an international perspective. The first iteration of the studio collaboration evidenced a deficit in the Iraqi students' ability to communicate graphically at a level expected in the global professional community. The faculty collaborated on a grant
proposal that funded a workshop at UMD to elevate the ability of Iraqi faculty from two universities to design curricula and deliver instruction in graphic communication that meets an international standard. By the fourth year of the collaboration, the quality

of the student work had risen to a level that was recognized by the Studio Prize, an international award given by Architect Magazine to six studio courses each year. The effects of the enhanced instruction should grow exponentially as each cohort of graduates produces new faculty to spread their expertise to universities around Iraq.

3.2. Decent work and economic growth

> *United Nations 2030 Sustainable Development Goal 8. Promote sustained, inclusive and sustainable economic growth, full and productive employment and decent work for all.* (United Nations Sustainable Development Agenda website).

Young Iraqis are protesting in the streets, demanding job opportunities. BTG studio is preparing students to take up the important work of rebuilding Iraqi cities after years of destruction and disinvestment. Through BTG graduates of the master's degree in the Department of Architecture at the University of Al-Nahrain obtained distinguished experiences in working in a global style and the capabilities Qualify them to obtain suitable job opportunities in important institutions in Iraq, including architecture firms and educational institutions. An internship offered by multi-national design firm Gensler enables the top Iraqi and American students to enhance their preparation for professional work by participating in global practice in a US office.

3.3. Sustainable cities and communities

> *United Nations 2030 Sustainable Development Goal 11. Make cities and human settlements inclusive, safe,resilient and sustainable. 11.2 By 2030, provide access to safe, affordable, accessible and sustainable transport systems for all, improving road safety, notably by expanding public transport, with special attention to the needs of those in vulnerable situations, women, children, persons with disabilities and older persons, 11.2.1 Proportion of population that has convenient access to public transport, by sex, age and persons with disabilities, 11.3 By 2030, enhance inclusive and sustainable urbanization and capacity for participatory, integrated and sustainable human settlement planning and management in all countries, 11.4 Strengthen efforts to protect and safeguard the world's cultural and natural heritage, 11.4.1 Total expenditure (public and private) per capita spent on the preservation, protection and conservation of all cultural and natural heritage, by type of heritage (cultural, natural, mixed and World Heritage Centre designation) …, 11.7 By 2030, provide universal access to safe, inclusive and accessible, green and public spaces, in particular for women and children, older persons and persons with disabilities, 11.7.1 Average share of the built-up area of cities that is open space for public use for all, by sex, age and persons with disabilities, 11.A Support positive economic, social and environmental links between urban, peri-urban and rural areas by strengthening national and regional development planning, 11.A.1 Proportion of population living in cities that implement urban and regional development plans integrating population projections and resource needs, by size of city, 11.C Support least developed countries, including through financial and technical assistance, in building sustainable and resilient buildings utilizing local materials.* (United Nations Sustainable Development Agenda website)

The studio projects focus on urban redevelopment strategies, preparing students for professional work addressing the subgoals listed above. In the face of global warming, Americans learn valuable lessons about urban development from Iraqis, whose architecture and rhythms of life have developed in response
to the extreme summer heat. BTG helps enhance the capabilities of Iraqi students

to work toward sustainability, Iraqi students tried with their American colleagues to reflect the knowledge gained through the studio to develop their cities, especially the city of Baghdad, which suffers from neglect and violation of its (urban and cultural) heritage. The students provided through their design solutions for safe and beautiful places to all social and gender groups. American students bring a perspective of diversity, equity, and inclusion to the design of public space. Access for people with disabilities is ingrained in US education, law, and practice. American students bring an ability to envision a peaceful future for Baghdad and to create plans for the buildings and public spaces that will support civic life that can return after the fear of sectarian violence is banished.

During the years that followed the war of 2003 in Iraq, the capital city, Baghdad, has witnessed a rise in crime rate and terrorist attacks (Damluji, 2010). According to the Global terrorism index, Iraq has become one of the top three countries in the world in terms of the number of deaths related to terrorist attacks (Global Terrorism Index, 2018). As a response, a plan for countering terrorism was initiated by the state to mitigate the impact of terrorist hazards in Baghdad (Damluji, 2010). This plan encompassed several strategies and interventions. For instance, concrete barriers and barbed wires were placed around sites of critical importance such as administrative, religious, and educational buildings. To restrain access, streets leading off to these buildings were gated off and controlled by military checkpoints. Consequently, several residential locations were transformed into gated communities (Damluji, 2010; Kilcullen, 2007) and post-war Baghdad has become a city of walls (Chandrasekaran 2007, Basi, Hussein, Abrahem 2019). The events in Iraq encouraged students to provide design solutions that seek to build a healthy and safe society, prevent violence and combat terrorism. Iraqi students bring a fresh vision to the development of Washington, DC, unencumbered by the local devotion to historic styles. By 2030, ensure access for all to adequate, safe and affordable housing and basic services and upgrade slums.

3.4. Peace, justice and strong institutions

> *United Nations 2030 Sustainable Development Goal 16. Promote peaceful and inclusive societies for sustainable development, provide access to justice for all and build effective, accountable and inclusive institutions at all levels.* (United Nations Sustainable Development Agenda website)

BTG studio promotes global peace by building relationships bridging geography and culture through international collaboration. By designing sustainable development plans for each other's cities, Iraqi and American students become invested in the futures of one another's countries. Working together to achieve shared goals, students build relationships that can transform otherness into shared humanity.

3.5. Partnerships for the goals

> *United Nations 2030 Sustainable Development Goal 17. Strengthen the means of implementation and revitalize the Global Partnership for Sustainable Development. Subgoals: 17.3 Mobilize additional financial resources for developing countries from multiple sources. 17.6 Enhance North-South, South-South and triangular regional and international cooperation on and access to science, technology and innovation and enhance knowledge sharing on mutually agreed terms, including through improved coordination among existing mechanisms, in particular at the United Nations level, and through a global technology facilitation mechanism. 17.7 Promote the development, transfer, dissemination and diffusion of environmentally sound technologies to developing countries on*

favourable terms, including on concessional and preferential terms, as mutually agreed. 17.9 Enhance international support for implementing effective and targeted capacitybuilding in developing countries to support national plans to implement all the sustainable development goals, including through North-South, South-South and triangular cooperation. 17.16 Enhance the global partnership for sustainable development, complemented by multi-stakeholder partnerships that mobilize and share knowledge, expertise, technology and financial resources, to support the achievement of the sustainable development goals in all countries, in particular developing countries. 17.17 Encourage and promote effective public, public-private and civil society partnerships, building on the experience and resourcing strategies of partnerships. (United Nations Sustainable Development Agenda website)

The collaborative studio functions as a global partnership focused on sustainable urban development, building architecture students' capacity for collaboration with counterparts in other countries and cultures.It takes young people from cultures recently in conflict and gives them common cause, the need to redevelop the cities and communities of their countries for a sustainable future. Sharing a professional culture and mobilizing for shared goals forms the foundation for partnership. The studio and its related projects leverage funding from multiple US sources, including academia (the University of Maryland's Global Classrooms Initiative), government (IREX and the US Embassy in Baghdad), and industry (Gensler) to enhance opportunities for both Iraqi and US students and faculty. The North-South collaboration of US and Iraq enhances access to innovations in architectural education for the Iraqi partner university. Bridging the Gap studio created a platform for additional projects focused specifically on developing the capacity of faculty at two Iraqi universities to deliver sustainable urban design education and to communicate professional concepts to a world audience. The faculty bring these lessons back to Iraq, educating the architecture students who will graduate to become faculty in universities around the country. Bridging the Gap studio has been building a global partnership over the past five years, with graduates of the program staying connected and contributing their expertise to current students, both inperson and through the growing private BTG Facebook group. When new students enroll in the studio
course, they discover that they are joining this global partnership.

CONCLUSION

Analysis of the case study virtual studio demonstrates that a blended learning approach to design studio education has the potential to expand architectural education's contribution to a sustainable global future. The virtual studio is in itself a sustainable institution, a carbon-neutral alternative to traveling to meet colleagues around the world. The case study studio elevates Iraqi architectural education, preparing Iraqi and US students for contributing to a more sustainable future through employment in the architecture profession. This benefit would extend to other collaborations between countries with disparities in development of educational systems. Intercultural collaboration prepares students for participation in global professional practice. The studio connecting students across culture and geography prepares students to design inclusive, safe, resilient, and sustainable cities through the exchange of information and approaches. A blended learning studio promotes peaceful and inclusive societies and global partnerships for sustainable development by creating a virtual workspace in which our shared profession is a vehicle for cross-cultural collaboration in a post-conflict

situation. When we introduce shared interests and goals for designing a sustainable future, we move away from notions of "us and them" towards the understanding that we are all citizens of the same planet.

The virtual studio grants the students access that they would not otherwise have to colleagues across the world. It leverages shared professional knowledge, expertise, and values to build empathy between students in nations emerging from conflict. The resulting working relationship offers the opportunity to work together towards creative solutions to complex sustainability issues. By building empathy for one another and the problems of their contexts, students come to care about global sustainability issues that may not touch them on their home ground. While the case study studio does not offer solutions to specific

real-world issues, it prepares students for leadership by teaching them how to work together in a global partnership. We propose this virtual global learning environment and a set of learning outcomes as a model that can leverage students' shared discipline of architecture to address society's big challenges in a global context, incorporating multiple cultural perspectives, and stressing how everyone and everything are deeply interconnected.

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PAPER #8.02

THE INVENTED OTHER: OF THE "STRANGER-GUEST," NOISE, AND THE CITY

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ABSTRACT

Derrida (2007) sets invention as the introduction of disorder. It is an interruption of the pleasant flow of being and time, or "the breaking of an implicit contract." Like an intellectually distant yet temporally recent utopian thought, invention deforms the existent. This deformation, on the one hand, extends from the existing and, on the other, is the haunting reflection of the non-existent: unseen, but long awaited. Invention is the noise of its time. What, where or who is this noise?

I want to approach the concept of the "stranger-guest" within an extended understanding of the ancient Greek concept *phílos* or friend. Aristotle's attempt to nest himself in his friend was nothing other than an effort to reinvent the self within the other. With Derrida, invention begins "by being susceptible to repetition, exploitation, reinscription." Thus, the "stranger-guest" is always the invented. This inventedness reflects an ambiguous state of being invited yet not being taken into account as a friend. As the unseen-known becomes visible, the archaic Aristotelian friendship is interrupted and noise will echo throughout the ruins of temples. Since the "stranger-guest" arrives with precipitations of centuries-old reflections, transformed attributions to the concept of friend, the host or the *polítis* would never have the time to be prepared. Hence, this encounter generates static. Digging into Lambert's (2017) reading of Benveniste's multifaceted dictionary (1969/2016), I aim to scrutinize the confrontation of the stranger-guest and the host on a spatial basis. What does the space of the *xénos* look like? Or, in other words, how does Russolo's *Intonarumori* in reality resonate?

KEYWORDS

The other; friend; stranger-guest; noise; city; values.

1. BEGINNINGS: AWARENESS

> This. Here this is. Ecco homo. I make history of it: I speak of it. It makes so much noise that it erases everything it says. - Serres

Buchanan (2005) refers to Marc Augé waking up on a mid-summer day in 1984, as described in his *La Traversee du Luxembourg*. Augé's first thoughts within the early hours of the morning lead to the idea that "the everyday, even at its most banal level, is in fact utterly remarkable." With these thoughts, Augé also experiences a moment of uncertainty, which Buchanan links to de Certeau's "shattering (éclatement) and Deleuze and Guattari's "cracking (craquement)." Augé realizes that:

> …anthropology will struggle to locate itself since its object has just disappeared: Since today it no longer seems possible either to delink oneself from the network of relations we call globalisation or find a place out of the way enough not to have been penetrated by it…, it is a mode of inquiry whose object has to all intents and purposes vanished…

He assesses that "[w]e live in a world without others." (Buchanan, 2005) In today's system there is a new type of social space "whose precise purpose is to facilitate a frictionless passage," namely a space failing to become "place": a non-place. However, I argue that

the other does in fact exist, but does so as an invention. And the question is rather, how should one see the present situation where the other-as-invention forces the non-place into a stage of constant confrontation? I suggest that turning to the concepts of *phílos*, or friend, and *xénos*, or stranger-guest (Lambert, 2017), would be valuable. No matter which model of friendship (according to Aristotle's *Nicomachean Ethics*) is dealt with, the concept of friendship foresees an insertion of the self into the other, or with other words, the projection of one's values on to the other. Hence, friendship requires claiming space within each other, dwelling within each other respectively, with no significance of temporality. Who acts first to carve the niche is of no importance, yet how this mutuality unfolds is. The combinatorics in Aristotelian friendships leads to a predictability, but also an ambiguity concerning the human condition: it is impossible to claim anything e.g. virtues in means of purity. Benveniste for his part sheds light on *phílos* and its related concepts; he conveys that the concept "friend" sets sail for distant territories of Indo-European languages accompanied by an apparatus of social and cultural hegemony. For example, departing *phílos*, we arrive at *civis* or the fellow-citizen, and heiwafrauja, hospitality, from Sanskrit and Germanic. The latter, *heiwafrauja*, then becomes traceable in *oikodespotes*, head of the family. In relation to this hierarchical connotation, Benveniste also points out Homer's reference to *phílos* as both friendship and possession. His multi-layered dictionary allows us to look at the concept's afterlife, following its roots in antiquity among a constellation of actors and institutions such as the individual, the family, the city-state, and note how its attributed properties are stretched and forced to change according to temporal and spatial contexts and structures of power.

2. MOBILITY: INTERCHANGING ACTORS

This traceable thread of concepts generates a cloud of plenty and the broadband discussion inevitably penetrates in many areas. I will try to discuss the "brought thing," specifically object and sound, within its relationship to the mobility and memory. Starting with sound, Yavuz (2018) points out to two tendencies in the evaluation of the displaced. First, Yavuz labels the "production of the migrant groups as the misinterpretation of the traditional." In this case awareness of the authentic is obsolete. As the two sub-concepts of stranger-guest (i.e. "stranger" and "guest") augment one another, there is a dichotomy in this point of view. The host, on the one hand is interested in the *strangerness, guestness,* and the *distanceness* of the "other," corresponding to the guest's ephemerality, invisibility, and temporality. This interest is not solely driven by fascination for the ambiguous unknown but at the same time by fear of it. The unknown on the other hand, arrives with authenticity that does not resemble the host. From the moment of its arrival onwards, the guest that only exists as such by a "strangeness" attached to it manifests its power through this authenticity. However, in reality this imported or attached authenticity may only be a mutated one. The personal belongings of the stranger-guest resemble unattended items waiting to be removed by the socio-political mechanisms of the host. Likewise, following its arrival, the stranger-guest is the most powerful and perseverant generator of noise in the harmonious sonorous milieu. It faces two possibilities: being silenced by host-made noise or suppressed and reformed so that it could be interwoven as a part of the milieu. The second tendency set forth by Yavuz is that "the status of being a migrant that belongs to a certain moment, and the physical and mental crossing between two centers [that] are passed to the next generation like a heritage," leading to a vicious circle, which soon itself becomes a tool of suppression:

the migrant status is presented as a method of sustaining the otherness of the stranger-guest. Yavuz also introduces the concept of *niche* and its overarching connotations in ecology, sociology, and economy. This would be important to understand the reflexive starting point of self-legitimization. The space in which the stranger-guest dwells and the place of projection of the self, carving a niche in to the place of the host. If we briefly recall Attali to the complex relationship of the roots and different paths of jazz, for example, with musicians carrying the music with them as they moved on. In this case, jazz music confronted the host and transformed into hybrid forms. The mobility within space or place is confined not only to imagination but also to memory and therefore, cannot operate as in the case of music. This is one of the reasons why the adventure of the stranger-guest is laden with an *in situ* re-erection of memory.

If we continue with the case of the object as "brought thing," Subasi (2011) offers creative input to the discourse by introducing the term invisibility. Her product-based rendering of migration is similar to what Yavuz mentioned in her dissertation: what does the "stranger-guest" bring with? What role can objects of use play in means of mobilizing memory? Invisibility enters the scene as a consequence and undeniable outcome of cosmopolitanism. Whether it comes from the cosmopolitan or suburban, the metropolitan must confront intrusion. In both cases a double-fold confrontation arises: the brought sound or objects belong to the "other," whereas they are only variations of a common essence, nested under the overarching concept of *phílos*. The "other" will always be a pseudo-invented since through all encounters (orientalist but also *occidentalist* intrusions) the host is already accustomed to the other. However, the most powerful impact is experienced when the "other" transforms itself into the "invented" stranger-guest. It is this *inventedness,* recalling Deleuze (2009), that interrupts a pleasant flow of being and time, preparing the grounds for "the breaking of an implicit contract," and like an intellectually distant yet temporally recent utopian thought, deforming the existent. Serres (2017) draws attention to the fact that "the supreme poverty of the system of harmony becomes known to us not only by the nature of things but also by collective establishments." This deformation, on the one hand, is the extension of the existent and, on the other, is a haunting reflection of the non-existent: unseen, but long awaited. An invention is the noise of its time. The impact of an invention lies within the dislocation and relocation of the other: the reduction of distance, which is augmented through the reality that the space of the host has to be shared and the host and stranger-guest claim the same rights. In order to understand how architecture confronts the multi-layered and not fully predictable evolution and alteration within time we only have to look in Akcan's complex analysis of the transformation of Kreuzberg, Berlin. (Akcan, 2018)

Theoretically the host and stranger-guest are on the same level, or equal. As they both exit the front door every day, it is clear that no matter if they have equal powers when claiming space, the claim for place is only reserved for the host. The host's claim, closely linked to an ill-constructed notion of temporality, and significantly with the concept of lateness cannot be taken for granted. It is true that the stranger-guest has no other option than to be late, but time within the concept of friendship is anachronistic and the claimed values are transcendental. The will of existence starts from home or the created niche, a space that is "place" per se. This legitimization is accompanied with a wide range of dislocated objects: furniture, relevant or irrelevant decorations, culinary artifacts, gifts (regardless of usage), musical instruments, and many more.

We arrive at the link between consumption and production, in which consumption mobilizes production to legitimize existence. de Certeau

(2002) names "practices of consumption" as the "ghosts of society." The stranger-guest's quest is to abandon its invisibility and become visible again. "Heterogeneity," set by Subasi as an important input within the world of objects and behavioral issues produces invisibility. For this discussion's premises, the importance of invisibility lies within its relation to different modes of existing: legitimization through which she discusses the invisibility of codification leads to a visual state of non-classifiable, hybrid and simultaneous existences. The basics here would not be other than stimulation through simulating the known. The known or, in a way, "claimed" in an *a priori* sense would become the first tool for the projection of place onto space; the primary surface for this projection would be none other than the shelter, in other words a space with a non-detachable "placeness": home. As this primary space-place is saturated with projections of the habitual, the stranger-guest having claimed its "bastion" steps into the world of the other into the heterotopic world of the invented host.

The city or, as de Certeau names it, the "operational concept," depends on a tripartite structure, which finally is declared as decaying due to shifts of modes of production and a mis-setting of priorities:

> The production of its own space: rational organization must thus repress all the physical, mental and political pollutions that would compromise it
>
> The substitution of a nowhen, or of a synchronic system, for the indeterminable and stubborn resistances offered by traditions, univocal scientific strategies, made possible by the flattening out of all the data in a plane projection, must replace the tactics of users who take advantage of "opportunities" and who, through these trap-events, these lapses in visibility, reproduce the opacities of history everywhere.
>
> Finally, the creation of a universal and anonymous subject which is the city itself: it gradually becomes possible to attribute to it, as to its political model, Hobbes' State, all the functions and predicates that were previously scattered and assigned to many different real subjects—groups, associations, or individuals.

As this concept decays, 'microbe-like, singular and plural practices," manage to outlive the process. These are likened to "noise," as Attali and Serres would have named them, which the metropole "was supposed to administer and suppress," favoring a silence or harmonious music over noise and cacophony. In fact, it is no surprise as the system as a whole is parasitical in which decay only forms one aspect of operational strategies.

3. NOISE

> "Organization, life, and intelligent thought live between order and noise, between disorder and perfect harmony…Noise destroys and horrifies…, [and] it nourishes a new order by injecting a new chance." - Serres

Serres (2007) asks of the country and the city rats enjoying their "royal feast" of leftovers if it was only a noise or also a message, "a bit of information producing panic: an interruption, a corruption, a rupture of information," which frightened them. It is static in a flawless dialogue or, with de Certaud's terminology, a friction in a frictionless system. Noise is an open proposal that is not asked for and, once received, neither the existent nor the other can remain unaltered. In this sense, the French word for noise "bruit," also the title of Attali's book, means "vascular murmur," as the consequence of an obstruction of blood flow at an abnormally high rate. At the same time, in French it corresponds to rumor. Russolo in his *Art of Noise* (1913) claims that the world prior to the nineteenth century was all but silent and muted, and only because of the industrial revolution ne can speak of the reign of noise or *rumori*. Purity resolves into an "amalgam,

[and] assonance into dissonance." The once uncompromising rigidity now reconciles with randomness and porosity. Thus, Russolo sets forth that the world at the beginning of twentieth century is heading towards "noise-sound." Music in the post-industrial age enters the realm of factory, labor, every day, and the world created by them. Just as the concept of friend cannot be separated from that of the stranger-guest, music cannot be detached from noise. Music triggers power and subversion and noise gives birth to both order and disorder. Music, or "any organization of sounds," thus becomes a tool for the "creation or consolidation of a community..." and it could be seen as an "attribute of power in all its forms," linking "power center[s]" to its subjects. (Attali, 1985)

4. RECONCILIATION: VALUES TO DWELL IN

Referring to Serres's assumption that the city and noise create each other respectively, the contemporary urban context cannot be disassociated from the power of the individual. Both feed from the same rear-domain. Every functioning system—ecological, economic, or political—dwells on power struggle and has only one aim: to survive and develop adaptive strategies for sustaining hegemony. The individual starts its claim to existence from the smallest possible denominator. This is the creation of "home," or, in other words, of niches of survival with minimum available sources. This already complicated process gains further complication, ambiguity, and unpredictability as an existing system confronts an "other" from across the border. This "other's" existence was known, its content was discovered, but it had always been kept at the distance of sight. This is the information age's watchtower, the panopticon of recorded vision or, in other words, the server-as-panopticon. In this time of surveillance, the stranger-guest creates the minimum space or niche for survival. This niche is subjective, and this subjectivity has to be sustained. Having entered the city, the stranger-guest now gains an ambiguous dual status comprising properties of the host and stranger but still lacking the power to claim a place in an existing space. Thus, it is destined to be late and it is this lateness that allows the stranger-guest to outlive the decaying conceptual structure. Through this attribution the stranger-guest –with its self-generated noise–is threaded into the symbiotic micro-structure.

Architecture, being located at the crossroads of this plenty has powers that could and should not be underestimated. Architecture has a humanist or posthumanist—whichever the majority is satisfied with—, "civic role" of "satisfying the unspoken wishes of strangers." (Farrell and McNamara, 2020) Pushing the boundaries further in the realm of the ideal rather than in the tangible could lead to the humility of tangible form, being content with a concept of unpolished and imperfect beauty yet not compromising elegance. A sustainable built environment that dwells on values (e.g. democracy, equality), instead on extravagant artifacts; and with an awareness of the different layers of citizenship (Farrell and McNamara), and proposes "overlapping" experiences without need for hierarchies like "stranger-guest," "host," and "lateness," declares a solid validity. An architectonic, theoretical, and ground-up approach has more chances to succeed by forcing itself towards openness and vulnerability and thus becoming a subject of togetherness.

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PAPER #8.03

DECONSTRUCTION IN ARCHITECTURE; A HISTORY OF COMPLETE MISUNDERSTANDING

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ABSTRACT

In 2016, David Bestué, the sculptor interested in architecture wrote an article called "The deconstruction in architecture. History of a misunderstanding", regarding the publication by Ginette Michaud and Joana Masó in *Editions of the Difference*, "Les arts de l'espace. Écrits et interventions sur l'architecture". It contains some notes that support the apparent "misunderstandings". However, in different previous writings I have defended the repeated amassing of errors in the reading and interpretation of the theories of Jacques Derrida, which I consider have led not to errors but to complete alienation in his theories on his architectural interpretation. Mistaken in its commitment, interference in its architectural transliteration, lack of rigor on behalf of the institutions, false use of personalism, commercialization, object of worship, simulation in its understanding, etc. Last October 9th, we remember the fifteen years of his death, an appropriate time for an assessment. In a distant architectural context, less polarized and not so significant in these allusions, it seems appropriate to make a critical review, put things in their place and give an honest account to the depth of his work. As he quoted in his farewell to Levinas, the *droiture*, "honesty" or "righteousness," requires us to specify what is "stronger than death."

KEYWORDS

Des-construction; transliteration; constructivism; alienation; simulation.

INTRODUCTION

Few are the direct contacts that the philosopher Jacques Derrida has maintained with the members of architecture, but not with the discipline, from which he always expressed an interest in learning -as he himself indicates- for his resistance (Derrida 1993); *"the resistance to philosophical authority can be produced within a core experience of specializing, of space"*. For the author the resistance to logocentrism has a better chance of appearing in this type of art. In an agitated social and political environment, with an air of emancipation and a certain gentrification of the emerging classes, after 1968 hippie, beat, rebellious and pacifist Marxist-based counterculture arose, with an interest between scholar and transgressor to meet the protagonists of the "criticism of criticism" (Cusset 2005). Initially championed in America by the Yale Quartet - Paul de Man, Harold Bloom, Geoffrey Hartman and J. Hillis Miller. In the period of conceptual coincidence between Eisenman and Derrida –between 1973 and 1984–, the American magazine "Oppositions" became the framework for architectural revision. In it, many intellectual positions were embodied, but especially the silhouettes of the two more powerful lines that emerged at the time and due to their impact on contemporary architecture were outlined; deconstruction and postmodernism. The first one supports the space-time binomial revising it towards temporality and the second one does not support it, but transgresses it until it is nullified. It is surprising that still today there are some that maintain that they are one in the same. And it is in the scope of "Oppositions" where the relationship between Derrida and

the architects is forged, like the refusal of his contributions, forging the negation of the post-metaphysical current.

1. THE APPEARANCE DERRIDA IN THE ARCHITECTURAL CONTEXT

Derrida appears in the panorama of American thought and architecture in the Conference given at the John Hopkins in 1966, called "Structure, sign and play in the discourse of the Human Sciences", where he states -among others- the term *deconstruction*. A term with an extraordinary influence and relevance in architecture from the 80s, due to its ability to contaminate this discipline, for various reasons that were later misrepresented. The body of that germinal Derrida lecture —contrary to the fascination that deconstruction proposes— dealt with the structuralist impossibility of ruling over the ultimate context of meaning; that lateral look —ultimately to the social context— to assure the acceptance of oneself and recognition of the environment. It was also about the inappropriateness of binding certain signifiers with their traditional meanings, as Foucault has already stated in his *heterotopias* or his "archeology of knowledge"; or the impossibility of *centering knowledge* and knowledge derived from the sign (as it was traditionally understood), composed of a meaning and a signifier as a closed and sealed binomial. Also addressed is the open terrain of the referential *game,* —consciously or unconsciously—, derived from the changing context and the psychological state of the subject in constant transformation, which allow differentiated and successive comprehensive, receptive, self-questioning states that open up to other additions.

And for this, Derrida enunciated the terms *dissemination, grafting, aporia, footprint, marks* all of them from the *difference*, a product of the inherent *hiatus* of thinking, or of remembering and the evanescence of the envelope with which present "the here and the now", the memory of concepts; in whose interstices there is room for other things, other memories, other connections, that not only allow contamination by the Other, but even place the other in a position of reference, transforming what we consider to be true or real. These two questions, which in their reiteration allow Derrida to affirm that nothing founded is fixed, there is no origin, no translation, no introduction, no presentation, no strict, closed and unidirectional communication. In short, universals and foundations do not fit, and therefore metaphysics cannot occur naturally in the subject due to its own impossibility, unless it is an imposition (own or foreign) of code, rule or strict external framework, introduced as act of domination or authority. Even against oneself. In short, what Derrida expresses in his lecture goes beyond the term deconstruction; he announced the rules of post-metaphysics and with it the *radical open work* beyond what was formulated by Umberto Eco in 1961, as an open work in progress (Eco 2017), compared to the closed work typical of idealism included in modernity. Another matter is that it be understood in all its terms, or that the architects eager to borrow a way out at the end of modernity, only approached its obvious part. This is what D. Bestué highlights in the text by Ginette Michaud and Joana Masó (2015): "haste and symbolization destroyed the author's memory".

2. THE WOUNDS OF EISENMAN TO DERRIDA

Peter Eisenman emerges in 1968-69 when he submits two model projects in a joint exhibition at the Arthur Drexler in 1967, with two articles (Eisenman 1975) In his articles he testifies what the design process has been throughout history, which he synthesizes as an equation of the "closed project" made up of (Form + Function + Meaning), from which

all the preceding history has been derived. After listening to the Derrida Conference, he will challenge this in his projects and advance in his philosophical studies (from an aspect of positivism). In short, a parallelism to what is said in that conference on the structure of the sign, composed of significance and signifier, which —according to him— are not inevitably linked, nor do they lead to the same according to context, interlocutor, culture, experience or psyche. However, if we question this equation, we enter the void. We question it either because form and function do not go hand in hand as an indissoluble symbolic unit, or because form is free of function and its meaning (coincidence with the prevalence of the signifier against the signified and its autonomy), or because there is no functional restriction that is limited to established forms, or because the meaning does not only depend on these factors, nor is it deduced unidirectional from them. It is then that we find the *abyss* of open work.

Abysmal architecture, as Scholem quotes in relation to Benjamin regarding the language which is inaugurated (Mendoza 2013, 155-176; Benjamin, 1916), is an architecture without limits, without restrictions, without impairment, without prejudice, modesty or complex, except that inescapably it must serve society, it must be livable and used according to the end for which it is intended; undeniable concepts of service, experience and utility which are neither closed, nor constant in time, nor fixed, so that the inherent adaptability of works already determines by itself the sign of its evolution, but also the sign of its statement. And for this reason, this description establishes the basis of the maximum autonomy that architecture can achieve without abandoning its irreducible principles of social service. Therefore, radical open work is a necessary condition of autonomy, although as we shall see it is not a satisfactory condition.

We have seen from the start how Eisenman tried to put Derrida's revisionist theory into practice (especially in its opening), and it was assumed from the beginning as an *attitude of design* that will essentially play and important role in the architect's professional career. In the 1980s, after Eisenman's studies of philosophy, a personal contact was made between the two in 1985 when Derrida was proposing a text on the *Khora* (place) subsequently published in 1993. In this text he addresses the extensive and complex meaning —while "space"— that Plato gives to this term in his work the *Timaeus,* the philosopher offering his reading to the architect, to debate on the very scope of his discipline, —the space—, a debate which carried on for three years. This reflection 'between the two' focused on the revision of the *"metaphysics of presence"*, a matter of concern and interest for Eisenman, or Libeskind, who was then circulating in relation to other concepts; to the "false determinant consciousness", of W. Benjamin, or the installation of images in memory that once presented are repeated; or by pre-constituted languages, a process in which by imitating, reproducing or simulating, the reasons of origin that are founded in it are blurred and therefore automatically transform into simulations of themselves. Eisenman will give shape to such reflections with the publication —on his own— of "Chora L Works", stating that they were made together with Derrida (published late in 1997), although they had not spoken since 1990. Eisenman had offended Derrida; for appropriation and because he did not understand the issue of *presence* as he himself pointed out, understood through Deleuze (2002). Ignasi de Solà-Morales (1995) tells it in an intelligent way and assigns the term *untimely* to architecture, a term taken from Nietzsche. This declaration can be seen in the presentation of Solà-Morales´ text which was reedited in 2004, where he not even once cites Derrida, he justifies his own architecture, as if it were a personal invention.

This link between the two was created with the invitation of Bernard Tschumi (French Swiss architect) to jointly participate in

the Parc de la Villette of Paris competition —of which Tschumi was the director for having won it in 1982—, whose transversal experience motivates both authors as Derrida shows (1988), and thus their relationship and dialogue continues until 1989. Tschumi was 'knowledgeable' of Derrida's theoretical work from his first approach in this project de la Villete, that of the 1986 Tokyo Opera, and others. He was the promoter and curator of the MoMA architecture exhibition, together with Mark Wigley and Philip Johnson, in 1988 on *deconstructivist architecture* (not to be confused with deconstruction) whose impact on the discipline was as relevant as it was false; because they symbolized something untrue. Tschumi had no scruples, knowing the theoretical depth of the Derridian deconstruction, in accepting the imposture of the term "de-constructivist". Manfredo Tafuri criticized these approaches because he did not trust this post-structuralism since he saw it as a bourgeois product without a truly transformative political intention. By then Eisenman had already become the theoretical reference for deconstruction within the field of architecture. In that time of agreement, both convincingly approach deconstruction as "attitude", alluding to previous examples such as Le Corbusier's position regarding tradition and history, Derrida expressing that:

> Those values of habitability and utility are not those who ultimately dominate the work or design. It is also about freeing architecture from certain aesthetic values. In the end, it is not harmony or beauty that control this work. This does not mean that the product must be ugly, but that, ultimately, its goal is not aesthetic.

Herein lies a criticism that his architects "friends" failed to understand: the liberation from the aesthetic yoke (as external imposition of pre-established norms) does not include two inherent aspects; avoiding the public dimension and service to the society of architecture, which many of these architectures show.

So what is the purpose of architecture? Derrida replies that:

> In a certain way, there is no such purpose. There is a game. It is about placing architecture in its specific place, that is, in a space that is not subordinated to values, for example, utilitarian, aesthetic or even metaphysical or religious.[…]. Tschumi and Eisenman try to free architecture from all those goals that are not, in fact, architectural, which does not mean, therefore (and this is the difficult part), that they try to restore a kind of purity of architecture. At the same time, they place the architectural "strictly speaking" with respect to other arts, to other languages: in Tschumi, with what a cinematographic narration can mean; and in Eisenman, there is a constant exchange with the literary text. We continually find a kind of reciprocal provocation between his "so-called architectural" projects and other spaces of invention, let's just say, of creation.

As we can see, Derrida clearly indicates to them the need to dismantle the anthropomorphic values that have adhered to architectural praxis, but in no case do they lead them to its replacement or alteration, which is ultimately what they provide. (This section takes on more chronological interest, when we read Marc Wigley's text on the Russian avant-garde, in the Catalog of the exhibition months before, justifying the reference to constructivism, with a "name" so similar).

Eisenman had developed his personal career from that assertion, of the "open project", according to his perspective. From an approach based on structuralism, such as the axonometric proposals for variations of the elements of their houses, I, II, III... 11th of Palo Alto, 1978- where he not only tests the semantic capacity of alterations and variations introduced, but also -and with it- an open graphic narrative compared to the closed conventional one (Eisenman 1971).

Such a *game-like* attitude seeks not only to influence the receiver, but also to require him to position himself, to participate, as already stated in the epic theater of Tretyakov, Bertolt Brecht, and included in the aesthetic statements by W. Benjamin, as Eisenman himself collected in "A Adolf Loos & Bertolt Brecht" from 1974. To this game strategy that opens up to the significant participation of the receiver, he referred to as *bleaching,* described as distancing, absence of the author subject, unfamiliarity, and inquiry into the alienation of the architectural form to escape the secular gag. Such a process, refers in its succession to fragmentation, the dissolution of the pre-established form of origin, (the cube), the significant dissemination, and the blotting out or blurring of the traditional form where the trinomial form + function + meaning resides. This could contain certain reminiscences of the deconstructive emergence, even if it is to follow an equivalent process of voiding the traditional unity between significance and signifier in sign formation.

His later strategies of inquiry are determined around scaling (mixing scales) and *overlapping* (process of overlapping planes) in proposals such as those of Cannariego in Venice 1978, Verona in 1985, Long Beach 1986, or La Villette in 1987; conceptualized strategies already researched by Tschumi and, who gives theoretical thought in various articles and texts (Barja 2014; Eisenman 1993; 1992; 1988; 1987; 1986; 1985; 1984; 1984; 1983). But outlining some differences with respect to Tschumi leaning towards Derrida; differentiating the result that came from the montage (Benjaminian concept taken from Brecht), with respect to *scaling*, in the first generates superimposition as well as the second superposition. A nuance that marks the difference between the unit and the unitary, the one and the multiple, the same as the traditional –but more complex or flexible–, compared to the pluri-significant and interpretable. And that is summarized in the difference between closed and open project.

A field of research in which he immersed himself in search for a post-metaphysical architecture, from the acceptance of the open work but also from the *negativity of emptiness and lack of it.* This aspect —of the open work— , that here can no longer go unnoticed.

Although Derrida does not mention the open work in any text (but of the *opening of the text*) as such (but Umberto Eco does (2017) in twelve specific references of his own on Derrida), this reference will simplify the reflection of this text, bringing it closer to the design exercise of architects. One of the derivatives of this relationship that we follow and between the two poles of contemporary architecture, the link that connects Identity and Autonomy but that allows their distance, is precisely the distinction and separation between open and closed work. We understand from Benjamin the idea of closed - when everything that must be said is said and everything that must be understood is in sight, therefore, the understanding of the entire work is feasible and it is about knowing how to see, knowing how to recognize, knowing how to identify on behalf of the receiver. That is, to follow and detect everything said there. In the open work these questions are not fixed; they are posed in such a way that, in the normal interaction between the work and the receiving subject, it must contribute part of its experience, culture, memory, that is, it is not complete and is capable of being completed with the other, an action that produces corruption, the spread or the graft that Derrida spoke of, to be understood. Because its spatio-temporal capacity to integrate into sociopolitical-economic, cultural and bond-generating contexts and settings, beyond its generation limit (authorship that Derrida calls signature), is key in the open work. What in literary terms would distinguish Italo Calvino from Umberto Eco; and in architectural terms what distinguishes Libeskind from Eisenman, both from pseudo-deconstruction.

But how does this break-up between Derrida and Eisenman take place, after such a

close relationship and what are the wounds that cause it? Luis Fernández-Galiano (2004a;2004b) talks about their relationship. Derrida replies: "But, furthermore, I cannot hide that, as far as architecture is concerned today, I feel less competent and inspired than ever." In other words, Derrida's disappointment with Eisenman —who is not able to catch sight of Fernández-Galiano— was not to make him understand the scope of the radical opening of the work compared to the closed or half-open one, and Eisenman's relief when moving away from the deconstruction was the calm assumption of identity in the face of autonomy, which he could not achieve. What is also surprising is that Fernández-Galiano in his posthumous article on the philosopher, beyond explaining that 'he knew him personally', points to third-order questions as justification, when relevant was much more evident. Already in April 1990, the philosopher granted an interview to Brunette and Wills, on the subject of "The Arts of Space", where he responds in parallel to the *Assamblages letters* (Derrida 1990; Eisenman 1990), that caused the divide between philosopher and architects to those who posed as followers, not listening to anything. What Derrida basically highlights and that separates him from Eisenman, –his wound– is the fact that the open nature of the project (as text) is *a necessary but not an adequate condition*. It is necessary since it allows the participation of the receiver, the introduction of other signifiers by the receivers who, in such action, become authors and thus change the work, beginning the circularity of the signifier that allows its comfort over time, with time and giving time. But it is not enough if the themes are restricted, therefore thematized or there is a minimum mediation bias of the first author subject; that is, if the signature persists, the "bad identity" acts. And it is at this point that Derrida is frustrated by not making the architect Eisenman see such scope, wrapped in a communicative environment - in which Fernández- Galiano is a participant - that guides architecture towards the star system. Because the work —Derrida will say— "is welcomed, they simply ARRIVE, it does not contain a signature and it does not choose; it's just sheet music. "Eisenman's mistake was to understand that the opening of the work should be oriented towards *nothingness,* towards *emptiness* (which implies for him a *negativity*), subtracting in such cases what the author himself is, his own Jewish condition, and his own teleology. And so Derrida writes to him in a letter in 1990:

> He formulates a discourse on negativity too easily; he talks about the architecture of absence, of the architecture of nothing (like Libeskind). His works are too inclined to speak of emptiness, negativity, and absence, in a sometimes teleological, even Jewish-theological tone. No architecture can be called Jewish… but his is based on a type of Jewish discourse.

And so he synthesizes such a *necessary and sufficient*, pointed out in other texts (Barrera 2019): "If there is a work, it means that the analysis of all circumstances only served to make room in an absolutely indeterminate place (the OTHER to arrive), to something that is at the same time useless, supplementary and irreducible, finally, to those conditions". Because the exaggeration of the autonomy in a creation empty of meaning end up as a narcissistic identity, as he indicates:

> If there is that kind of practice (personal, narcissistic, self-indulgent) then you don't stand a chance. Its future lies precisely in that the practice is transformed, disfigured… subjected to a normalized or identifiable formula… would have been born dead… it has opportunities since it moves and manages to transform itself, so that it is not instantly recognized… and that it appears as something forbibben…

This is the first wound that Eisenman inflicts on Derrida; he is not able to understand the project as a music score, that allows what has resulted from the forbidden, that is just a call, an "arrival"' that welcomes the receiver. In Eisenman's work, Eisenman himself always emerges cryptically hidden. The second wound comes from the temporary dimension present in the previous process and in the *differance;* because the 'arrival' is a postponement. Differance-*différance,* understood as defer and deferral, which requires spacing where time meets. It indicates, "the effect of the signature cannot be reduced to the effect of authorship... the signature exists as long as a given work is not limited to its semantic content". Later clarifying:

> A signature will appear every time an event occurs, every time there is a production of work, whose occurrence is not limited to what can be analyzed semantically. This is its *significance*; it has its place, its non-present existence, that of the work as a print, as permanence (*restance*). That means that one can repeat it, review it, identify it, walk around it... even if it doesn't mean anything, it is there as an addition to all that. And that excess obviously provokes an *endless* speech; and in this consists the critical discourse... the signature is the occurrence of the work itself.

Therefore, contamination or grafting, if possible, arises in the deferral, in time. This is the basis of temporary *turn*, the wait. At the insistence of Eisenman and Libeskind importing other texts to the work (that become the hypertext of borrowed) and Tschumi's search for transgressions with cinema, for wanting to cryptically connect all the contents and underlying the work, thinking that the cause is well hidden, Derrida clarifies that this is not the way, showing you the reception process:

> The confirmatory act that consists of people arriving and deciding that there is something interesting there..., It all starts with the *contresignataire*, the receiver. The origin of the work resides, ultimately, in the recipient... the temporality of the signature is always this perfect future that instinctively politicizes the work, which delivers it to the other, society, the institution, the possibility, ... It is necessary to say "politics" and "institution", and not simply "someone else", ... this takes us from private to public. A work can only be public.

This being the case, the poignant polyphony of multiple dismembered objects under the sign of what is called deconstruction seems misaligned with what Derrida presents. What would be the tone in which the work should be presented?

> The tone, writing in many tones, does not allow me to reduce myself to a single person or moment. The question of tone is not a pragmatic analysis, of determining the meaning, the thesis, the theme, or the theorem of a text... it is knowing who it is for and to produce what effect... suddenly the person changes, the voice changes and everything acquires spatiality, ... because spatial works that should even produce this effect still give the impression of some sort of order.

For this reason, the deferral time is given a condition where it is possible to omit the established order. In this way, he emphasizes that the seed of his proposal is temporary in nature, since once the work has been left to the world, someone, perhaps, will understand it and assign some signifiers that integrate one other, the other, with the Other. And this is not irreconcilable with the beauty that is intended in the work; for those who advocate voluptuous rupture, incomprehensible formal anarchy, because beauty is a *vibration* related to *time*:

> In no case (inside and outside art) can it be separated from the experience of the body; and therefore from the experience of desire...

> a libidinal nature... inseparable from the relationships with the desire of the Other, ... through the voice, through something that has to do with tonal differences... through of the voice as something that intensifies desire to the maximum, precisely because it separates it from the body. There is an effect of *discontinuation*, of *interruption*, (making love in silence or with the voice only); the voice *separates*, ... then it is about what is in the voice that causes desire; it is a *differential vibration* that at the *same time interrupts*. That is what beauty is, the great beyond, a transcendence, which is inaccessible... and therefore I cannot consume it. That defines a work of art, not being able to consume it; beauty is something that arouses my desire by saying precisely, "you will not consume me.

As E. Miralles points out, you cannot consume what lasts over time, because it is restored sequentially in it. For this reason, Zabalbeascoa (2013) calls Architecture of time -that of Miralles- and deepen in time as subject of the project. In this way, autonomy, radically open work, *différance*, the temporary nature that another, my other self, the Other can germinate the work, are the misunderstandings that led Derrida to distance himself from architects, not architecture. None of this architecture is deconstructive, but only a simulation of deconstruction. The theory of arrival, gift and forgiveness is of inexhaustible patience.

3. THE WOUNDS OF MARK WIGLEY AND PHILIP JOHNSON

Curators of the modern architecture exhibition in 1988, under the title 'de-constructivist', a similar but different word from 'deconstruction'. In this paradoxical similarity, transference occurred: such concepts were understood as those early architects and critics said when approaching these ideas (Libeskind, Gehry, Hadid and critics like Stuart Wrede with the same curators). Primarily like destruction, like rupture, explosion, fragmentation, like disassembly, with reference to other things (constructivism). But that was never the basis for Derrida's ideas that appealed to *dismantle* and *evoke*. That exhibition was a way of representing an avant-garde opportunity, absorbing the wake of a philosophical theory that became a motivation to copy. This representation was signaled by the heterogeneous but repetitive selection in disruptive and hatched codes by Philip Johnson and Marc Wigley at the 1988 MoMA exhibition. A collective error in representation without understanding the scope of these nuances. It is possible to overcome modernity without breaking its deliberative course, although it is necessarily incorporating other cultural parameters. Derrida's sustainable and ecological feminist or gender reading, with absolute adaptability in certain proposals, show that the framework of values can be "re-established", without necessarily maintaining the status quo. But this does not justify the impersonation of its name that leads to the denotation of his theory due to the false transferred balance.

But what did its curators want at that architectural meeting? Philip Johnson (Nieto and Sobejano 1987) unabashed stated the following: (1) "architecture is a decorative art". A demonstration that automatically excludes you from the debate that we are following. (2) He refers to architecture as a frame, dressed in glass, in reference to the Toronto-Dominion Center building, as de-constructivist, although its appearance is Miesian (purely metaphysical). This already indicates that the curator was involved in other different things – transforming a booming post-metaphysical current into a metaphysical impersonation; (3) when asked about the difference between the deconstructive philosophical framework and its de-constructivist name, he points to his reference in Russian constructivism, "it is constructivism in its origin"; (4) when asked about what he found interesting he answers with several notes: Aaron Betsky's book,

Violated Perfection and Giovanini's reference in Coop Himmelblau's work to Malevich, about the decomposition of forms, its paradoxical sensuality and imperfection contrary to classical perfection. Such references are a ploy to distract. The apparent similarity or similarity of lines, designs, angulations, "diagonal, structures, ... designing with that freedom is very exciting", it does not belong to the philosophical register we are talking about. The invention of "de-constructivist architecture", symbolized, with historical foundations, inserted in the institutions, presented with godparents, was the construction of a conspiracy against deconstruction. It sought to make metaphysical the current stream of architectural reflection of underlying layer post-metaphysical more widespread. It was a *firewall*.

If we read the contributions about the exhibition "Deconstructivist Architecture" (Johnson and Wigley 1988) within the architecture program Gerald D. Hines architecture program -Interests in MoMA in NY-, we do not find any parallels with the deconstruction. The preamble to Johnson's text speaks of the coming together of "similar approaches." To confirm this, he refers to the photographs in Nevada of a spring shed, by Michael Heizer; for being "disturbing, dislocated, mysterious... the contrast (with the bearing of machinist architecture from 1932), is between perfection and violated perfection". Years later Derrida would not let the opportunity pass him by to contribute from the deconstruction of Heizer's work, "double negative" in "the double session" and "GLAS" that reveals these insignificant approaches. Like his reference to violence as a fold, different from the one confirmed by them (Derrida 1971a, 48; 1997b; 1994; 1997a); "the fold holds the secret, it is a closed book, and folded onto itself, virginity that keeps the secret of its violation".

Wigley's text does clarify; "It is not that they derive from the contemporary philosophical modality called *deconstruction* (forget the "s" that Derrida adds when deriving the term from Heidegger)... they emerge from architecture and exhibit certain deconstructive qualities"; (really none, except the intention to break its anthropomorphic foundations) "because they deal with dismantling" he will say, borrowing the meaning from Derrida, but referring to different things, changing the meaning; "it identifies the symptoms of a repressed impurity, showing its duality between soft conviction and violent torture, so that the form questioned. This is common but in reality it is a simulation. Therefore, the title is a trick: like the one that Derrida himself highlights months after the exposition in the interview we saw. But Wigley returns to pre-revolutionary constructivism such as the Tatlin's Tower Monument to the Third International of 1919 that inaugurates *the radical line*: "with pure forms, conflicting sets were composed", "stability formalizes instability"; "there is no axis, but a nest of axes"; "it was social, but it was based on function"; "the drawings became reliefs, and from them to three-dimensionality"; "the pure forms are trapped in a twisted frame, then penetrated from within and finally dissolved". A textual link that, turned the base into pure ornament by excluding those tensions between its antinomies, transforming its dynamism into stability, losing the strange part of its designs, its sculptural vision, ending up as a stylistic twist. What Wigley does is formalize a working scheme, some design bases, and some patterns, which in Derrida (1997a) dismantles. The exhibition explores the relationship between the instability of the first Russian avant-garde and the stability of the late-modern period. This is a temporary leap that invites parataxis, the accumulation and not the circulation of time, an object of deconstruction. That was the staging of an *assault,* which Mark Wigley tries to take back when he meets Derrida in 1991 at the University of Columbia, motivated by Derrida: "is there a different between architecture and hospitality? A speech repeated at the Round

Table in Madrid in 1997, where he focuses his answer on the talent and in forgiveness.

Why that attack? The text "Delirio y estuco" ("Delirium and stucco") (Fernández 1996) analyzes the socioeconomic structure in relation to the monopolies of power that fosters the emergence of the two postmodern positions; classicism (*stucco*) and abysmal (*delirium*). Solà-Morales in the same publication states that it was the division between the theory of imitation and the theory of invention, after the debate between innovation and necessity, which later concurred with *experience* (Derrida 1993), in the desire. It reproduced the scenario of the "anti-war" bourgeois imposture of 68, as "anti economic power" in the 70s, a scenario of *control and surveillance* is woven in the 80s at the hand of the epigones of those doctrines. In order to distract the restless people, they propose to transform the radical emerging positions into pragmatism, where the new sorcerer recovers the lost center with the appearance of mass culture. Those upheavals generated difficulties and social demands, while the economic structures had lost growth and relevance. It was necessary to regain control by intensifying violence. From the propaganda empty of content, the operation, a "bloodless fascination for the non-existent as something real" was proposed, with the epigones taking on the role of "fifth column of architecture". Once the material, military and economic power is brought together, a priestly aura is installed, taking a quote from Lippman; "when times get out of control, some attack the barricades and others take refuge in convents".

The origin of delirium founded contextualism, metaphor, analogies and typological invention, generating the "epigonism of epigones", explaining the beyond modernity as "*an illusion-allusion*", through disorder, obliqueness, the evasion and elision common to architects faithful to the representative tradition, even if it is a different self-referential representation. But such an origin led to the generation of works of empty or absent of meaning. A question that did not fit into the dynamics of "the late monopolies that demanded an eloquent code for their envelope, that is, to make it possible for these decorations to have the effect of a *moral rectification* in the face of decadence", which these works showed of the previous system. This supported a genuine *formal riot*, leading to "a re-mastering operation of the *managers*, an updated specularity." Where Philip Johnson played the role of sorcerer, a demiurge of symbolic apologetics. Thus an *ideology of consolation* is presented through architectural images, against those that undermined the structure of the mercantile-industrial bourgeoisie. The figurative recovery led to the iconic, speculative recovery, which alternated the production of images by the most redundant methods and means, in the direction of an altering reality. A "happy context" is therefore created, by having the signifiers tied together, where the effectiveness of *surveillance* led to the dialectic of "surplus value", building "the space where to ritualize the exchange ceremonies". Because "everything is made to be sold, without wasting a second", the circulation in magazines fully entering here. Where the subliminal mechanisms that distilled these spaces were aimed at drawing attention accepting therefore the premise of desire. Generating desire represents "a perspective of new life, facing the insufferable of that reified present (eternal present) and the demand for a more acceptable society", which Eisenman or Koolhaas refer to the new human form of the world; the apocalyptic-sublime. The scene turned towards *animus projects* with which to mitigate the stark interests of affluent society. Because the rise of conceptual art was taken advantage of, the generator of new concepts where the work is exhausted in ideation, so that the need mutates from desire to irrepressible desire, or alienating ecstasy. An area of full autonomy in research that excludes theoretical interference of another nature that

challenges the hegemonic powers. Later on, *architecture of meaning* will emerge from here, that which presents virtuality in substitution of the imagined reality, another step forward of the now digital economic power.

CONCLUSION

Why refer to architecture as *de-constructivism,* in a historical moment where the concept *deconstruction* is declared, in whose shadow some authors said they were working on? Its appropriation: its representation taking advantage of the inertia of such a term: "The word deconstruction, like any other, has no more value than that which gives it its register in a chain of possible situations...
"The context", a question that does not concur in this impersonation. Why do architectures and architects obsessed with deconstruction mix with unrelated people who work in the simple search for their personal reference? For masking appropriation under a pile of comparable signs under the bias of equality, similarity, likeness, resemblance, reasonable, etc. Derrida speaks of an attitude that leads to evocation. Why is a constructivist discourse built around a set of architectures, when its reflective underlying layer is metaphysical, about something that wants to be seen knowing that it is post-metaphysical? To impersonate it and build a firewall that blurs its expansion. And this is exactly what happened.

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PAPER #8.04

PUBLIC PARTICIPATION AND CITIZEN PARTICIPATION IN CURRENT VALENCIAN URBANISM

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ABSTRACT

To talk about participation in urban planning is to discuss not only its concept, but also its relationship with the models of Democracy, the meanings of Governance and the governance of the territory. From the analysis of the Law of Territorial Planning, and Urbanism and Landscape (LOTUP, 2014) of the Valencian Community, Spain, and its modifications of 2019, two types of participation, public participation and citizen participation are derived. These are different processes and levels of participation in urban planning and planning, since they have different ends, dimensions and participating agents. In addition, the hierarchical position that the Law establishes between them is significant, subordinating the second one to the results of the first one. This separation and hierarchy invites us to reflect on the concepts of Democracy and Governance that are applied in the development of municipal urban planning instruments. Citizen participation remains one of the workhorses.

KEYWORDS

Public participation; citizen participation; democracy; governance; urban planning law; Valencian Community.

PREVIOUS POINTS

Public participation and citizen participation are terms that seem to be used without making a difference between them in the context of urban planning. Can we talk indistinctly of both? Can they be differentiated from political or democratic theory and especially in the dispositions and processes that the laws in urban planning gather?

In its generic sense, participating means *being part of…*, which leads us towards socio-political and legal conceptions of the forms of government, Constitutional and Representative State, where the dimension and sense of participation evolves within the opposite discourse between liberal democracy and participatory democracy, models that respond to different institutional designs .

Following the teachings of Almagro (2016, 179-182), which synthesizes much of socio-political thought from the middle of the s. XX, the force ideas that underpin the reasoning basic of both types of democracy, regarding the participation of citizens, are the following:

• *Representative liberal democracy.* Citizen participation is limited to electoral participation, to the election of its representatives, or is its preferred instrument. This is the only effective political management medium leadership at the complexity and size of societies today, and respect for property, security and natural rights:

a) The otherwise -direct participatory democracy- will overflow the political system because of the continuous social demands that would lead to bankruptcy (the scale).

b) Citizens are unable to understand the technical complexity of decision-making, solution of political problems and take responsibility for the management of public affairs (Almagro 2016, 181).

The citizen is a managed, their role is passive. The relationship between Government, Administration and citizenship is vertical.

• *Participatory democracy.* Understands participation as a right and value that legitimizes democracy, so freedom in democracy is conceived as a space without domination. Popular sovereignty is not transferable. It implies the expansion and strengthening of the channels of "direct and semi- direct participation", as well as civil association, public hearings and forums. Participation must be influential in decision-making processes and their results respected, so citizens are considered active subjects:

a) They have knowledge of the reality that affects them and the ability to decide.

b) Its effectiveness in solving problems may be equal to or greater than that of specialist technicians. Sociologically it leads to increasing public awareness, social cooperation and democratic involvement with institutions and their procedures, as well as reducing the power of the ruling elites on the democratic path. It has three approaches: deliberative, direct and radical. (Almagro 2016, 181-182).

The citizen is an active part. The relationship between Government, Administration and citizenship is horizontal.

Participation, through this last democratic model, takes a new meaning directed towards collective construction of life and the future. In this sense, Villasante (2009, 14)[1] synthesizes the idea in a praxis aimed at "reflecting collectively, building participatively, based on our own reflexivity, to be more operational and transformative".

Both models seem to be combined in the *New Public Management*, based on the *new governance*, a concept developed and analyzed by multiple authors from public and private framework. Public governance can be defined as a process of self-government and self-coordination, with the participation of a varied network of performers: government, public and private companies, civil society organizations and citizens, in which the direction of society is decided, objectives of coexistence are defined —their sense and direction— as well as the way to coordinate and organize to achieve it (Aguilar 2006, 90 and 2010, 30).

This new direction, therefore, forces states to change laws, transform its institutions and make settings in its bureaucratic apparatus. It surpasses governance - the ability to lead linked to a political performer and the yields of its policy - and it gets installed in a process of constant negotiation among all those who make up the network (Vallés and Martí 2015, 426). Cooperation is in its foundations, also "freedom and unlimited flow of information, innovation and agreements based on commitments and mutual understanding (…) means an equitable distribution and redistribution of power and resources" (González, Gascó and Llopis 2012, 32).

It involves incorporating the citizen as the subject of the process of management and decision making on the collective, recovering, in words of Pindado (2008, 25), both the "political character of citizenship" and the "citizen character of politics."

Therefore, we can talk about a new way to manage social conflict and work consensus.

The citizen participation contained in public participation remains in that network of performers.

	Dimension		Relationes	Citizen role
Liberal Democracy	Limited	Electoral	Vertical	Passive
Participatory Democracy	Multiple Multidimensional	Direct Deliberative	Horizontal	Active

Table 1. Democracies and Citizen Participation Dimension. Source: made from Almagro (2016)

[1] Foreword by Tomás Rodríguez Villasante, en Montañes Serrano, M. 2009. Metodología y técnica participativa. Teoría y práctica de una estrategia de investigación participativa. Barcelona: UOC

1. URBAN PLANNING. GOVERNANCE AND PARTICIPATION

Fundamentals and processes of governance, commented in previous lines, are related to the participatory democracy, which is a new redistribution of power in making decisions that affect the physical and social space, the territory and the city. It introduces a way to abandon the bureaucratic hierarchy, the "technocratic elitism" (Villasante 2017, 169).

To incorporate this new public management of our cities, the new administrative legislation in urban planning fit participation, cooperation and collaboration of civil society as a different bureaucratic model, by overlapping or curling it sometimes in their administrative traditions. The Aarhus Convention of 1998 and the European Landscape Convention of 2000 about Environment are the starting point of the European framework in relation to Public Participation. The United Nations Economic Commission for Europe assumed in Aarhus (Denmark, 1998), the Convention about access to information, public participation in decision-making and access to justice in environmental matters. In general terms, it's upheld that "participation must be guaranteed in the authorization procedure for certain specific activities

For its side, European Landscape Convention (Florence, 2000), urges the "development of landscape policies at different political-administrative levels, to establish procedures for public participation, to identify and qualify our landscapes (Zoido, 2012, 13).

Subsequently, in transposition of Directives 2003/4 / CE and 2003/35 / CE)[2], European regulations on environmental information and participation, culminates in Spain in Law 27/2006, of July 18, which regulates the rights access to information, public participation and access to justice in environmental matters. Participation in which Spanish Constitution of 1978 advocates must guarantee democratic functioning of society and introduce greater transparency in the management of public affairs.

Thus, article 16 of the 2006 Law promotes "real, complete and effective participation in preparation, modification and review of plans, programs and dispositions, of general nature, related to the environment, by the Administration"; Furthermore, it is fundamentally established that "public has the right to express observations and opinions when all possibilities are open, before decisions are made on the plan, program or disposition" (regulations expressly include citizen participation)

In the Spanish urban area, citizen participation is subsequently included in the Land Law of 2008[3], which in its art. 3.2 c) establishes "The right to information for citizens and entities representing the interests affected by urban planning processes, as well as citizen participation in urban planning and management"; likewise, in its art. 4 by providing for the rights of the citizen and, after pointing to public information (letter e), which indicates the effective participation "in procedures of preparation and approval of any instruments of management of the territory or urban planning and execution and of their environmental evaluation by formulating allegations, observations, proposals, claims and complaints, and obtaining a reasoned response from the Administration, in accordance with the legislation regulating legal regime of said Administration and the procedure in question ". Nowadays, all of this is regulated in Royal Legislative Decree 7/2015, of October 30, which approves the revised text of Land and Urban Rehabilitation Law, art. 5.e), within basic statute of the citizen, and in relation to the citizen's rights.

In summary, transparency, openness and citizen participation are the three

[2] Directives on public access to environmental information and by which Directive 90/313 / EEC, of the Council, and Directive 2003/35 / EC, of the European Parliament and of the Council, of May 26, 2003 is repealed, which establishes measures for participation of public in certain plans and programs related to the environment and which modifies, with regard to public participation and access to justice, Directives 85/337 / CEE and 96/61 / CE, by reference in Fernando Manero, M., "La participación ciudadana en la ordenación del territorio: posibilidades y limitaciones", Geographical Notebooks, 47, 2010-2, pp. 47-71, at p. 57.

[3] By Real Decreto Legislativo 2/2008, de 20 de junio. Texto Refundido de la Ley del Suelo.

axles on which governments and public administrations must design public policies and specify their forms of implementation and evaluation.

The countries of European environment (France, Germany, United Kingdom as well as Spain), coincide in pointing to the binomial citizen participation and administrative efficiency attending to new forms of relationship and involvement that rebound on management; legislative reforms are therefore necessary involving new instruments where participation is more extensive, more relevant in decision-making, and, in addition, it must be aimed at both organized and non-organized citizens (Ganuza, 2004).

To observe the status of citizen participation in urban planning in Spain, we will analyze the Valencian case through the relevant Legislation in urban planning. We refer to *Law 5/2014, of July 25, on Territorial Planning, Urban Planning and Landscape* and its modifications of 2019 (LAW 1/2019, of February 5, of the Generalitat, of modification of Law 5/2014, of July 25, of land management, urban planning and landscape of the Valencian Community).

In this analysis we will try to answer questions like: in the relevant legislation on Valencian urban planning, does a liberal conception of democracy predominate?; What's the position and role of the participants?; Is there a hierarchical separation between the participation of government public entities and the participation of citizens? Does this legislation include consultation of the population and establish a system of binding decision-making?

We will start from a brief reference of the national legal framework, to focus later on the specific reference law.

1.1. Legal framework: transparency and citizen participation

In the Spanish state, through the Constitution, the obligatory nature of the public powers is collected to "promote the conditions so that the freedom and equality of the individual and of the groups in which it is integrated are real and effective; remove obstacles that prevent or hinder its fullness and facilitate participation of all citizens in political, economic, cultural and social life" (art. 9.2).

The right to information and freedom of expression is included in the same constitutional text (art. 20); and, art. 20.1.a, the right "to freely express and disseminate thoughts, ideas and opinions through word, writing or any other means of reproduction". On the other hand, according to article 23.1 of Constitution:

> Citizens have the right to participate in public affairs, directly or through representatives, freely elected in periodic elections by universal suffrage.

More specifically, all people have the right to access public information, in accordance with art. 105.b), regardless of format or support, which is in the hands of any of the subjects included in the scope of Title I of the Act state 19/2013 of 9 December transparency, access to public information and good governance, and that have been prepared or acquired in the exercise of their functions (art. 12 and 13), as well as art. 13.d) of Law 39/2015, of October 1, of the Common Administrative Procedure of Public Administrations.

Likewise, Law 7/1985, of April 2, regulating Bases of Local Regime, comes to consecrate public-citizen participation in a framework of information transparency. With enhanced role of the municipality as "basic entity of the territorial organization of the State", the councils are equated with "immediate channels of citizen participation in public affairs, to institutionalize and manage independently their own interests of the relevant authorities" as well,

> Will provide the most extensive information about their activity and the participation of all citizens in local life. Article 69.1.

Recapitulating, to participation is a democratic principle enshrined in the Spanish Constitution as a fundamental right (art. 23.1) that must be regulated by law (art. 105), establishing forms of participation. As a fundamental right it affects all areas of political action, which includes urban planning, land planning and landscape. The Spanish territorial division, collected in it, recognizes autonomy of the autonomous communities to manage their interests (art. 137), recognizing among its powers the management of the territory, urbanism and housing (art. 148.3rd).

The Autonomous Communities have been legislating in this area for several decades. Currently, the Valencian Community manages and regulates this area through *Law 5/2014, of July 25, on Land Management, Urban Planning and Landscape* (LOTUP) and its 2019 modifications (LAW 1/2019, of 5 of February, of the Generalitat, of modification of Law 5/2014, of July 25, on land use planning, urban planning and landscape of the Valencian Community).

1.2. Legal regime of citizen participation in Valencian regulations

We will start from the consideration of transparency, openness (open access) and citizen participation, such as the three axes on which governments and public administrations are designing public policies and specifying their forms of implementation and evaluation, as thus follows from the preamble of Law 2/2015, of April 2, the Generalitat, of Transparency, Good Governance and Citizen Participation of Comunitat Valenciana. Chapter I, establishes the general principles that should govern actions related to citizen participation, both individually and collectively. The participation instruments are determined in Chapter II and will be indispensable tools for citizen use that will make collaboration between administration and citizens more effective. Participation processes in elaboration of norms, the right to propose normative initiatives and the regime of the Citizen Participation Council are regulated. Under such a postulate, a new model is advocated, which regulates, on the one hand, the obligation to inform and publicize public action, and, on the other hand, the right of access to public information. More specifically, Title V regulates aspects related to citizen participation; consequently, "the active participation of citizens in public affairs" (art. 43., on development and promotion of citizen participation is encouraged —strengthening the associative fabric; citizen involvement; furtherance of communication, meeting and work spaces, etc.—; and, article 44, measures for citizen participation; with reference to the regulatory route).

Translated into the Valencian urban environment, the legal regime of public participation is set up by Law 5/2014, of July 25, on Land Management, Urban Planning and Landscape, of the Valencian Community, which has been modified by Law 1 / 2019, from February 5. This Law advocates transparency that is guaranteed by public participation, from the beginning and in all phases of formulation, approval and monitoring, in the terms required by strategic territorial evaluation.

> All agents with ability to operate in the territory will know from the beginning the environmental and territorial criteria, and the functional requirements that must be taken into account in the development of urban, territorial and sectoral plans (Section I of the Grounds Exhibition of the Law 2014).

In turn, the modifications made by Law 1/2019 insist on the need to guarantee proper citizen participation:

- In the new section 5th in art. 6, in relation to landscape instruments, on the need to submit them to the process of public participation and consultation with the affected administrations.
- In definition of public interested in the processing of the strategic environmental

and territorial evaluation of plans and programs (art. 48. f).

- On regulation of public participation in the processing of planning instruments (art. 49.1b).
- In the new art. 49. bis, in relation to actions prior to the drafting of the planning instrument.
- Equally, public participation plan which refers to the new paragraph 4.c) of the art. 51, which allows "telematic participation from a forum or space enabled where the document is open to citizens and in which contributions are allowed".
- In article 53.1 which includes obligation of the promoter body to submit the strategic environmental and territorial study, as well as the rest of sector documents, to citizen participation: "with people, associations, platforms or groups", which "is have made or provided suggestions in the phases prior to the drafting of plan or program or information in the scope document", etc.

2. ANALYSIS OF THE TREATMENT DISPENSED TO PUBLIC / CITIZEN PARTICIPATION, IN THE VALENCIAN URBAN REGULATION

From all of the above, several fundamental questions can be dealt with from the normative point of view: if the law differentiates public participation and citizen participation, moreover, if it is a separate process clarified in the law in a taxative and/or decisive way.
Attending to the procedure of preparation and processing of the planning, in accordance with the provisions of art. 48 of the Land Planning, Urban Planning and Landscape Law 2014 (LOTUP), the persons and institutions participating in the strategic environmental and territorial evaluation of plans and programs are established, mainly targeting legal persons, public institutions competent in the matter, such as the "promoter body, substantive body, territorial environmental body, as well as the Administrations affected". At this point (phase 0 of beginning) we can affirm that it is attended to the public participation , but far from the citizen participation understood as really involved in the starting point of the elaboration and processing of the planning, with really contributions of what is It will start and what is being done. Citizens would enter to participate, effectively, at a later stage (Phase 1) when there is already a Draft Plan (BP) and a Strategic Initial Document (DIE). The "technocratic elitism" and the hierarchy of specialization, marks the beginning and territorial strategy, so that the results of citizen participation are limited and conditioned since their incorporation into the process. The citizen is an administrator, his role is semi-passive. The relationship between Government, Administration and citizenship remains vertical.
With the modification of the LOTUP in 2019 (of the new article 49bis), in attempt to promote public participation, make citizen participation proactive and more effective, it is noted that before draft plan is prepared, a website of the promoter body will be enabled in order to have a first rapprochement with the public, for 20 days, in relation to a document that briefly indicates problems that are intended to be solved, the objectives of the Plan and the possible alternative solutions (art. 49bis 1.), so that it can serve as a starting point.

> (…) Prior public consultation will have internal administrative effects, preparatory to the drafting of the plan, and will give rise to the obligation to prepare a joint response report to the contributions received. The result of the consultation must be included in the file, indicating the number of participants, number of opinions issued and the response report (Article 49bis, 2., Starting document, preparatory work, before the start phase 0).

For the first time the Valencian legislator makes a public consultation before drawing up the Draft Plan (BP), but without elaboration

of an earlier participated diagnosis, ie, again from a diagnosis and proposals processing tea art, without horizontal and collaborative relational model, supported by the basic principle of Governance. On how active advertising is carried out, the volume and diversity of participants will depend, since it is known that the participation of factual powers stands out through the web. Even so, it constitutes an advance in proactive listening and towards a collaborative model. It implies a strengthening of the direct and semi- direct participation channels and is supposed to influence the decision-making processes and their respected results. The path towards the incorporation of Governance in the new management of public goes with small steps, even with verticality between the technical and institutional proposal and the citizen.

In the same way and with the same order of importance is included in the new art. 48 e) —modification LOTUP 2019— as persons and institutions participating in the "interested public", who for purposes of this law may be a natural or legal person in accordance with the law of the common administrative procedure, Law 39/2015; giving non-profit legal entities entry to the platforms or groups represented, with consolidated grouping, or with specific creation as such for that plan or program in question, with compliance with the requirements that the regulations themselves stipulate in this same article that provides it.

The article 51 comes to collect public participation again through citizen participation in its drafting in 2019, since in the following, Phase 1, "the draft plan or program and the initial document strategy", will take part for pronunciation and contribution:

> (…) To how many people, associations, platforms or groups that have made suggestions or provided suggestions in the previous phase (indicated in article 49bis.1) to the drafting of the plan or program, for a minimum period of 30 business days (article 51.1).

The elaboration of the document of scope of the strategic environmental and territorial study will gather the answers received to the consultations made (...)", in the ordinary procedure (art. 51.2 a); and, also, where appropriate, resolution of strategic environmental and territorial report, in the simplified procedure (art. 51.2 b).

On the other hand, the scope document will contain the public participation plan in which:

	LOTUP 2014	LOTUP 2019	
Previous actions	----	Brief Previous Technical Document	Public Consultation, open. Web

	LOTUP 2014 y LOTUP 2019	
Phase 0. Start	Participants: — Promoter organ — Substantive organ	Result: DIE and BP
Technical control.	Participants: — Environmental Organ	Result: — DIE + BP inadmissibility or — Admisión DIE + BP = goes to Phase 1
Phase 1.	Participants: — Public administrations affected — Citizenship	Result: Scope Document Strategic Environmental and Territorial Evaluation (DA EATE)

Table 2. Public and citizen participation in the beginning of urban planning, LOTUP 2014 and 2019. Source: made from LOTUP 2014 and modification 2019

> (…) The public interested in the plan or program is identified and the modalities or breadth of information and consultation (article 51.4.c) LOTUP 2019

As well as possible ways of participation and the possibilities that these must incorporate:

> (…) Telematic participation from an authorized forum or space where the document is open to citizens and in which contributions are allowed" (article 51.4.c) LOTUP 2019.

CONCLUSION

Relevant regulations regarding transparency and citizen participation, both in Spanish state level and within the framework of the Valencian Community, establish the need for proactive participation of citizens in elaboration of plans and programs. In urban and land planning matters, the Law 5/2014, of 25 July, Ordination of the Territory, Urbanism and Landscape of Valencia, has some openness to this type of participation, still marked by self technocratic elitism of Liberal Democracy, the citizen is an administrator who participates from an already elaborated strategy, decided from the governmental apparatus, his role is semi - passive from the administrative procedure established by said law. The relationship between Government, Administration and citizenship remains vertical in the development and approval of urban plans in the Valencian Community.

The partial modification, which this Law undergoes, with new text in force since 2019, provides a new beginning in participatory process in development of urban plans, opening a process of prior consultations based on a synthetic of what is technically thought of what happens and how it is fixed. Even marked by a certain attitude prone to preferences that depart from a democracy of initiative from citizens, from the people, this modification of the Law can constitute a step forward in strengthening the channels of direct and semi- direct participation, prior to the decision making that affects the community, walking shyly towards a collaborative model of relationship between technical and institutional proposal and citizen. Now we just have to wait for the practical experience of its application.

From the analysis of the 2014 LOTUP and its modification of 2019, two types of participation emerge, from public entities and citizens. These constitute different processes and levels of participation in urban planning and land planning, with differentiated purposes, spaces and times, with nonexistent or little collaborative relationship between them in the conception of the present and the joint construction of the future of the city. Thus, the hierarchical position established by the Law between them is made significant, subjecting the second —the citizen— to the results of the first —highly specialized public entities—. A concept of Liberal Democracy thus begins, against the currents of current Participatory Democracy, very sensitive to the application of the principles of Governance for a new management of the public.

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PAPER #8.05

SOCIAL PARTICIPATION THROUGH EXPERIENCES IN PUBLIC SPACES IN THE CITY OF GUADALAJARA, MEXICO

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ABSTRACT

The public space in Mexico is mostly disused spaces and generating conditions of insecurity and unhealthiest. The generation of methodologies through social participation begins to be key to the reactivation of spaces, also encouraging an experimentation of the place from a community constructivist perspective.
With the exposure and analysis of seven public interventions the objective is to compile a range of possible actuations in public space linked to their results in order to improve social, environmental and economical processes in a city. The methodologies used in the analyzed interventions are based on tactical urbanism whose core is strengthened through citizen participation and feedback, being a collective urban design commitment for emerging cities, in recovery or with critical urban problems.

KEYWORDS

Social participation; public space; collaboration; intervention; community.

INTRODUCTION

Seven interventions in different geographical areas of the city and with different goals for the use of public space allow us to identify differences in social behaviour, find strengths in the methodologies, impact and perception of the activities carried out. Although understanding public space is a complex science since behavioural patterns tend to have many variables in themselves, it is possible to determine interventions that have been able to generate a long-term impact based on methodological contrasts.
The objective of documenting the seven interventions considers establishing a chronology of interventions in the city of Guadalajara, Jalisco, since it is becoming one of the cities in Mexico with most improvement from an urban and citizen perspective. On one hand with investigators who contribute to the analysis of the transformation of the historic center as well as understanding of the historic urban landscape, on the other hand, groups that contribute towards mobility prioritizing collective and pedestrian rights, as well as government instruments such as the Secretariat for Substantive Equality between men and women. women and the Secretary of Planning and Citizen Participation; specifically through a new determined program called "Culture of Peace", all these efforts make up what in the state of Jalisco on the public and private level is gestating in the search to improve the conditions of the state, since the last 5 years it rises and falls in the scales of states with greater violence. Although, it is well analyzed since violence not only occurs in public spaces, it does contribute to a significant percentage of its incidence.

1. DESCRIPTION OF THE CASE STUDIES

The research is mainly located at the down town of Guadalajara, Jalisco in Mexico in

order to facilitate the tools of knowledge of the behaviour of citizens through social participation through experiences, these, catalogued as "activations", that is, experiences that they come to transform the patterns of use of public space. During the period 2015 - 2019, a series of exercises were developed in the public space that are described below, In the first part, a summary is placed to facilitate the location of the names of the interventions with respect to the numbering and topic that each one. After that, each intervention has the information about location and date, context and expected result, this to contextualize the reader regarding the place and specific goal of each intervention.

Summary

1.1. Te regalamos una mascota (We give you a pet)

LOCATION AND DATE: The activation takes place in Guadalajara, Jalisco, in the Mezquitán Country neighbourhood during the first quarter of 2014. The activity is focused on specifically reactivating a small park located on Jaime Nunó street between Guanajuato and Del Istmo, this park selected for having the peculiarity of being located just in front of a kindergarten, Hiawatha
CONTEXT: A colony with approximately 10 small vegetated parks, although not specifically in a situation of degradation if in a state of abandonment by neighbours when not using them regularly.
EXPECTED RESULT: That children and parents can be much more frequent and active users of the park that is right in front of the school they attend. The public space may become a detonator in the beginning associated with the acquired vegetation by potential users of the park, but becoming in the long term an acquired habit for the use of the public space.

1.2. ¿A dónde va chofer? (Where are you going, driver?)

LOCATION AND DATE: During Spring and Summer 2014, the initiative arises for the Guadalajara Metropolitan Area, comprising 8 municipalities: Guadalajara, San Pedro Tlaquepaque, Tonalá, Zapopan, Tlajomulco de Zúñiga, El Salto, Juanacatlán and Ixtlahuacán de los Membrillos, however, due to the activities carried out during the first stage, which are detailed below, the municipality in which the activities were manifested and, therefore, impact, were in the municipalities of Guadalajara and Tlajomulco.
CONTEXT: The Collective Transportation System in Jalisco as in many other states is characterized by being a system held by private concessions, the Mobility Secretariat and the General Directorate of Public Transportation does not operate as a regulatory body, causing dealerships not to be forced to comply with a regulated organization, bringing this an endless number of problems associated with routes, paths and stops, these three aspects sharing the same problem: The lack of information.
EXPECTED RESULT: A collective network for signalling bus stops, which is fed between those who have the information and those who do not, but which, in turn, as the collective knowledge increases, those who did not know the information before can be part of the signalling devices

1.3. Hazte paso (Make your way)

LOCATION AND DATE: On the occasion of the car-free day, a specific campaign takes place

on September 22nd, 2015 in the downtown area of Guadalajara.

CONTEXT: The little or non-existent respect for pedestrians is a problem that concerns many Mexico cities as well as many other countries in the world, however, in Mexico, pedestrian victims of run-over are around the figure of 20 thousand annually (INEGI 2020). Although, fortunately, this quantity is decreasing with the last count of 12,884 abuses, it is still an alarming figure for Mexicans, also because it is a gender problem, with women being the most affected, which also represents a public health problem, already declared by the World Health Organization (WHO 2017).
EXPECTED RESULT: Directly respecting the areas for pedestrians marked in the street, and in the short and medium term promoting greater tolerance for the parties involved in mainly motorized mobility in the city.

1.4. Extra-público (Extra public)

LOCATION AND DATE: Held from September 25 to October 5, 2014 (Extra Public 2014) as a workshop to be held in the building called Kukuruchos, located in the municipality of Zapopan, Av. Adolfo López Mateos Sur 2040, Colonia Chapalita Sur. And later to carrying out an intervention in an ejido land located in San Lucas Evangelista, in the municipality of Tlajomulco de Zúñiga, Jalisco.
CONTEXT: A public space not used and abandoned by the administration, with the potential to be a functional area due to its location right on the side of a soccer field.
EXPECTED RESULT: Create awareness of the importance of active public space, using the minimum resources with maximum impact. (Peña 2014)

1.5. Un día para la ciudad (One day for the city)

LOCATION AND DATE: This activation has already been carried out on 3 occasions by the Urban Orthopaedics Office, the first edition was held on February 7th, 2015.
CONTEXT: This place we call Andador is the area located next to the Pilgrim Park, behind the Alameda shopping center, this space was located in the first Workshop: "Proposals for the city", as a key to start rescuing the Tepatitlan River. (Gomez 2016)
EXPECTED RESULT: Understanding how a poorly perceived place can become a cultural tour for pedestrians. (Gomez 2016)

1.6. Espacios humanos (Human spaces)

LOCATION AND DATE: During the year of 2017, a series of recoveries of public space were carried out in the north-eastern periphery of Guadalajara.
CONTEXT: Public spaces in abandonment generating problems of insecurity, meeting point of gangs and unhealthiness.
EXPECTED RESULT: Reactivation and appropriation of public space, generating a citizen commitment for the care and maintenance of place implementations, with a tendency in the medium and long term to improve the quality of life of neighbours and influence the reduction of violence and public insecurity.

1.7. La esquina (The corner)

LOCATION AND DATE: April 29 and 30, 2016, property located in the Santa Teresita neighbourhood, Guadalajara Jalisco on the corner of Juan Cumplido y Reforma.
CONTEXT: A space, which, although belonging to private use, is ceded by its owner in order to carry out activities that benefit the community, providing safe friendly and dignified public space for the neighbours.
EXPECTED RESULT: Creating a space that in design is better planned to respond to demanded and useful activities for neighbours.

2. METHODOLOGY

The methodology encompasses as a critical analysis of the interventions carried out, is based on the plasticity of the systematization of data particularized for each experience of the public space, in which, citizen participation becomes the axis of observation, diagnosis and synthesis of the implementation in each of them. The methodologies adopted by each intervention are described below as a narration of actions:

2.1. Te regalamos una mascota (We give you a pet)

The activity is carried out by the architecture firm Aion Plan; led by Isamar Herrera and Alfred Esteller based on finding the interaction mainly of children and adjacently, parents who visit the school mentioned above from Monday to Friday. Parents and children are invited through small leaflets with information, which are delivered prior to access to the institute to be part of an activity in the park in which they will be given a pet, this, using a pun on the phrase so that be more attractive and increase the curiosity of the receivers. The exercise has 3 phases:

1st Phase. In a space enabled for a small workshop, the activity starts with the infants showing them a series of photographs of public spaces, one of them with vegetation, thus begins the sensitization process through the opinion of children. Later they are explained that adopting a pet is a responsability, which really refers to adopting a small plant for their care in this activity.

2nd. Phase. It is done in a collaborative way, facilitators, parents and children work to do the sowing of the seeds inside small glasses or boxes of reused sources, showing a brief explanation of the components that are involved in the germination process.

3rd. Phase. There is a direct interaction, again between facilitator, parents and child in which a commitment is made, in order that after their seed has hatched and a couple of leaves have sprouted, they must come back to that park to plant that plant and every day after school, go on to check its status and need of water when it's necessary.

2.2. ¿A dónde va chofer? (Where are you going, driver?)

The architecture office, directed by Alfred Esteller and Isamar Herrera, are the ones leading this activity, which is purely shaped by an informative process of using the tool. The citizen initiative "Where are you going, driver?" is a collective information tool that operates through a Facebook group page (https://www.facebook.com/adondevachofer) with the same name, in which some images are preloaded with the truck routes of the Guadalajara and Tlajomulco area, and a description and videos explaining the activity. The intention of these images is that they are downloaded and trimmed as indicated, in the same image, so that they can be used as stencils, which can be used by any citizen to mark the floor of the area where, by individual or collective knowledge, there is a space in which boarding and stops are made by drivers, despite the absence of a formal or built bus stop.

2.3. Hazte paso (Make your way)

This is a signalling crosswalks intervention, in this case, partly undertaken by Alfred Esteller, Isamar Herrera and his team of collaborators; Brando Soto, Vania Ayala and Juan Carlos Barajas. Carried out during the night-early morning, due to Chapultepec area is a high traffic area during most of the day, in the beamed crossing of Avenida La Paz and Chapultepec, on its west side. The activity considered the participation of more than 100 people, who were assigned to different crossings of the city, with the freedom to propose design and painting methodology.

Prior to the day of the activity, in the eve of worldwide pedestrian's day, the entire "Make your way" movement carried out an awareness campaign through social networks.

2.4. Extra-público (Extra public)

Intervention in an ejido land located in San Lucas Evangelista, in the municipality of Tlajomulco de Zúñiga, Jalisco. Conceived as a self-management initiative, the proposal seeks to reactivate the area by providing it with a public space that fosters social dynamics. The intervention is designed by the Madrid office Zuloarq, Bittertank, from New York and the JAPI Guadalajara office, in this context, Aion Plan; Isamar Herrera and Alfred Esteller, join as collaborators for monitoring project impact through an analysis methodology.
The operation is divided into two phases. The first is a series of meetings where the objects that will intervene in the site will be analysed and resolved. The second will focus on the manufacture of objects in the land of San Lucas (Peña 2014), with the participation of the neighbours.

2.5. Un día para la ciudad (One day for the city)

This is a whole day with different activities with some things in common: they are cultural, open to the public and seek to improve the city. In order to a better understanding they can be divided into 3 blocks:
Cultural exchange = Bazaar of crafts, design, food and art
Teaching of the city = Workshops of Mural, Crops and Body Expression
Public Art = An urban installation and outdoor concert. (Gomez 2016)
In this intervention, collaboration was carried out with Urban Orthopaedics, to perform the energy analysis of an urban intervention carried out in Tepatitlán, Jalisco. In order to be able to obtain energy and cost data that were invested to carry out this intervention and thus be able to know the impact at the environmental and economic level.

2.6. Espacios humanos (Human spaces)

This project is created for the recovery, creation and activation of public spaces through citizen participation and the inclusion of the different actors involved in the development of society (government, private initiative, civil society, etc.) with the advice of a technical and social team to guarantee the quality of the space, optimization of both human and economic resources, as well as the generation of communication platforms and processes of social transformation, for the empowerment and appropriation of communities with respect to these spaces, led by Francisco Javier Vázquez Romero, Bladimir Rodríguez López and Lucy Sarahi Estrada Ledesma as part of Collective 1.618, they generated a program called Human Spaces, in which they developed 22 projects to improve public space, under a methodology designed by themselves taking conceptual consideration of the Desing Thinking methodology. Its design, implementation and monitoring process is described by the creators, as follows:
1. Research of the study area, 2. Selection and study of the application area, 3. Community exploration, 4. Contact with community leaders, 5. Informative neighbourhood meetings, 6. Technical research; (this being based on an exhaustive mapping method through observation in which architects, urban planners, designers, sociologists and psychologists participate) to find patterns of use in time and function, 7 Participatory Diagnostic Workshop, 8. Participatory Design Workshop, 9. Development / validation of the architectural project with the community, 10. Preliminary construction, 11. Participatory construction, 12. Activation workshops, 13. Inauguration, 14. Follow-up. The collaboration by the authors of this article was associated in the selection of the materials to be used as

part of a series of recommendations in the line of sustainability and construction of low environmental impact.

2.7. La esquina (The corner)

In that property, activities related to art and sports were already being carried out, but it was sought to establish a type of furniture that, although in its itinerant quality could lead to more activities, as well as integrating a small ramp for skateboards. Alfred Esteller and Isamar Herrera are involved as workshops for the realization of the participatory design of the space, involving the surrounding community.
The design method of the space is conformed with a participatory process through workshops considers a first introductory stage as a neighbourhood board, subsequent design workshop between the team of architects, sociologists and designers to subsequently submit it to a second neighbourhood board for implementation through resources and collective labour.

3. DISCUSSION

The exposure of results allows a comparative contrast to be made, although the methodological application yields diverse results it is possible to make a critical analysis of the observed patterns. In that sense and looking for the opposite of generalization, the results are explained according to the specific goals sought in each intervention, recalling the main axis of all that lies in citizen participation.

3.1. Te regalamos una mascota (We give you a pet)

Once the school's departure time has arrived, of 50 leaflets delivered for 3 days, only 8 families approach the meeting point (see Fig. 1) to learn a little more about the information provided, and of those 8 only one In the next 30 days he will be following the activity.

Figure 1. Workshop at the park with kids. Source: (Esteller 2014)

3.2. ¿A dónde va, chofer? (Where are you going, driver?)

Through the follow-up in the intervention after approximately 6 months, comments are received from two concessionaires who take action to signal official stops with their route information, one of them physically signs, routes 51 being, 101, 604 and 629, the other does not get to know about its actual implementation.

Figure 2. Stencil signalling. Source: (Esteller 2014)

3.3. Hazte paso (Make your way)

The pedestrian crossings were visible for the next two years or so until the paint was completely erased, during this time, Chapultepec promenade being one of the busiest pedestrian roads; mostly during the weekends, it was easy to hear comments in which reference was made not only to the need to keep the area well signposted for the benefit of pedestrians but also positive comments regarding the design implemented. Unfortunately, this initiative did not continue, although it was the 3rd edition.

Figure 3. Painting crosswalk. Source: (Esteller 2015)

3.4. Extra-público (Extra public)

The analysis in this case was focused on the environmental impact specifically tabulated by the use of means of transport used before and during the intervention, found that the use of the car that although if shared was not carried out at its maximum capacity, which magnifies the amount of Energy and waste generated. In this case, citizen participation had a sectorized impact on those who were in the previous process and who were participants during and after the intervention. Of the 3 elements built during the intervention, 1 of them failed to remain in good condition the next day, this also impacting from the energy perspective of the use of materials.

3.5. Un día para la ciudad (One day for the city)

The activity developed satisfactory results regarding the previous mobility and during the workshop from a more comprehensive perspective that led to the use of collective transport and shared car, also, the use of materials was positively impacted by performing everything digitally during the previous workshops and, during the activities on the site, the implementation of waste management by the main team and the citizens, as well as the low use of disposables when having food by the neighbours, was also notable.

3.6. Espacios humanos (Human spaces)

The exercise under the methodology was applied in all the intervened parks, the use of low impact materials was important from the perspective of low environmental impact, but also economically more affordable and with a greater citizen involvement,

Group	Element	People	Kind	Cuantity	Kwh		Days	
Transport	To kukuruchos	15	Car	5	6	30.00	7	210
	To the lot	12	Car	5	15	75.00	4	300
	About carry materials	3	Car	3	18	54.00	1	54
								564
							Total	270
							Easily saved	97

Table 1. Transportation analysis. Source: (Esteller 2015)

Group	Element	People	Kind	Quantity	Kwh		Days	
Transport	To the lot	7	Car	2	6	12.00	3	36
		15	Bus	1	200/60	3.33	3	9.99
							Total	45.99

Table 2. Transportation analysis. Source: (Esteller 2015)

therefore, neighbours that perhaps by time or effort could not be active hands during the interventions, they were in charge of obtaining low-cost materials that were very feasible for their possibilities. Of the intervened parks in which the Aion Plan team was present, none of them generated rejection or apathy on the part of the communities, on the contrary, the team and citizens themselves sought that in their neighbourhood meetings could clarify issues that could be cause doubts to any neighbour.

Figure 4. Children sowing at park. Source: (Herrera 2015)

3.7. La esquina (The corner)

The intervention was not carried out, as there was no collective involvement by the community, it is believed that the private nature of the lot could generate some uncertainty or distrust in order to be more actively involved.

CONCLUSION

Taking into account that the medullar methodology rests on the axis of social participation as a basis for improving conditions, the difference focuses on improving the use of public space in different areas; In that sense, the seven interventions can be classified in order to understand their impact in 3 types: 1: Improvement of public space conditions as a recreation space: 3.4, 3.5 and 3.7, 2: Restructuring of public space as a recreation space , generation of safety and improvement in environmental quality: 3.1 and 3.6. and 3: Improvement of the citizen experience in mobility: 3.2 and 3.3.

The interventions that gave the monitoring and long-term results and considered that had the greatest impact were 3.2, 3.4, 3.5 and 3.6. Being those that, although belonging to different category of use or goal of public space, developed particular methodologies that achieved to integrate greater amount of citizen participation. Being in the first of them, almost massive, and with the potential to generate a greater lobby of pressure for its implementation and monitoring, concluding that it is the community networks that manage to generate a collective force with the greatest impact.

On the other hand, the ones with the lowest impact, 3.1 and 3.7, since they were in a more sectorized organization, in addition to having a much more specific or limited goal, it is likely that they should have used other types of citizen methodologies for smaller groups and where the follow-up was much more accompanied or hand in hand with these citizen groups.

The intervention 3.3 although as an intervention has not continued, other types of campaigns and team groups that come to advocate for the same reason have emerged from the individuals involved in this project, what is considered as a seed in pedestrian participation in Guadalajara. At the same time, other similar interventions in the state and in the country have appeared, showing the data and the concern is firm, although it remains a public health problem and Mexico one of the countries in the top 10 of death due to run-over, are figures that have been decreasing, as a punctual intervention lasted what the quality of materials and goals of the same allowed but not as a long-term intervention.

With this, we can conclude that the methodologies applied are not marked to the greatest success by the issue that is addressed but by the steps that determine each of them according to the audience to which they are addressed.

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PAPER #8.06

THE CITIZEN-ARCHITECT: EVALUATING AN INTERACTIVE GAME FOR COLLABORATIVE URBAN SOLUTIONS AND GREEN INFRASTRUCTURE SUCCESS

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ABSTRACT

This paper uses recent citizen-scientist literature to frame a new 'citizen-architect' model where urban actors claim agency in the design and long-term performance of decentralized infrastructure nodes. Municipalities are increasingly identifying renewable, decentralized sources of energy and water (e.g. rainwater harvesting, photovoltaics) as opportunities to add resilience to their cities. Green Infrastructure (GI) is a growing trend where stormwater is managed by expanding pervious areas of natural vegetation throughout a city. However, current implementations largely rely on untrained citizens adjacent to a GI site to provide the necessary upkeep to ensure design performance. Numerous studies have pointed to long-term maintenance as a problematic unknown for the success of decentralized infrastructure. This paper provides a replicable case study for academia to join with local government to fill this current gap. In the case study, twelve Bachelors of Architecture and Master of Architecture students led by one professor collaborated with Pima County Regional Flood Control to develop an interactive, didactic card game. Through this innovative game, high school and university students are engaged in understanding the design and performance of GI projects recently installed by the City in their communities. The game has students build their own decentralized infrastructure networks with the competitive goal of mitigating the most flooding by accruing the greatest number of high performing sites. This study evaluated the motivation and agency of twenty-five high school and university students to actively implement learning outcomes in their communities through pre and post surveys. The paper concludes that by educating young, citizen-architects about new paradigms of infrastructure, they can advocate for the implementation and performance of decentralized solutions within their community. Young non-architects can be trained as citizen-architects to promote and sustain new designs for decentralized infrastructures in our cities.

KEYWORDS

Citizen-Architect; green infrastructure; decentralized infrastructure; community engagement; community maintenance.

INTRODUCTION

Municipalities are increasingly identifying renewable, decentralized sources of energy and water (e.g. rainwater harvesting, photovoltaics) as opportunities to add resilience to their cities. Green Infrastructure (GI) is a growing urban trend where stormwater is managed by expanding pervious areas of natural vegetation throughout a city. The Environmental Protection Agency defines GI as "an approach to water management that protects, restores, or mimics the natural water cycle and one which is effective, economical, and enhances community safety and quality of life (EPA 2020)." However, current implementations largely rely on untrained citizens adjacent to a GI site to provide the necessary upkeep to ensure design performance. Numerous studies

have pointed to long-term maintenance as a problematic unknown for the success of decentralized infrastructure (Chini et al. 2017). This paper provides a replicable case study for architecture academia to join with local government to fill this current gap within GI by engaging young, citizen-architects throughout the community.

Through an upper-level architecture studio course, twelve Bachelors of Architecture and Masters of Architecture students led by one professor collaborated with Pima County Regional Flood Control District to develop an interactive, didactic card game called Monsoon. Through this innovative game, high school and university students without an architecture background in Tucson, Arizona are trained on the performance of GI projects recently installed by neighborhoods and the City in their communities. The game has students build their own decentralized infrastructure networks with the competitive goal of mitigating the most flooding by accruing the greatest number of high performing sites.

The paper begins with a review of the recent literature on citizen-scientist engagement and GI techniques. Links are made between these literatures and the development of the Monsoon game. Next, methods are outlined. Twenty-five high school and university students were engaged to play Monsoon in two separate sessions. The impact of the experience was evaluated through pre-activity and post-activity surveys. Results from the surveys are discussed in terms of change in student understanding, perceived effectiveness of GI, and agency to actively implement learning outcomes in their communities. The paper concludes that the game was successful in increasing student understanding of GI and perceived agency over flooding through GI in their communities. By presenting innovative communication methods (a game) to educate young, citizen-architects about new paradigms of infrastructure, they can advocate for implementation and performance of GI solutions within their community.

1. LITERATURE REVIEW

1.1. The Growth of Green Infrastructure and the Need for Sustained Maintenance

In the last several decades, the use of Green Infrastructure has increased in cities across the United States as a way to address flooding, reduce combined sewer overflows, and promote secondary benefits like heat island mitigation. This paper employs the EPA definition of GI and refers to stormwater mitigation through the use of vegetation, bioswales, basins of various sizes, permeable pavement, cisterns, and channeling devises (such as culverts or curb cuts) (EPA 2020). The goal of using GI in Tucson is to reduce areas of localized flooding and nonpoint source pollution throughout the city. GI has been shown to be more cost effective than grey stormwater infrastructure (Jaffe 2011) and have multiple benefits beyond flood reduction (Tzoulas et al. 2007). Past literature has shown, however, that citizens adjacent to GI sites do not readily understand these multiple benefits (Barnhill and Smardon 2012). To expand citizen understanding, various outreach programs (e.g. Chicago, Portland, Cleveland) have sought to improve GI education upon implementation and encourage the integration of GI into private property.

Despite recent growing adoption of GI across United States cities, several persistent barriers to GI integration have been identified in the literature: lack of knowledge of what GI is and its benefits, deficient data demonstrating benefits and performance, insufficient technical knowledge and experience, and lack of design standards and best management practices, and the need for maintenance and evaluation components of a GI installation (CWAA 2011; Chini et al. 2017). The Monsoon

game sought to fill in the public perception gaps identified Keeley et al. (2013, p 1103) of "making the connection between unmanaged stormwater and environmental degradation; appreciating the role of the individual citizen or neighborhood-level actions in ameliorating this problem; and becoming familiar with and accepting GI within the community." This paper focuses on the barriers of educating community members on GI, its benefits, and best management practices for maintenance.

2.2. The Need for Citizen-Architects within a Sustainable and Resilient City

The use of citizen science (also called participatory or community-based monitoring) has gain popularity in the last several decades. Literature defines a citizen-scientist as a member of the public who collects and analyzes data relating to the natural world, typically as part of a collaborative project with professional scientists (Roy et al. 2012). Extending from this definition, this paper defines a new citizen-architect as urban actors who claim agency in the design and long-term performance of built solutions in their community, typically as part of a collaborative project with professional architects. When applied to GI, there citizen-architects advocate for and maintain decentralized infrastructure modes in their communities.

Despite the growth of citizen science, literature has consistently raised concerns with the accuracy of data collected (Law et al. 2017). Other studies raise concerns about the lack of evaluation of participant learning outcomes. One recent study found that through pre and post survey analysis that the learning outcomes for citizen-scientists were not being achieved despite the collection of data (Druschke and Seltzer, 2012). These critiques of citizen science hit at the foundational objectives to conduct research while changing the public perception of the value of science. Extending these lessons to the formulation of a citizen architecture, this study sought to evaluate learning outcomes and the change in the participant's agency to impact the environment around them. Citizen architecture can expand the public's knowledge of the built environment around them and increase the perceived value of design.

2. METHOD

2.1. Study Area

The Sonoran Desert City of Tucson, Arizona is the area of study for this paper. Tucson faces two pressing and seemingly opposed challenges: (1) a projected shortage in local potable water supplies in the coming decades and (2) a seasonal excess of damaging floods from heavy monsoon rains. Tucson currently imports over a third of its water from the Colorado River 336 miles away, yet concurrently has the highest yearly extreme storm count across Western US Metropolitan Statistical Areas (MSAs) (Bakkensen and Johnson 2017). These urban water extremes affect citizens directly and disproportionately. Tucson averages $9.5 million in property losses each year from flooding in the city center where stormwater infrastructure was historically not installed, mainly in lower income areas (Bakkensen and Johnson 2017). Tucson has a unique stormwater management history. The majority of the urban center of Tucson does not currently have storm water piping. Streets were designed to carry the heavy rain flows that occur during the winter and monsoon seasons to washes throughout the city. Over time, the city grew and greatly shifted its majority pervious land cover to impervious. This currently results in annual flooding in parts of the city leading to chronic property damage and loss in transportation accessibility. To address these issues, the County and City are working to collaboratively develop and optimize a network of sites that will address current flooding issues and retrofit Tucson with a new, softer, GI.

2.2. The Creation of the Monsoon Game

Twelve Bachelors of Architecture and Master of Architecture students led by one professor worked together during a Fall 2018 upper-level architecture studio to develop an interactive, didactive card game called Monsoon. The twelve students used the sites and prototypical GI interventions they were designing throughout Tucson for their studio course as the starting point for the cards game. The overall flood mitigation numbers computed by the County through base hydrological modeling were used to generate a scoring system that communicated the relative impact of each type of site and each system of prototypical pieces. During the semester, the studio shared three version of the game with the director of the K-12 education organization, Project Wet, and the community outreach director of Pima County Regional Flood Control District to gain critical feedback. The game evolved from a highly quantitative, competitive game to one that was collaborative with mission cards and simplified numbers to signify the relative impact of mitigating flooding at each site.

2.3. The Rules of the Monsoon Game

The Monsoon game (Figure 1)contains: Prototype Cards (68 total, each featuring a component of a flood mitigation system), Mission Cards (36 total, each describing a location in Tucson and a mission statement specific to the site), tokens (40 total, used for marking each site location based on the success of the mission), a map (the base of game, used as reference for mission card locations), and a timer (1 total, sand hourglass used for timing each round). In the game, players collaboratively construct water harvesting systems to mitigate flooding and address other urban challenges (e.g. heat island impact or habitatforurbanwildlife)forrealsitesinTucson. Eachsitetheplayerswinismarkedonamap. Together the winning sites form a network of decentralized infrastructure for an aggregate impact on the city. The rules of the game are as follows:

STARTING THE GAME

1. Thoroughly shuffle the two decks.
2. Deal prototype cards to each player as directed: 2 players/10 cards, 3 players/7 cards, 4 players/5 cards, 5 players/4 cards, 6 players/3 cards

PLAYING THE GAME

3. Start the 30 second timer by flipping it over and begin reading the mission card.
4. Players must work together to find three prototype cards that satisfy the needs of the mission card.
5. Prototype cards must match the mission card in order to be counted.

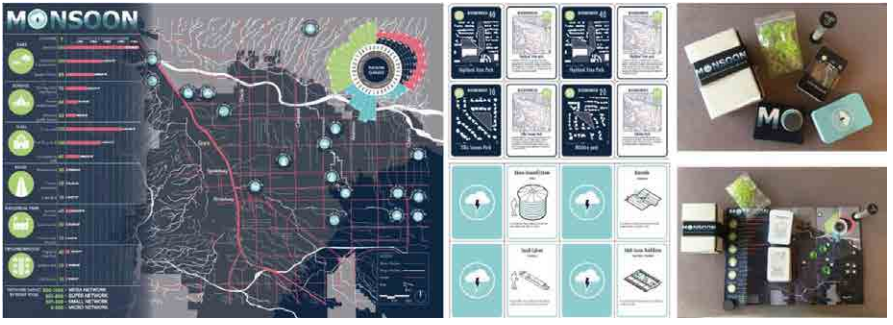

Figure 1. Pieces of the Monsoon Game. Source: (Author 2019 and ARC451b fall studio students 2018)

6. When the timer runs out or the mission card is satisfied, the round is over.
7. If the mission was accomplished in the allotted time, place a green token on the designated site on the map. If the mission was not accomplished, place a white token on the designated site on the map.
8. Replenish used prototype cards to make sure all players maintain 4 cards.
9. All played prototype cards are to be discarded into a used pile to be re-shuffled when the prototype deck is exhausted.
10. Repeat this process until all sites have been played. In the event that another mission card is pulled for an already played site, discard that mission to the bottom of the deck.
WINNING THE GAME
11. Once all mission sites have been played, count the total number of green tokens on the map.
12. Based on the number of green tokens, the title breakdown is as follows: 0-299 Micro Network, 300- 499 Small Network, 500-799 Super Network, 800-1000 Mega Network.

2.4. Engaging Citizen-Architects: High School and University Students

Two groups of students were engaged to play Monsoon: (1) seven freshmen high school students from a local school and (2) eighteen upper-level (non-architecture) university students from University of Arizona. The number in each class was determined by enrollment and student attendance on the day of the scheduled activity and survey. The high school students were engaged through their art class that was learning about urban development and sustainability. The Monsoon game was used by the teacher to teach students about water harvesting concepts and the potential impact they, as citizens, can have on the local landscape and water conservation goals. The university students had limited exposure to architecture, engineering, or design coursework. The Monsoon game was played in the middle of the semester in a general studies course, after students had learned general concepts about urban sustainability. The students had not yet learned about water management, conservation, or GI. For both student groups, the Monsoon game was their first introduction through coursework to GI concepts.

2.5. Evaluating the Impact of Monsoon: Pre-Activity and Post-Activity Surveys

To evaluate the impact of playing Monsoon, all students were given a pre-activity and post-activity survey. The surveys were administered through an online survey interface run through the Qualtrics software. This software anonymized the responses from the participants and created a uniform survey experience. Students took the survey in the classroom either with their smartphone or laptop computer. The pre- activity survey had nine questions and established the student's awareness and locations of a flooding problem in Tucson, understanding of the term GI and the many components of GI (e.g. basin, curb cut, bioswale, culvert, etc.), co-benefits of GI, perceived effectiveness of GI, and total agency as a citizen to make an impact in reducing flooding. The post-activity survey had eleven questions. These eleven questions repeated the nine questions from the pre-activity survey and introduced two new question asking the student to rate the overall impact that Monsoon had on their perceived ability to reduce flooding.

3. RESULTS

Results from the pre and post survey were analyzed to determine the impact that playing the Monsoon game had on the high school and university students (the potential citizen-architects). Survey comparison sought to assess the students' change in understanding, change in perception of the effectiveness of

GI, and change in perceived personal agency to impact their built environment as citizen-architects.

3.1. Understanding

Overall, students showed a marked increase in their awareness that Tucson had flooding issues, understanding of the term GI, and knowledge of the component pieces of a GI design after playing Monsoon (Figure 2 and Table 1). Most significant was the change in student understanding of the term GI and the components of a GI design. Although many students claimed to "know a little bit" about GI before playing Monsoon, after playing the game the 72% reported to be "somewhat knowledgeable" to "very knowledgeable" (as compared to 44% in the pre-activity survey). The number of responses to the prompt "please select the terms on which you have knowledge" significantly increased from the pre- activity survey, from 148 to 226 responses.

The concepts that were significantly better or newly understood by the participates were: Round about basin that went from 3 to 8, edible vegetation from 14 to 20, site inlet berm from 1 to 7, street berm from 4 to 10, micro basin from 5 to 15 and large basin from 5 to 17. However, all the concepts increased for at least one participant.

3.2. Perceived Effectiveness of Green Infrastructure

Students showed a marked change in their perception of the ability of GI to help address flooding problems in Tucson after playing Monsoon. Student selection of "can make a big difference" and "can solve all flooding in the city" shifted from 52% to 84% in the post-activity survey (Figure 3). These results show that the game may even contribute to an exaggerated understanding of the capacity of GI to influence flooding issues as GI is not capable of completely addressing very large

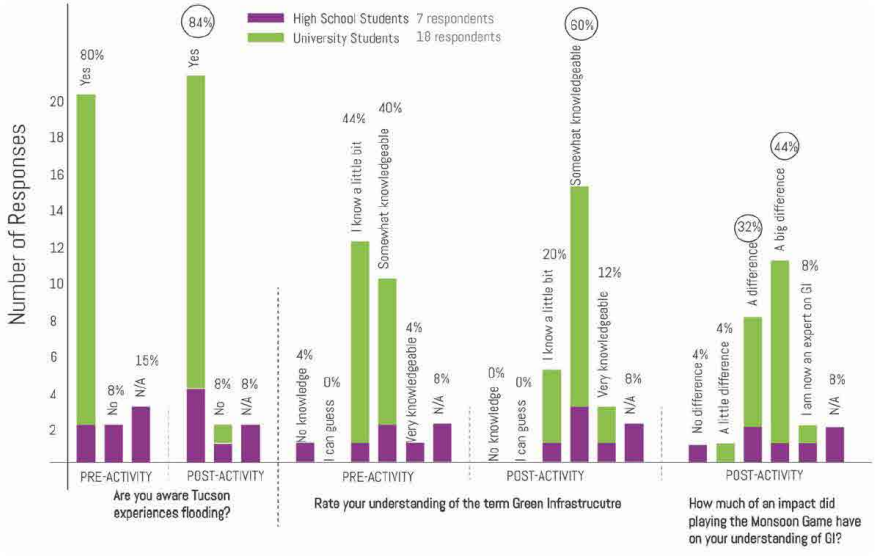

Figure 2. Responses on Understanding. Source: (Author 2020)

	"Please select all the terms below on which you have knowledge"					
Options	High School students			University students		
	PRE	POST	% Change	PRE	POST	% Change
Large basin	1	1	**0%**	4	16	**300%**
Micro-basin	2	2	**0%**	3	13	**333%**
Curb cut	3	3	**0%**	7	13	**86%**
Above ground basin	1	2	**50%**	7	9	**29%**
Bioswale	-	-	**0%**	2	4	**100%**
Culvert	1	1	**0%**	4	6	**50%**
Channel	1	1	**0%**	12	14	**17%**
Community garden	2	2	**0%**	18	19	**6%**
Corner basin	1	-	**0%**	2	5	**150%**
Permeable concrete	1	2	**50%**	11	15	**36%**
Street berm	2	1	**-50%**	3	8	**167%**
Site inlet grate	-	-	**0%**	1	7	**600%**
Native vegetation	2	3	**50%**	13	17	**31%**
Underground cistern	2	2	**0%**	7	12	**71%**
Edible vegetation	2	3	**50%**	11	18	**64%**
Check dam	-	-	**0%**	2	3	**50%**
Round about basins	1	2	**50%**	1	7	**600%**
Urban agriculture	1	2	**50%**	13	17	**31%**

Table 1. Responses on Knowledge of Green Infrastructure Components. Source: (Author 2020)

volumes of flooding. The number of responses on the question "which community urban issue can GI impact in addition to flooding?" increased from 111 in the pre-activity survey to 128 in the post-activity (Figure 3). Although this participation is a marked increase, students indicated a general awareness of the ability of GI to have multiple benefits for a community before playing the game.

3.3. Perceived Agency

Finally, students showed a marked change in their own perceived agency after playing Monsoon. Selection of "can make a difference" and "can make a big difference" shifted from 32% in the pre-activity survey to 48% in the post-activity survey (Figure 4). On the question (only on the post-activity survey) that directly asked students to rate the impact Monsoon had on their change in perceived agency, 88% reported that it some type of "difference" (Figure 4).

4. DISCUSSION

4.1. Understanding Green Infrastructure: Educating the Citizen-Architect

The Monsoon game was effective at changing the level of understanding by students of GI, its components, and its effectiveness at addressing flooding and providing other co-benefits. There was a surprising level of prior comprehension of GI in the pre-activity survey. Similar to Baptiste et al. (2015), most citizens

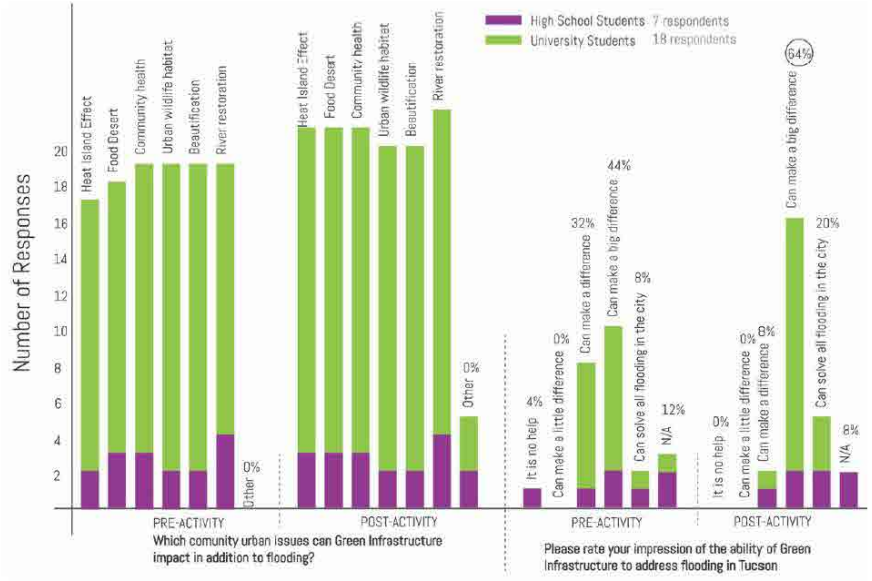

Figure 3. Responses on Perceived Effectiveness of Green Infrastructure. Source: (Author 2020)

had previously heard of the term. Thus, the challenge of the Monsoon game (and other future citizen-architect engagements) is to fill in the public perception gaps identified in the GI literature. Keeley et al. (2013, p 1103) underline a gap identified by their research on GI outreach of "making the connection between unmanaged stormwater and environmental degradation; appreciating the role of the individual citizen or neighborhood-level actions in ameliorating this problem; and becoming familiar with and accepting GI within the community." Among the university students, the substantial change in understanding of the components and functioning of a GI system was a promising result where students went beyond basic understanding to acquire a greater mastery of GI system components to be in a better place to plan, design, and maintain such systems. Finally, the game also supported student comprehension of the effectiveness of GI installations. This marked change in perceived effectiveness (from 52% in pre-activity to 84% in post-activity survey) is critical to bridging the gap between knowledge of GI and motivation to advocate for and maintain installations within a community.

4.2. Instilling Agency: The Responsibility of Professional and Academic Architecture to Train Citizen-Architects

Overall, 88% of the students responded that the Monsoon Game made some difference in their sense of agency to reduce flooding in their community. Professional and academic architects are called upon to broaden architecture and include community members in sustaining the long term performance of realized designs. GI installations are challenged by lack of design standards and best management practices for maintenance (CWAA 2011). Citizen-architects can help

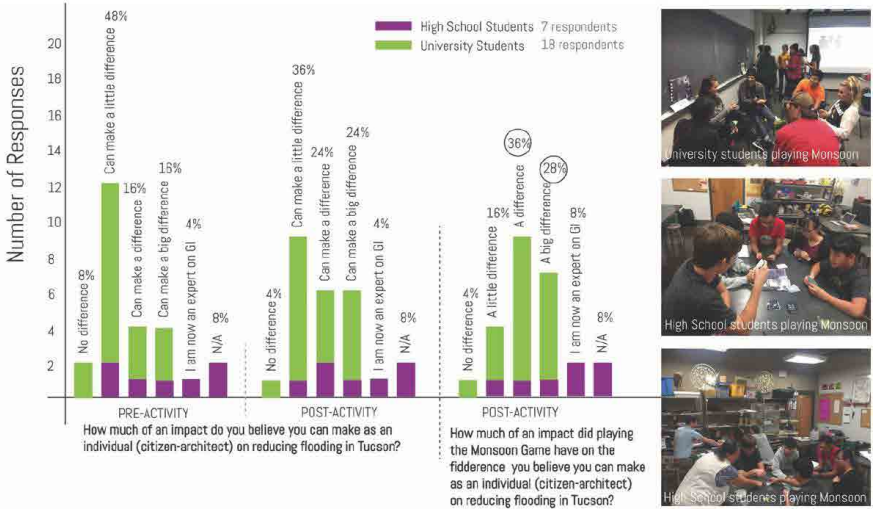

Figure 4. Perceived Agency. Source: (Author 2020)

the municipality maintain GI installations in their community to sustained designed performance and create more tailored and specific standards through this experience. Further, citizen-architects can help address the challenge of dispersed infrastructure. As they are the ones regularly seeing the installations, they can provide the municipality with important feedback and monitoring.

The Monsoon Game can be improved in several ways. As a tool the game depends of a strategic plan for educating throughout communities where GI has been recently installed. The students included in this study were helpful for understanding the effectiveness of the game, but dissemination of the game through a holistic community education strategy needs to be tested. Further, the success of this educational strategy can also be assessed through longitudinal observations of the GI installations in the communities with trained citizen-architects. Continuous education and training every several years is needed to ensure that new community members are provided information and formerly trained members retain knowledge and agency.

CONCLUSION

The purpose of this study was to engage high school and university students without an architecture background in the conceptualization and maintenance of decentralized GI systems. A game called Monsoon was designed and used for the engagement of these young citizens. The strategy followed a citizen-science paradigm where non-scientists are engaged in science-based goals. Similarly, the game sought to connect non-architects with urban design and sustainability objectives.

Results show that the game was successful at increasing student understanding of the purpose of GI, the system components, the target performance, and expanding perceived agency over flooding issues in

their communities. The paper concludes that the Monsoon game can educate young, citizen-architects about new paradigms of infrastructure to advocate for the implementation and performance of decentralized solutions within their community. Young citizen-architects can be trained and empowered by professional and academic architects to promote and sustain new designs for decentralized infrastructures in their comunities.

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PAPER #8.07

SPACES OF DIFFERENCE AND ASSOCIATION: ISLAMIST POLITICS AND URBAN ENCOUNTERS AMONG HETERODOX MINORITIES IN TURKEY

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ABSTRACT

Alevis –a large religious minority of 10-15 million in Turkey– have historically suffered marginalization due to the state's strict endorsement of Sunni Islam. The Alevi demands have become vocal since the 1990s in what has been called Alevi renaissance: the Alevis insist on their difference from Sunni Islam and demand the recognition of their rituals and practices, yet the Turkish state persists that Alevism is a branch of Islam. Within this perspective, the mosque is the sole space of worship in Islam, and Alevi shrines (*cemevi*) cannot officially be accepted as temples.

The last two decades under the Islamist Justice and Development Party (AKP) led to two significant phenomena which made Alevism a challenge to the Turkish establishment. The first is the expanding role played by Sunni Islam in the definition of the national identity. Alevis increasingly feel that they are denied recognition and forced to abide by Sunni practices. The second phenomenon is the gradual urbanization of Alevism due to rural-to-urban migration. These two dynamics brought about an unforeseen outcome: the urban environment became the site of encounter for various strands of Alevis facing the growing dominance of Islamism.

This paper discusses the predicaments of this encounter through the case of Adana in southern Turkey. Being a major industrial city and the center of an agricultural hinterland, it has received migrant (Turkish and Kurdish) Alevis from Eastern Anatolia; it has also been home to nomadic Alevi tribes of the Taurus Mountains and the local Arab Alawites. All these groups call themselves Alevi and the venues built by their NGOs facilitate interaction among them. I will analyze this new phenomenon through a number of recently built buildings and the architectural dialogue they display through spatial and iconographic analyses of the buildings and the interviews conducted with architects and NGO representatives.

KEYWORDS

Alevism; islamism; heterodox Islam; *cemevi.*

INTRODUCTION

The relationship between Islamism and the built environment has been under scholarly scrutiny for the past few years due to the increasing political influence of Islam (AlSayyad and Massoumi 2010, Desplat and Schulz 2012, Deeb and Harb 2013, Batuman 2018). While politicization of Islam (and religions in general) is considered in relation to secularism (as a normative condition of non-religiosity), it is also curious to consider the political responses of minority faith groups. In this respect, this paper focuses on the politicization of heterodox Islamic groups who are threatened by the rise of Islamism in Turkey. The case in point here is the Alevis –a large religious minority of 10-15 million. The last two decades under the Islamist Justice and Development Party (AKP) led to two significant phenomena which made Alevism a challenge to the Turkish establishment. The

first is the increasing role played by Sunni Islam in the definition of Turkish nationalism and the national identity. Alevis increasingly feel that they are denied recognition and forced to abide by Sunni practices. The second phenomenon is the gradual urbanization of Alevism due to rural-to-urban migration. This process has brought about an unforeseen outcome: the urban environment became the site of encounter for various strands of Alevism cutting across ethnic divisions in Turkey. Particularly the increasing influence of Islamism is forcing the Alevis to reconsider their identities with respect to the changing definition of what constitutes the "national."

I will discuss the predicaments of this encounter through the case of Adana in southern Turkey. Being a major industrial city and the center of an agricultural hinterland, Adana has received migrant (Turkish) Alevis from Eastern Anatolia, Kurdish Alevis from the same region and shelters nomadic Alevi tribes of the Taurus Mountains (called Tahtacı) and the local Arab Alawites (Nusayri). All these groups call themselves Alevi and the increasing number of venues built by their NGOs challenge the dichotomy of Islamism versus secularism. I will analyze this new phenomenon through a number of recently built buildings and the architectural dialogue among them, after discussing Islamist attempts at controlling the production of Alevi spaces. My analysis is based on fieldwork conducted in late 2019 which included site visits to the buildings under discussion as well as interviews with their architects and the representatives of Alevi NGOs.[1]

1. ALEVISM: A BRİEF HISTORY

Alevism is the second largest faith after Sunni Islam in Turkey. It combines elements from Shiism and Sufism as well as local rituals and traditions in Eastern Anatolia (Dressler 2013). The Alevi ritual is called "*cem*" and their shrines are called *cemevi* (house of *cem*). Alevis had historically suffered from the centralization of the Ottoman Empire beginning from the sixteenth century. Their suppression took the form of systematic Islamization and Turkification in the 19th century (Lord 2017, 55-6). This trend was also followed in republican nation-building despite relief from persecution. Sunni Islam would be a major component of the national identity and the Directorate of Religious Affairs (DRA), which was established in 1923 to control religious activities in the country, would not accept Alevism as a separate belief system. The DRA persists that Alevism is a branch of Islam and denies official status to the *cemevi*. Moreover, due to the oppression Alevis faced for centuries, *cemevi* does not display a specific architectural typology; in the villages the houses of the clerics -called *dede*- had been used for *cem* gatherings.

As a result of the continuous exclusion, Alevism maintained its rural character up until the second half of the 20th century. Similar to other parts of the developing world, Turkish metropolises experienced massive rural to urban migration after the 1950s. Major cities were quickly surrounded with squatter settlements built illegally on public land. The squatter neighborhoods were seen as a threat to the urban order especially with the rise of social movements across the country (Batuman 2006). In this context, Alevi neighborhoods in the squatter areas were marked by left wing politics ranging from left-of-center Republican People's Party to clandestine socialist organizations in the 1970s.

The 1980s witnessed a shift in urbanization policies in Turkey: building amnesties allowed the replacement of single-story squatter homes into 4-5 story apartment buildings

[1] The interviews are numbered to maintain anonymity of the interviewees from the NGOs. Interview 1: representative from Hacı Bektaş Veli Anadolu Kültür Vakfı (26.10.2019), Interview 2: user of Şakirpaşa Cemevi (26.10.2019), Interview 3: representatives from Alevi Kültür Dernekleri (25.10.2019), Interview 4: Nusayri representative from the Alevi Platform (25.10.2019); Interview 5: architect Serhat Nisanoğlu (26.10.2019).

(Işık and Pınarcıoğlu 2001, 161-65). This process also transformed the old squatters into an urban petty bourgeoisie demanding recognition. The majority of this new class would provide the initial base of Islamism in the 1990s (Batuman 2018, 64-66). In a similar way, Alevis also began to raise demands for recognition of their rituals and practices, insisting on their difference from Sunni Islam. This process in which new Alevi organizations were founded and new debates on Alevi identity flourished has been labelled as "Alevi renaissance" (White and Jongerden 2003, Part IV).

The architecture of *cemevi* has also become a topic of investigation in the 1990s, parallel to attempts at promoting modern designs addressing contemporary needs (Andersen 2015). This was an urgent need on the one hand due to the increasing prominence of identity politics (not unlike the contemporaneous expansion of intellectual debates among Islamists). But it was also due to the urbanization of Alevism, which, for centuries maintained a rural character. Within this context, *cemevi* assumed the function of representing Alevi identity beyond faith, encompassing educational and cultural activities attended by even non-practicing Alevis (Akın 1996; Aslan 2015).

2. ISLAMIST GOVERNMENT AND ALEVISM: AN ARCHITECTURAL ATTEMPT AT ASSIMILATION

The early years of the AKP in power was a fierce struggle against the secularist establishment led by the military. In its quest for power, the AKP allied with different political actors ranging from liberals to nationalists depending on the immediate needs of the conjuncture. Thus, the AKP was attentive to Alevi demands in the early years of its rule and a series of workshops were organized toward an "Alevi opening" in 2009-2010 (Alemdar and Çorbacıoğlu 2012). The workshops did not achieve any result and they were dropped from the agenda after the elections in 2011, which marked the clear victory of the Islamist government over the secularist establishment. A new initiative emerged in 2013, spearheaded by the Gülen movement, the largest among Turkish Islamist groups with international network and influences. The Gülen movement saw itself an equal partner of the AKP since it provided well-educated cadres which were vital to take over the bureaucracy (Turam, 2007; Hendrick, 2013). The cooperation between the two parties later turned into a deadly clash and led to a failed military coup in 2016, in which Gülenist officers played an important role. The new initiative towards Alevis involved mosque-*cemevi* complexes, with the claim to serve the association of beliefs. The first of these was begun construction in Tuzluçayır, a low-income Alevi quarter in Ankara, in September 2013. However, the project was perceived as an attempt to force the Alevis to attend the mosque and was met with opposition from some Alevi organizations, although some others endorsed it (Mutluer 2014: 155-6).

The mosque-*cemevi* complex proposed for Tuzluçayır comprises three main components: mosque, *cemevi* and *aşevi* (soup kitchen) organized around a courtyard.[2] While the former two spaces are for religious performance, the *aşevi* is a traditional part of Alevi culture. Yet, within the current conditions of Turkish urbanization, the emphasis put on *aşevi* as a connector between mosque and *cemevi,* rather than an extension of the latter, dislocates it and places within the context of charity activities of the Islamist municipalities. The architecture of the complex embodies references to the Mevlana Shrine in Konya, the center of the Sufi order, where its patron saint Celaleddin Rumi lived in the thirteenth century. Embodying his tomb as well, the shrine enjoyed imperial patronage in the sixteenth century due to the order's pro-

[2] The analysis of the building I am presenting here has previously been published in Author (2018, 49-50).

establishment stance. The choice of Mevlana for inspiration is not a coincidence since he is today recognized as an advocate of humanism and tolerance.

The Mevlana shrine, especially its sixteenth century extension comprises a prismatic mass with two main halls (a prayer hall and a *semahane* for the order's trademark whirling ceremony), covered by identical domes with octagonal drums. There is a minaret attached to the western wall, which was later confined within the building with later extensions. The mosque-*cemevi* complex interestingly seems to emulate this juxtaposition within a shared courtyard, if not the same building. Nevertheless, it is hard to say that the two spaces of worship are treated equally in this scheme. The architectural form of dome is allocated only to the mosque and it is taller than the polygonal hipped roof of the *cemevi*. While the *cemevi* is accessed only through the courtyard, there is a direct entrance to the mosque from the street. Thus, the Sunni worshippers do not need to use the common courtyard. The courtyard is a characteristic feature of the traditional Turkish mosques and when they exist, they contain the main gate to the prayer hall. That is, the courtyard always has visual access to the interior through the gate as well as windows. Yet, here, the mosque space, although it has a lesser door to the courtyard, is cut off from this unifying open space with the walls of the staircase to the minaret. The minaret, unconventionally, yet resembling the current condition of the one in Mevlana shrine, is within the mosque massing, towering over the courtyard.

Figure 1. The abandoned condition of the mosque-cemevi complex

While protests continued in Tuzluçayır, the government pushed the construction, which was only possible with constant police presence (Yürekli 2016, 284). Although the government was eager to finish the building despite protests from the locals, the clash that escalated between the AKP and the Gülen movement suddenly rendered the project obsolete. Construction was stopped and the building was sealed (Figure 1). The municipality decided to demolish the complex finally responding to the locals' legal applications calling for the cancellation of the project. Nevertheless, the violent attempt to implement the mosque-cemevi complexes led to convergence among various Alevi groups and organizations.

3. ENCOUNTER OF ALEVISMS

3.1. The urban context of Adana

Here, I shall move on to the context of my inquiry, which is the city of Adana. Adana was an important settlement in the historical region of Cilica. The city is the center of the fertile Çukurova plain and currently has a population of 1.7 million. The expansion of large farms and the emergence of cotton-based industry triggered social conflict in the late 19th century, which resulted in massacres of the Armenians in 1909. While the Armenian population diminished especially after 1915, the local population comprised Turks and Arabs; the latter was identified as Nusayri-Alawites. The belief system of the Nusayri is closer to Shiism and shares very little with both Sunni Islam and the heterodoxy of Alevism (Winter 2016). Approximately 300,000 Nuysaris are settled in the southern Turkish provinces of Adana, Mersin and Hatay.

In Adana, much of the community is located in the southern fringes of the city, where their major religious spaces are single-roomed, mudbrick shrines (*ziyaret*) that are built and named to mark the burial places of important religious figures.

Adana also experienced massive rural-to-urban migration in the postwar period. The influx of migrants from Eastern Anatolian villages included Turkish and Kurdish Alevis. Moreover, the massacres in smaller Anatolian towns against Alevis also resulted in middle-class Alevi migration into Adana. Finally, with the escalation of armed conflict between the Kurdish insurgents and the Turkish military in the 1990s triggered a new wave of -this time forced- migration, in which Adana was one of the major destinations.

Within this context, the 1990s was a scene for significant urban transformations leading to interactions among these minority groups. The arrival of impoverished Kurdish immigrants triggered ethnic tensions between the Kurdish and Arab minorities as the former arrived in the southern districts where the latter were historically settled. Meanwhile, middle-class Nusayri began to move to the modern districts of the city in the north (Keser 2008, 123-40). Alevi identity, which had historically been concealed in the public sphere, served as a mediator for the Kurdish Alevi in the face of anti-Kurdish hostility.

As I have mentioned earlier, all ethnic and religious groups were affected by identity politics and demanded some level of recognition in the 1990s. The most striking aspect of this was the architecture of the shrines, which were denied official status whether it be the *cemevi* of the Alevi or the *ziyaret* of the Nusayri. Below, I will discuss the architectures of these shrines and the growing interaction among them through four projects in Adana: two *cemevi* designed in different periods, one recent Nusayri *ziyaret*, and a cultural center under construction to be collectively used by all Alevi groups in the city.

3.2. From shrines to spaces of encounter

Since they are denied official status as religious shrines, the *cemevi* are officially built as cultural centers since the 1990s. The design of the *cemevi* embodies a prevailing tension: on the one hand it is supposed to represent the Alevi identity in the absence of a historical typology. On the other hand, it is required to embody modern architectural solutions to various rituals in addition to *cem* gatherings (such as soup kitchens and funeral facilities) while also acting as a communal space of gathering to attract the non-practicing Alevis. Within this context, the denial of religious status to the *cemevi* turns these buildings into venues with ambiguous -and at times ambitious- architectural programs including libraries, study rooms, exhibition spaces and conference halls as well as butcheries added to kitchens and morgues integrated to funerary spaces. The expanding programs force the *cemevi* to turn into urban community centers rather than religious shrines to the dismay of older generations. The lack of historical precedence opens room for experimentation with architectural idioms, which is effectively pursued with the growing number of architectural competitions.

However, this was not the case in the 1990s. One of the earliest attempts to build a *cemevi* in Adana began with the purchase of a peripheral lot by the Haci Bektas Veli Anadolu Kultur Vakfı in the mid-1990s. The project was designed by an architect based in Ankara towards the end of the decade. The ambitious program of the 6000 m2 building included a *cem* hall on the top floor, a conference hall, a multi-purpose hall equipped for wedding ceremonies, a dining hall with a kitchen, a library, classrooms, exhibition spaces and a morgue. The backyard has a canopy for funerals. While the extent of the program resulted in delays in construction which was finished only in 2014, there is also a stark contrast between the ambitious architectural program and the building's overall image

(Figure 2). From the outside, the building resembles a public building, a school perhaps, with its cubic mass and the hidden skylight of the *cem* hall.

Figure 2. Yüzüncü Yıl Cemevi in Adana

The design dated back to the 1990s illustrates the ambitions regarding the expansion of functions, but it also symptomatically refrains from displaying its identity. It contains liturgic references such as the numbers 3 and 12, which are "visible yet hidden." Nevertheless, the two decades between the conception of the building and its opening witnessed significant transformations that also led to changes in its use. Currently, the large courtyard in front of the building is used for mass gatherings of 15-20 thousand such as *Ashura*, where the cooking as well as distributing the ashure dish takes place. The courtyard also has a raised platform used as a concert stage. The officials in charge of the *cemevi* take pride in the building's use by various groups ranging from Tahtacı Alevis spending winters in the city and summers in their mountain villages to the Sunni Muslims attending the events with curiosity (Interview 1). They emphasize that the *cemevi* is used by various ethnic and religious groups not only for cultural activities such as the popular chess tournaments but even for funerals. Yet, they would not allow for the use of Arabic -which they perceive as an instrument of Sunni oppression- unless the dead is of Arabic origin. The same goes for Kurdish: the language is reduced to mother tongue, where Turkish, Kurdish and Arabic are treated equally.

The second example is a *cemevi* located in a mixed neighborhood with Nusayri landowners and (mostly Kurdish) Alevi migrants. It was designed and built by the municipality in 2018. The three-floor building has 1280 square meters of floor area, and has a dining hall on the first floor, classrooms on the second floor and the *cem* hall on top. Although the conical skylight is also not visible from the outside, the *cem* hall is indicated within the façade organization (Figure 3). The building represents a negotiation between the Alevi and the Nusayri, since it was an undertaking of the Nusayri mayor, who convinced Nusayri landowners for the construction of the *cemevi* here. He was also successful in raising funds among middle-class (mostly Turkish) Alevis to build the *cemevi* in this predominantly Kurdish neighborhood. The members of the community report on their growing integration with the Nusayri neighbors through the example of inter-group marriages which they previously disapproved (Interview 2).

The 1990s also witnessed the emergence of Nusayri NGOs and the transformation of their shrines (Keser 2008, 182-97). The old ones were mudbrick huts with single spaces, sometimes including a grave. The major

Figure 3. Şakirpaşa Cemevi in Adana

ones were frequently visited by pilgrims from the region (Procházka- Eisl and Procházka 2010; Prager 2013). The religious rituals of the Nusayri were generally organized in the courtyards of the houses but larger *ziyarets* were also used. The rituals involve cooking of a special dish (*hrisi*) made with sacrificial meat and its distribution to the community. Another important ritual is condolences, which would take place at the funeral home. In the 1990s, additions were made to *ziyarets*, which sometimes overshadowed the shrines. They embodied architectural programs incorporating practices of communal worship that previously took place in the private spaces of the home. Similar to the transformation of the *cemevi* into urban communal spaces, the Nusayri shrines also expanded in functions with spaces for prayer (which is performed in seated position, unlike *cem*, where it is required to touch the ground), rooms for condolence, dining halls and kitchens with butcheries (Figure 4).

Figure 4. The transformation of Sheikh Ahmed Garib ziyaret in Adana from late 1990s to 2019

These buildings displayed no architectural significance and did not contain cultural facilities such as libraries, conference rooms, etc. like the new *cemevi*. One reason for this was that the Nusayri neighborhoods have always been exclusive and such facilities already exist within the neighborhood. Another reason was that the shrines were destinations of a region-wide pilgrimage network which did not require a recognizable architectural image.

Figure 5. Nebi Nuh ziyaret in Adana

Nevertheless, the new *ziyaret* built at the site of Nebi Nuh (Noah) shrine in 2018, which was the first one designed by a professional architect, is in stark contrast with earlier examples and displays a clear attempt to prioritize its architectural image (Figure 5). The functions in the building are expressed with the differentiation of volumes. While the butchery, the kitchen and the condolence hall are on the ground floor, the main prayer hall on the upper floor is expanded outwards and tilted in both axes. The bold choice to emphasize the prayer hall is further pursued with references to mosque architecture. In addition to the minaret-like unfunctional tower, the prayer hall is sky-lit with a sliced dome. In this way, the religious symbolism of the dome is appropriated yet detached from its Sunni connotations through its

deconstruction. Moreover, the architect has presented her project in a professional journal as *"cemevi"*, which is never used for the Nusayri shrines (Baykam 2019). This is a clear attempt to derive legitimization from the public recognition of the *cemevi.*

The last example represents the materialization of the alliance among Alevi groups in Adana. An Alevi Platform was established in the city in 2014 bringing together twenty organizations including major Alevi associations and the Nusayri NGOs. The Platform has been successful in raising a unified voice in political issues. They also managed to improve collaboration in the organization of religious rituals. For the past few years the Ashura has been organized by the Platform instead of the individual organizations (Interview 4). As a result of the growing alliance the platform applied to the municipality demanding a center that they will use collectively, which would function both as a public venue as well as a site for religious rituals. The main functions which have been common in all the examples I have discussed are also present in this proposal. The building, which was designed in 2018 and is still under construction, is organized around a courtyard (Figure 6). The basement houses both the kitchen and the funerary preparation spaces including a morgue. The ground floor contains a dining hall, a condolence room and workshops. The first floor contains spaces for each of the organizations and a conference hall. The cem hall rises as a solid box covered with timber motifs derived from the octagonal Seljuk star. Finally, the front façade of the courtyard is composed of a portico imitating the entrance of the Haci Bektas Veli tomb, a major Alevi pilgrimage site. The architect, who incidentally is of Nusayri origin, has reported on the discussions he had with the representatives of the organizations (Interview 5). According to him, there is a clear tension between the older generation's desire to identify the building as cemevi, primarily a religious building, and those who wish to see it as a public space of gathering. He emphasized that the architectural elements he added are compromises resulting from the negotiations between various parties including different Alevi groups, the architect and the municipality.

Figure 6. Hanedan Cultural Center in Adana

All four of these recently built buildings are ambiguous as institutions. They are officially cultural centers, which makes it possible to negotiate their architectural programs as well as their images. This ambiguity also opens room for negotiating their public perception swinging between religious shrines and inclusive community centers. The interaction among the Alevi groups is best expressed in the gradual unification of the architectural programs of the *cemevi* and the *ziyaret.* Interestingly, even the rituals began to affect each other. The traditional Ashura of the Alevi is increasingly attended by the Nusayri and its emblematic ashure dish is occasionally adopted by the latter, who have increasingly preferred labeling themselves Arab Alevis. In return, the main Nusayri event *Ghadir Hum* (celebrated as Eid al-Ghadir by the Shiites across the Middle East but not by the Alevis in Turkey) is being recognized by the Alevis, who attend the Nusayri celebrations.

CONCLUSION

The interaction among Alevi groups in Adana is initially a response to the current urban political condition in Turkey. All these groups believe that they are "undesirables" under the Islamist AKP and feel the need to collaborate. The insecurity of the minority groups has further escalated with the Syrian civil war, which triggered anxiety among the Alevi and especially the Nusayri who are associated with the Syrian regime by the Islamists. News reports on the use of refugee camps by Jihadist militants are particularly terrifying for them.

The contemporary Turkish metropolis is marked by the increased potential of political dissent latent in the public space despite the authoritarian measures implemented in the wake of the unsuccessful coup. Under these conditions, the specificity of Adana sheltering various minority groups created conditions for an unexpected alliance cutting through ethnicities. The more the government defines Turkish nationalism with reference to Sunni Islam, the more the minority groups turn to Alevism as a unifying identity which is currently displacing centuries-old architectural traditions. The ambiguous status of their shrines, whether it is the *cemevi* or the *ziyaret,* in this context, turns into spaces of association among the hitherto withdrawn minorities of heterodox Islamic beliefs.

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PAPER #8.08

HORIZONTAL EXCHANGES AS A DESIGN METHOD. AFRICA URBANISATION AS A CASE STUDY.

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ABSTRACT

Within a globalised world, it is easy to find community problems, especially outside our boundaries, in countries that are growing up quickly. Therefore, there is the tendency, not only for architects, to direct their efforts for the benefit of society; from it, the participatory approach became a tool in the design process. There are different ways to understand participation in the design process, and each of them can lead to different results: in terms of effects on the building and its grade of acceptance. All of it is directed by the mutual exchange of competences and information between the actors inside the process. In all of these dynamics, the architect is playing a role. Moreover, what happens when the community is one of the main actors inside the urbanisation of a country should be the point to address this research. Through the observation of the urbanisation of sub-Saharan countries and the study of European based studio projects inside the continent, is possible to explain how the participatory approach is not just a manner of design but a process ruled by different interactions. The question is not how to involve the community inside the process but who is driving it out, which role the architect is playing. The core issue is localising in which stage of the process the community is taken into consideration. Meanwhile, the bottom-up method is going to be overlaid by a horizontal exchange became essential to question the reason why this kind of method can be useful inside the process of design. Is it the community approach led just by willingness or it is the result of a complex process of interaction? The main issue remains how much this kind of participation may contribute to a useful involvement for the community inside the project. It can be an opportunity for the community to recognise its identity inside the building, or instead can slip into a mere way to publicise an elusive ethic approach.

KEYWORDS

Design process; sub-saharan Africa; exchange; architect role; design method.

INTRODUCTION

Inside the process of urbanisation of Sub-Saharan Africa that is spreading out in the last ten years, the strong involvement of the community is still one of the main bulwarks inside the process of building and construction of the new face of the continent. Considering it as a unique vehicle for a good design inside the region is still a mistake that this research is trying to avoid. Moreover, foreign architectural studios, many of which are European based one, lead most of the projects developed to increase the services inside the continent (Lepik, 2013). For this reason, the comparison of cases study of built educational facilities in Sub-Saharan Africa made by European based studio gives a general overview of the facts and the typical dynamics that are easily employed inside the process of urbanisation of small urban and rural centres. The number of projects carried out from local architect is inconsistent compared with the European. Each of them,

in different ways, address how the architect is actually playing a different role inside the urbanisation of the country and how straight, or sometimes indirect, communication with client and community leads to a different level of involvement and approach to participation processes.
Architect, client and community are the three main actors taken into consideration during the analysis. Each of them shapes the process of design in a different way; moreover, the mutual interactions characterise the results of each project. All the main actors are placed at the same level to understand the transformation inside the continent. The multiple configurations of the relationship that spreads out give to the reader different point of view of the project that, on the surface, have the same purpose: community interest in the first place.
Starting from an overview of the continent and the brand new directions of the participatory process inside marginalised realities the research lead to unlocking a debate about the urbanisation of the continent from a different point of view; not only economy but also from the operative way of doing architecture.

1. COMMUNITY APPROACH

Inside the books of theory of architecture or design, usually, there is no direct relationship between the architect and the community as a user of the project or deterministic actor of design choices. On the contrary, the community is associated with the terms of society. This word was one of the main issue addressed by the prevailing attitude spreading out in the fifty. The collective vision and the political conception of architecture have given rise to a reaction of internal opposition to the entire system of values that are still rediscovered today by social practice (Biraghi, 2019). In "The architecture of reality", Antonio Monestiroli (1999) even defines the function of the architect as the detector of collective reason. Still, Giancarlo de Carlo was one of the promoters, in Italy, of the participation of the community inside the process of design. Not only as an informed person, moreover, as an active actor inside the design; someone that is taking place inside the process and is shaping it (De Carlo, 2013).
In recent years, the theory shifted from a purely participatory approach to overcoming it. Within a globalised world, it is easy to encounter societal problems, especially outside one's borders, in developing countries. Hence the tendency, not only for architects and designers, to direct their efforts for the benefit of society (Tromp, Hekkert, 2019). A significant number of organisations devote their work on communitarian projects implementing and using the community to archive the goals (Abuom, 2005). Numerous critical issues related to a transcultural approach to architecture undoubtedly accompany this vision (Hernandez, 2012). Especially when the debate is moved to an extra-continental environment, the role of the architect inside the process of transition of different culture became essential. The task of the architect became very complicated, especially in the post-colonial context, as Sub-Saharan Africa can be. There is an essential need for mediation inside the design process. Mediation between two cultures (one of the architects and the one of the community) with the purpose, at the same time, to archive adequate spaces and satisfy the need of the society (Hernandez, 2012). In this environment, the participation of the community to the design process can allow the architect to archive goals that he could not reach by himself. Upstream of all, according to reflective practice, the designer is finding himself again, trying to solve a problem that a previous project has done (Tromp, Hekkert, 2019). According to the definition of Tromp and Hekker, social design based its roots on an effect driven design in which the social effect that the designer would like to obtain depends on the analysis of the behaviour of

the community. The context and its analysis are the ones that are shaping the behaviour thought the final artefact. Between these two levels (social effect of the artefact and behaviour around it) is placed the mediation as a definition of common objectives to arrive, through an approach that takes into account the architect and the community, to a final product that meets the vicissitudes required and in which the community can be recognised (Tromp, Hekkert, 2019). Again the world mediation inside the process of design is coming out to underline how deep can be the relation between the process to obtain a specific artefact and the tangible results. Once again, facing a paradigm of being inside the system but against it (Biraghi, 2019), the architect places himself in a central position of mediation and interaction between the parties. The architect remains the subject that deals with the design, understood as a purely technical and disciplinary fact (Armando, Durbiano, 2017). However, the community is taken as an essential element with which to activate relations and cognitive and interpretative dialogues that lead to a conscious design that reflects shared social values. The architect thus aims at a general involvement able to produce changes starting from small projects of activism within the community system that transforms itself from a static actor concerning which to assume a set of values, to a dynamic subject that generates effects on the design system (Lepik, 2010).

2. RESEARCH APPROACH AFRICA

The African continent was, for a long time, a sort of heterotrophy for occidental designers. Especially in the context of architecture after 2000 began to emerge the tendency of "not-for-profit aid-architecture" (Albrecht, 2014). The prevalence of foreign architects building in Africa is connected with a particular situation of architectural education. The range of architectural school is way lower than the European average, and the number of architects cannot supply the needs of the country (Lepik, 2013). Often European studios to validate the project inside a marginalised reality use this kind of sharing processes between the designer and the community. It is often publicised as a method of integration of the artefact inside the cultural environment, using local materials and employing the villagers as shapers of the project. However, this is not still enough to design and build a good architecture that will supply the need of the community. Numerous are the projects made that are not working. Above all, because of the lack of sense of belonging of the artefact to the community. Static buildings that are not keeping the essence of practical use (Di Campo, 2018). Going deeper into the field is possible to understand how many different points of view can be generated by this kind of approach. Sometimes it is just promotion of intention, but in other cases, internal dynamics can lead to a co-shaped result.

Sub-Saharian Africa, as a case study, leads to understanding the dynamic of cooperation project and the participation of the users inside the project. The research is structured in two different part: the identification of a body of knowledge about African projects and the comparison of five cases study. The first part is based on interactions of different parameters that, through the attention on the role of the architect inside the design project, are going to understand how different relations are giving new interpretations of a participatory approach. Moreover, the primary assumption is asking how the relationship between architect and client are shaping the relation that design has with the local community. Projects in the sub-Saharan country give us the condition to study a phenomenon where the community is still one of the major actors inside the processes of the continent. To have a comparable analysis sample is necessary to fix some

specific characteristic that each architecture should observe. The localisation of the intervention and the year of construction is limited to have a general historical frame that can be comparable inside the sub-Saharan continent. Each case study is focused on instruction building realised from 2000 to 2019 (form when the not-for-profit project by Europe begins till nowadays). For instance, other parameters are taken into consideration to amplify the richness of the sample. That information became essential to define the general assessment inside the panorama of the interventions "not for profit" that are spreading out inside the continent. That will not give a detailed analysis but a general frame to define a common tendency and the most common process of design laded by European based architects.

Moreover, it should be clear how the community could be an influencer inside the urbanisation of the continent. In fact, with a variety of approach, the European architect is searching to emphasise a communitarian sense, local tradition and construction typology. The common element is that most of them would like to involve the community inside the process of design and construction of the building. This approach aims to create conventional narratives that will help the community to recognise deserves inside the building. The architecture in this way will be the vehicle of new practices and social engagement, nonetheless a matter of importance for the interpretation of the tradition. The building in itself is a representation of the community that can shape and reframe social asset and dynamics all around (Africa Architecture Culture Identity, 2015). Case of White Elephants is spreading inside the continent. This kind of project is often characterised of a lack of reality inside the socio-economical condition of the environment (Africa Architecture Culture Identity, 2015). The community became an essential subject helping the architect to take some choice and face with the real problem that should be taken into consideration during the design process.

Among the tasks that European architects aim to develop through projects in Africa is to initiate a new aspiration towards the use of effective techniques. The level of engagement of the community assumes particular importance within the production process, not only concerning the development of an identity feeling that allows the recognition of the community within the building but also to open a sort of reflection and re-evaluation of local experiences (Marschall, 1998). All these practices that are defined as participatory are nothing more, for African culture than common practices of discussion within rural villages (Albrecht, 2014). For years, the self-regulating practices of African rural communities without any administrative system have been studied with fascination (Carbone, 2005). Everyone in the community also has a specific role when it comes to design and which the architect must take into account if he wants to establish a constructive dialogue within the community.

3. AFRICAN PROJECTS

The second part of the research is more focused on the direct observation of chosen case studies. Through a compositive analysis and the interview with the architect, it was possible to frame a critic scenario of the Sub-Saharan continent and the European designer in it.

Many projects inside the continent are experimenting process of participation of the local community. The most crucial difference is the level of participation of the citizen in it. The level of involvement and how architects are dealing with the community is different. To have a general framework, are taken into consideration five case studies: Gando Primary school by Françis Kéré, the communitarian school of N'tyani by Caravatti, Gaugorouboru Primary school by LEVS, the

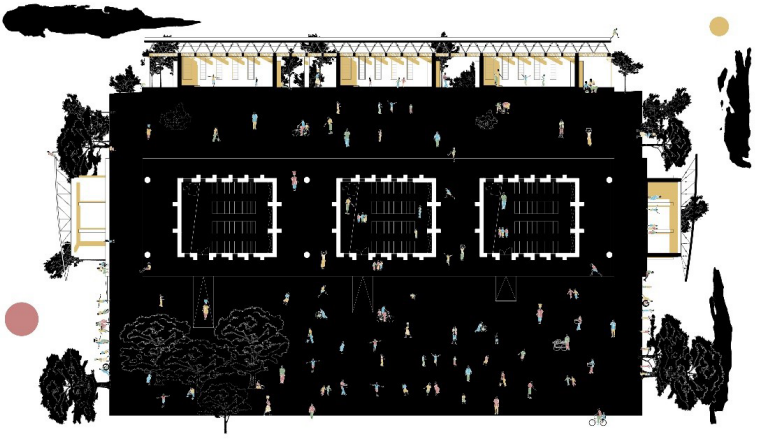

Figure 1. Gando Primary School by Françis Kéré. Source: (Gugliotta R. 2019)

library of Muyinga by BC and 5 Kindergartens by ColectivoMEL. The choice of these cases is led by the willingness of having a brother panorama to understand how different studio, by size and experience in the continent, can have different outcomes on the project. All the studios are European based but apart from the control case (Kéré architect), have not cultural relation with the continent, and some of them were even neophytes in Africa.

As the first case, Françis Kéré reflects the voice outside the chorus against which other designers can be compared. In addition to being widely familiar within the continent, his experience as a citizen of Burkina Faso and designer in the same area, allows him to have a broader general vision and to possess much more in-depth specific skills. With his project of the Gando primary school (Fig. 1), he tried to go deeper inside the process of participation of the community inside the process of design. He knew precisely the need of the community because he was part of it during its life. The same, he was also conscious about the difficulty of getting the community involved in a project coming from outside. The vehiculation of new construction systems, coming from the tradition of the place, were spread out from a long interaction and communication process with the locals. Projet LOCOMAT instructed the men, an agency of the Ministry of Transport promoting the use of local materials and traditional techniques, for making bricks, the children helped transport the stones, and the women supplied water. Each of the members of the community was included to develop belonging and ownership of the building gradually.

Caravatti, a studio in Monza, with projects in Mali since before the early 2000s, presents two types of projects: those carried out for an association of missionaries to which they have been linked for a long time, and those carried out through their own NGO. The Africabougou organisation, which deals with development projects in Malian territory and raising funds for interventions, is recognised in the figure of Emilio and Matteo Caravatti. The association is assimilated directly to designers rather than the studio. Inside the project of the communitarian school of N'tyani, the local community was involved in the design through meetings (an essential method to exchange information) to agree

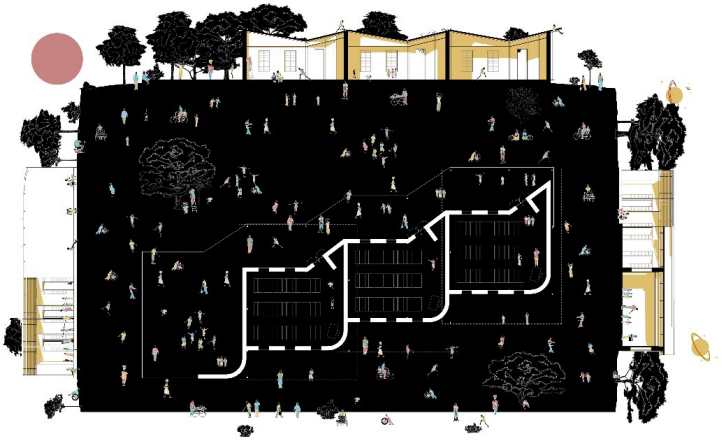

Figure 2. Communitarian School by Caravatti. Source: (Gugliotta R. 2019)

in which times, materials and technologies used. The school was built in raw bricks made by the local population. The interaction that the architect developed inside the community of N'tyani, not only with the primary school (Fig. 2), allows facing a horizontal exchange in which the design is just a small step inside all process of life of the building. They start to develop their project in a territorial grid to have a system of intervention and not just a white mosquito. The building and the community are free to develop by themselves after the intervention.

LEVS, a studio based in Amsterdam and initiated projects in Mali by the figure of Joop van Stigt, as Caravatti holds an NGO, Partners Pays-Dogon, which deals with projects in Mali with a rather significant position concerning the territorial management of interventions. The association plays both the role (client and financial promoter) for which the question remains about the involvement and relevance of the designer in the process that seems, at first glance, to remain marginal, just confined in the design of the object. Besides, where is the community here? Long-lasting relation of architect and community, in this case, is leading the studio to be part also of the community knowing needs and traditions. The same history for Caravatti; instead, they have a different approach when it comes to talking about design and involvement of the community inside the process of development of a new project inside the villages. The Gangouroubouro Primary School (Fig. 3) is mainly composed of a single block with three classrooms and local services. The architect used a "typical Malian" model to build the classroom joint with particular attention on the details of the buildings. In it, the design process leads to an overtaking of the constant dialogue with the community assuming their knowledge built with years inside the continent as detailed enough.

BC architects, a studio directed by two young Belgian designers, have only recently approached the sub-Saharan panorama, boasting numerous workshops and projects in Morocco. Unlike the other two studios, it does not rely on any particular association but is called to design on behalf of ODEDIM NGO, but sees within the process the alternation of many other associations including SATIMO (Belgian NGO) which is

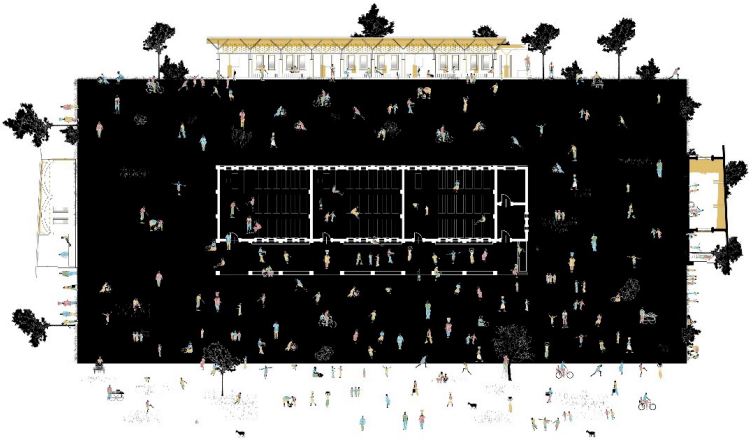

Figure 3. Gangouroubouro Primary School by LEVS. Source: (Gugliotta R. 2019)

responsible for raising funds. Their approach to the project is therefore different, according to an architect-client exchange much more similar to traditional dynamics. The process of engaging the community and the client together became essential to understand how to approach in a first time a different reality. Moreover, workshop and involvement of students inside the processes led to a continuous exchange of knowledge to build the Library of Muyinga (Fig. 4).

The last case study, a project of the Portuguese studio Colectivo MEL in the African continent is examined. They, like BC architects, are not supported by its NGO but they were contacted by a Portuguese organisation operating for

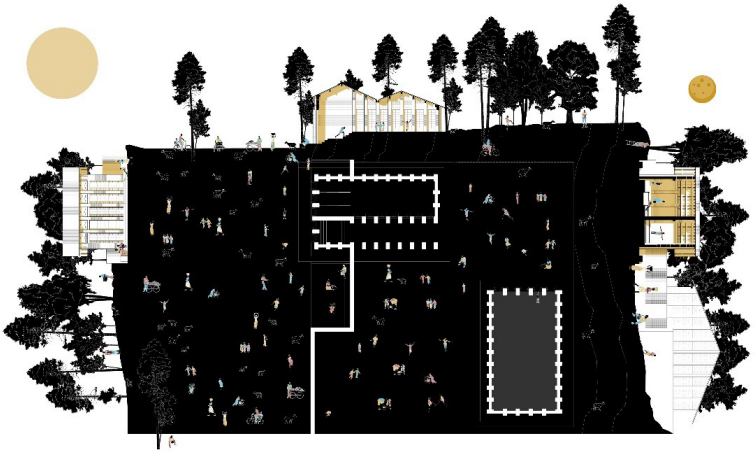

Figure 4. Library of Muyinga by BC architects. Source: (Gugliotta R. 2019)

Figure 5. Kindergartens by Colectivo MEL. Source: (Gugliotta R. 2019)

years in the territory of Guinea-Bissau. In this case, funds raised by the association come from the European Union and the relevance of the client inside the design process is substantial. They became the first interface and the filter between the community and the architect that had no direct relation. For this reason, the project of 5 Kindergartens (Fig. 5), at the end of the construction, does not take all the designed items. The main construction was made by concrete as suggested by the NGO, and at the same time, the community changed the roof cover in straw after the construction with a metal sheet. The traditional in this case was not fitting with the willing of the local.

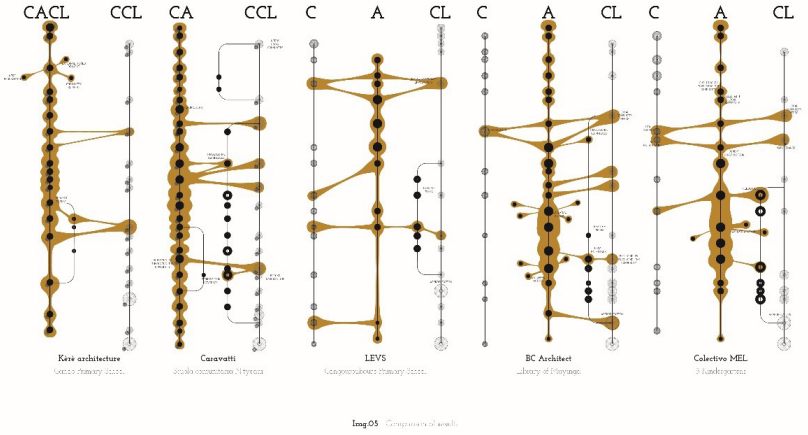

Figure 6. Process comparison. Source: (Gugliotta R. 2019)

Inside the diagram processes (Fig. 6) each relation are showed to understand the approach of the architect inside the design. Each architect has different synergies with the community and the client. Some times they have more than one role: architect, client and member of the community itself. Each studio kept with its strategy a different level of engagement. Sometimes the architect is more present inside the process to deal with the community (Caravatti, Kéré and BC studio) and some others have the client, most of the time NGO, as the most relevant factor inside the process (LEVS and Colectivo MEL). As much as they can share a common characteristic, each studio is approaching differently to the design inside extra-continental reality and the involvement of the community with it.

4. HORIZONTAL EXCHANGE

Each of the studios involved in the inquiry has different approach inside the dynamics with the local community. Sometimes this change of method is leaded from a different involvement of the client inside the process of decision. The customer is often one of the main actors inside the design process of the building. In some case is the one that knows more about the community, it is the one with money, and that is commissioning the intervention.

A particular differentiation occurs in the first instance between architects with a long tradition on the continent and newcomers who approach projects for the first time. The narrative of the reality with which they had to deal is also different. The dynamics of emerging studies are much simpler and easily assimilated to the European context. BC and Colectivo MEL that were analysed in the previous paragraph have a relatively similar relation with the client. Both are depending on it to talk with the community. The difference is henced in dealing with this relation and the stage of involvement of the community. Besides both were approaching for the first time a challenge in the sub-Saharan country, BC architects decide to involve the community from the beginning and keep this relation in different stages of the process: from design to construction. However, Colectivo MEL led heavily from the power of the client, used the community just to keep some knowledge. It was not directly involved inside the consistent part of the process.

The client is a subject with high power but not always definable. Certainly, the obviousness of considering the local community as a client does not provide any change of position concerning the European situation. Instead, the dynamics scattered out by Françis Kéré and Caravatti gives a different point of view on the process of participation inside the continent. The main issue became to develop a sense of identity of the community inside the entire process. Not only explaining them the reason but make them understand the entire mechanism behind the design of the building without losing their volunteer as an architect. The designer, inside the processes, remains the bearer of a value shared by both (client and local community), becoming mediator among the subjects. Through this, any top-down or bottom-up process is eliminated in order to establish dialogue and linear exchange between subjects. The architect becomes an interpreter and translator. Within mediation brings values and contributions to projects that take into account the needs of a client, even if latent, but which at the same time are respectful of the local community. It is not so much a question of community participation in the projects as the involvement of the community itself to enable it to become an active part. The main problem of welfare projects in sub-Saharan Africa derives from the excessive power of the client and the use of the term "local community involvement" as a valid element of the project.

On the contrary, a shared and functional approach by the architect can contribute

to a different degree of awareness than urbanisation projects. The architect as a mediator is therefore not alienated from his own ability to transmit values within the project, on the contrary, he uses his preferred perspective point to observe and identify the strategy of action that allows him to carry out the work through the involvement of community and client. A mediation that turns into a communicative practice between the subjects were meetings, and discussions aim to transport the architect's knowledge of the project within the process.

CONCLUSION

The participatory approach in these cases is not a method directly employed by the architect in a canonical way. Therefore, it is a process of continuous dialogue that allows the community to be part of the project maintaining the designer as a reference point. The community is taken into consideration as an actor that shape the general scheme, and that will have a future impact on it. Reaching horizontal participation inside the process and balancing the weight of each actor results more important than promoting participation and a bottom-up method. In this way, the community is not forced inside the design and construction processes but accompanied in developing a sense of identity toward architecture. In it, practice does not allow to talk about a simple method that can be systematised but moreover of a practice that can be shared and absorbed in the design process in foreign countries. This permits opening a debate on practice and role of architects outside their cultural frame of knowledge and experience.

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PAPER #8.09

UNDERSTANDING BUILT (INE)QUALITY IN PERIPHERIES THROUGH BOURDIEU'S DISTINCTION: THE CASE OF PORTO'S URBAN AREA (PORTUGAL)

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ABSTRACT

Sociological distinction explains how certain subjects (individuals and groups) gain an advantage using their *social, economic, cultural,* and *symbolic* capitals according to Bourdieu. In the same way, elements in urban areas use their *qualities* to distinguish themselves in an analogous competition within both the physical and social space.
The clearest of these qualities is *centrality,* which describes the benefits of location and precisely creates the classic distinction between core and outskirts (nowadays measured in time as well).
Urban elements (buildings, for instance) also possess *material quality* – related to their technical properties such as size, habitability, or performance – which gives them advantages in material competition. In the same way, they have *cultural-symbolic quality* – referring to the interpretation of their elements such as social appreciation, value, or coherence – which makes them stand out in representative aspects. These two qualities of distinction are used as axes to develop a two-dimensional space to study the elements' positions.
This scheme is applied to housing developments in Porto's urban area (Portugal) in order to analyse their *qualities* (and inequalities). Each ensemble of residential buildings is characterised separately by its *centrality* (in distance and time) and by its material and *cultural-symbolic quality*. The cases of low *centrality, material,* and *cultural-symbolic* quality do not necessarily coincide and then the different types of peripheries do not necessarily overlap.
As explained and exemplified, urban elements have a certain *centrality, material,* and *cultural-symbolic quality*, which are properties related to respective *social, economic,* and *cultural/ symbolic* capitals of their users. This scheme enables discussion of the constructions' and residents' problems at the same time. Thus, research can theoretically circumscribe three types of inequalities: segregation, (energy) poverty, and marginalisation.

KEYWORDS

Bourdieu's distinction; peripheries; *inequalities*; architectural quality; Porto (Portugal).

INTRODUCTION

Inequality is defined by the Cambridge Dictionary as an unfair situation in society created by a difference in social status, wealth, or opportunity. In contrast, *quality* is in singular a high standard, whilst *qualities* (in plural) are the characteristics or features of someone or something. These concepts have a different etymological evolution, but a related origin (from 'in-aequalis' and 'qualis'). Thus, their relationship enables research to understand *inequality* as a process when some *qualities* are missing, or when a certain lack of *quality* exists, in the case of the built environment, *architectural quality*.

This approach is also relevant to understand peripheries in a broad sense, not only as a location separated from the centre, but a territory with a lack of certain qualities, for instance, centrality in the case of geographical peripheries. Similarly, the economic peripheries could be defined by their lack of economic assets and the social peripheries by their integration problems. For these reasons, the characteristics and features of the elements emerge as a critical factor to understand inequalities, especially in territories defined by their differences, like peripheries.

To study these complex and unequal situations, this research takes advantage of a methodological framework based on the differences: Bourdieu's sociological distinction. Firstly, this paper explains Bourdieu's theory and its relevance to architecture. Secondly, a theoretical adaptation is developed to analyse the qualities of social distinction in architecture. Thirdly, this framework is applied to housing developments in Porto's urban area, discussing the empirical results. Finally, this paper analyses the general implications of this approach and explains its main conclusions and lines of research.

1.BOURDIEU'S SOCIOLOGICAL DISTINCTION AND ADAPTATION TO ARCHITECTURE

Sociological distinction explains how certain subjects (individuals and groups) gain an advantage using their *economic, cultural, symbolic,* and *social capitals,* which constitute the interdependent axes of distinction (Bourdieu 1979). The capitals employed in the social struggle are materialised in several objects of distinction: possessions – among them buildings -, activities, education, etc. This objects act on one or several of the abovementioned axes, creating differences in society.

According to Bourdieu, social differences are not only structured by a one-dimensional linear scale, but rather occur in a social space mainly structured by two composed axes (Fig. 1). Firstly, there is the *total volume of capital,* the amount of economic and cultural capital that an agent possesses. Secondly, there is the *composition of capital,* which takes into account the differences between them, mainly in terms of economic and cultural capital. In addition, social and symbolic capitals also act in the same social scheme. Social capital is not just the number of people that a person knows, but rather the sum of these people's capitals, which constitutes the network to which a person has access and can eventually mobilise. Similarly, the symbolic capital requires some other capitals and a certain position to exert its influence, namely in terms of social recognition. The positions in the social space thus defined are also affected by the length of their permanence in the same place and by the trajectory of the subjects (and their ascendants) in the social space.

Thus, Bourdieu's theory overtakes the simplistic approach based on economy, to build a complete system to understand positions in society with their *effets de lieu* (effects of place). Not only do the upper classes (++) have money (*economic capital*): to maintain their hegemonic situation they also have a high cultural level (*cultural capita*l), relationships with other influential people (*social capital*), and the iconic character of their status (*symbolic capital)*. Moreover, they usually get more advantages, acquiring exclusive pieces and patronising professionals of high cultural capitals. In the same way, medium and lower classes are characterised by their total volume of capital, but with important differences according to their capital composition, and also, their habits, tastes, and ideologies (*habitus*). This variation of *habitus* can be illustrated by industrial bourgeoisie (+-) vs. intellectuals (-+) and urban workers vs. peasants, which

was highlighted in several empirical studies in France (Bourdieu 1979).

Lately, this same approach has been used in other countries with relevant results. In Portugal, the populations of Porto's neighbourhoods were characterised by their capitals and built environment, finding a strong correlation between their habits and their economic, cultural, social, and symbolic capitals (Borges Pereira 2018 and 2016). In Spain, Bourdieu's distinction has served to explain how social capital and other characteristics are shared between rural and urban territories (Lamela 2014).

As mentioned, Bourdieu's distinction is a complex and holistic framework to understand reality that is applicable to many approaches: from the sociology of people themselves, to the space they occupy and the elements they use, issues with an intense relationship with architecture and urban studies. Thus, buildings are one of the most significant elements of social distinction. Residences, for instance, are probably the biggest investment that many subjects make in their life (Lizancos 2000). This is why they carefully decide if a building's elements give the appropriate (social) representation of them (Villanova, Leite, and Raposo 1995). As constructions have and use different features for distinction, they also become subjects of these social processes and play the same role, struggling in social space as a representation of their users. This is very interesting because then, research can describe buildings by their characteristics, emphasising high *qualities* and also claiming against their *inequalities.* In the same way as people do, the constructions in urban areas use their qualities to distinguish themselves in an analogous competition within both the physical and the social space.

This study about built elements changes the terminology to *'quality'* and *'qualities'* because these terms are more appropriate and widely used in the architectural field. This also coincides, as mentioned, with what is known as *quality* in design and, more precisely, *architectural quality.* Bourdieu's distinction uses the term *capital* because it refers to power relationships in society, which would not be exactly the case of buildings (even if sometimes this metaphorical use can be found). In other words, the buildings' *qualities* constitute important *capitals* for their users; there is an evident and strong connexion between them, but *'capital'* remains in the sphere of people and *'quality'* in the field of architecture.

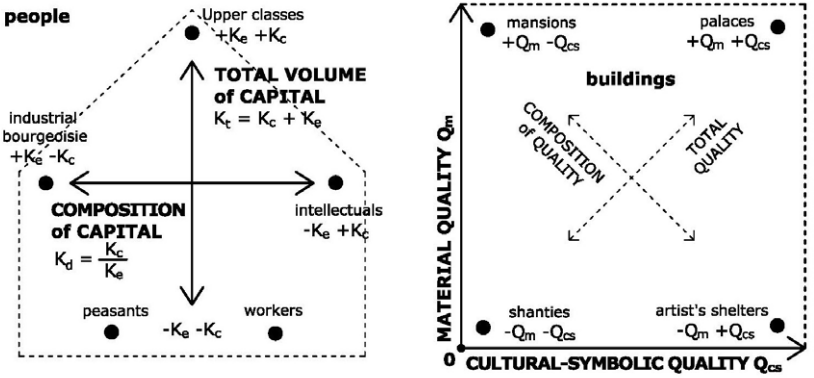


Figure 1, 2. Bourdieu's social space to study people, proposed social space to study buildings. Source: Authors

Quality is an essential discussion in architecture. For instance, it was the topic of the Davos Declaration of 2018 *Towards a high-quality Baukultur for Europe,* adopted by the European ministers of culture (Forte 2019). This topic is especially crucial in peripheries which have a significant lack of architectural values. As Bourdieu's distinction focuses on the differences and relationships, it is particularly suitable to characterise peripheries. Firstly, because they are characterised by their difference from average and central areas and, secondly, due to their particular lack of homogeneity. In these spaces, distinction's theoretical framework can better appreciate and process the variations between elements (for instance, in comparison with a typological approach).

1.1. Proposed social space for buildings

Taking into account the abovementioned Bourdieusian framework and its multiple implications, an analogous analysis matrix has been developed to study buildings in an equivalent social space (Fig. 2). This proposed scheme uses two simple axes, instead of composed ones, for a simpler and more straightforward explanation. Thus, the new scheme is practically a copy of the original one rotated 45º.

The two main axes are the *material quality* - related to users' *economic capital* - and *cultural-symbolic quality* - related to users' *cultural* and *symbolical capital*. These two axes are fully explained in the next section, but they can be respectively presented as related to physical nature (in a materialistic approach, mainly quantitative and geometric) and social interpretation (in a cultural and symbolic approach, mainly qualitative).

This two-dimensional quality space is easy to understand if extreme cases are explained. In housing, they would be: palaces (++), mansions (+-), artists' shelters (-+), and shanties (--) (Fig. 2). The proposed scheme does not make a difference in the lower positions in the composition of quality – which made sense for people -, because no consequences were detected in built results. Precarious constructions are so limited that the composition of quality does not seem to introduce variations.

It is also essential to know that many elements are contributing to both axes at the same time, but in different manners (i.e. a stone wall is a materialistic asset by its durability and thermic performance and, at the same time and for other reasons, it is a cultural-symbolic asset because of its semiology and social appreciation). This two-dimensional scheme about the quality of the built element itself can be completed by a third axis: *centrality*. This geographical quality of the place - related to the *social capital* of users - completes the proposed scheme of quality.

2. QUALITIES OF SOCIAL DISTINCTION IN ARCHITECTURE

This relationship between architecture and social distinction has been previously highlighted in scientific literature. Several studies have shown how returned migrants (once belonging to the lower classes) take into account processes related to Bourdieu's distinction in Northern Portugal (Villanova, Leite, and Raposo 1995) and in Galicia, Spain (Lizancos 2000). The elements, symbols, and composition of these migrants' houses are, apart from obvious cultural and necessity issues, consequence of the *effets de lieu* (effects of place) in social space. The results are affected by the promoters' current social position, as well as their previous one, their path in the social space, and the time spent in each position (Borges Pereira 2018). Other studies use Bourdieu's distinction to explain social influence in architectural design, like the preference for neoclassical design among the upper classes in Brazil (Pulici 2016).

In all these cases, there is a far-reaching discussion about style, taste, and what is

and how to measure *architectural quality*, a controversial issue since nowadays. The fact that the buildings' *quality* is normally measured on an academic one-dimensional scale hides a more complex reality, which this research tries to unveil. To achieve this, some preliminary considerations have to be made. Firstly, the proposed scheme serves to explained erudite academic architecture – the one with *significant material* and *cultural-symbolic quality*. This is a non-especial part of the social space, then comparable to other categories of buildings and, evidently, the one in a privileged position. Secondly, this research is focused on the understanding of general and average *qualities*; in this way, it formulates a basic but sufficient composition of variables for its objectives.

This approach aims to preliminarily explain the main inequalities between constructions. It can still be developed with more variables to better characterise other cases: specimens nearer in the social space, other buildings with other functions apart from housing, or public spaces (which are secondarily taken into account now). Logically, these general and average qualities do not study issues of composition or creativity which are essential in art and the history of art. Similarly, neither do they pay attention to security and structural integrity, which are relevant issues in the analysis of precarious constructions. This formulation has to be understood then in its general purposes, in a compatible coexistence with other approaches and possible specific evolutions. By taking these considerations into account, the different *qualities* can be now characterised to understand how the lack of them creates *inequalities*.

2.1. Centrality

The clearest of these qualities is centrality, which describes the benefits of location and, precisely, creates the classic distinction between core and outskirts. Apart from the geographic approach based on a distance between each point to the centre, centrality should be nowadays measured in time as well, according to the different means of transport available for each itinerary: walking, bicycle, car, public transportation, etc. This property is defined concerning a specified centre: the nearer, the better; but other similar features like general accessibility could be more adequate in the case of polycentric systems.

A deeper analysis of this location's quality should also be complemented with the difficulties and barriers (disabled access, slopes, stairs, lack of frequency, insecurity, etc). It also has to take into account the symbolical effects of the (social) barriers to understand the perceived *centrality*.

2.2. Material quality

Urban elements, residential buildings for instance, also possess *material quality* which is related to their technical properties, which give them advantages in the social competition in materialistic terms. These characteristics are based on the physical nature of the elements and are mainly quantitative and/or dependant on their geometry. This makes them quite objective and stable. The basic approach to housing *quality* in this study is carried out using size, *habitability* and *energetic performance* as variables.

Size refers to the total area of dwellings which includes the usable and constructed area, both with advantages for users. Dwellings with a certain amount of rooms should be compared to equivalent dwellings, but more rooms and auxiliary spaces also normally represent an advantage, as well as higher ceilings. As size analyses part of the *habitability,* the latter variable refers mainly to the shape and functionality of the spaces, their relationship with air, sun, and views at the façade, the dimensions of the exterior adjacent spaces, and their accessibility. Basic assessment of *energetic performance* provides an idea of

its potential to reduce expenses, energy, and carbon emissions.
Some of these three variables which form material quality are mutually contradictory (e.g. size and habitability tend to decrease energetic performance). Thus, a high material quality requires a balance between them and smart strategies. Moreover, for a deeper analysis, components like energy consumption, annual expenses, and carbon emissions should be studied separately and other properties like construction costs, sustainability, thermal comfort, utility, and durability should be taken into account.

2.3. Cultural-symbolic quality

In the same way, buildings have *cultural-symbolic quality* which makes them stand out in representative aspects. These characteristics are based on the social interpretation of their elements and are mainly qualitative and dependant on value judgements. This makes them relative to the society and sometimes partially subjective. *Cultural* and *symbolic* fields are conceptually different (and related to different capitals of their users), though they are difficult to separate from each other. In architecture, they usually act at the same time, which is why this study maintains the double designation of the axis.
The basic approach of this study is carried out using *social appreciation*, *value,* and *coherence* as basic variables to measure *cultural-symbolic quality*. Social appreciation is analysed taking into account elements widely valued by society, which can be qualitatively revealed in opinions, news, and narratives about buildings. *Value* is a theoretical selling price on the market, calculated following the rules of real estate valuation: an average or proportional approximation of a similar property's price in the same area. *Coherence* analyses the symbols, signs, and composition which generate meanings and define (or not) a coherent style.
In a deeper study, social appreciation should be divided into different groups or classes to take into account the respective tastes. In addition, the composition and aesthetics (coherence) should be analysed in comparison to previous and current fashion and trends in design.

2.4. An analogous social space of buildings using Bourdieu's theories

As explained previously, this research proposed a two-dimensional social space (Fig. 2) to study buildings using the explained *material* and *cultural-symbolic qualities* as its main axes, which encapsulate several variables of measurement themselves. The site's *centrality* could be added to form a three-dimensional space to study built *qualities* – which has problems of visualisation -, or analysed at the side for a clearer representation.
In this scheme, each building or group of buildings is represented by a point according to their properties of distinction. The points are placed in more or less privileged areas of the social space. This allows researchers to define and characterise *geographical, economic,* and *social peripheries* according to their lack of a specific property: respectively, *centrality, material,* or *cultural-symbolic quality.*
Moreover, as each case is a point according to these three *qualities*, any improvement (a new infrastructure or service that increases accessibility, a refurbishment of the physical conditions, or an aesthetical renovation) or deterioration produces a displacement of the point, which can be studied as a *vector* of change with a certain *direction* and *intensity.*
This study of the positions through the social space was extensively developed by Bourdieu, as well as the effect of time on each position, which affects the recognition and acceptance of a certain position (Bourdieu 1979). In an analogous application, this effect of time means, for instance, that old landmarks usually have a greater symbolism than new built icons, even in the case of an equivalent

exceptional design, taking advantage then of a greater *cultural-symbolic quality.* In contrast, the same effect of time could be seen in some historically precarious areas which, after a process of requalification with elements theoretically appreciated by society, are still connoted and considered to be of low *cultural-symbolical quality*. The limited space of this paper makes it impossible to deepen these discussions, but some of them are noted at the end as lines of research.

3. APPLICATION IN THE CASE OF PORTO'S URBAN AREA

In order to illustrate and validate this theoretical development to study territories' built (ine)qualities, this scheme is applied to housing developments in Porto's urban area (Portugal). It is important to highlight that this is a preliminary and basic application of Bourdieu's distinction. This study is effective and useful enough to be an introduction to the use of this theoretical framework in built quality assessment, and it is open to further developments. The means are adapted to the main purpose of the research: studying if urban elements' *qualities* and *inequalities* correspond to an old but still canonical one-dimensional centre-periphery distribution; or, on the contrary, the introduction of the other axes improves the understanding of their patterns and nature.

For this exemplification, a small number of case studies (10 housing developments) have been chosen in a sector of the Porto's urban area. The city of Porto is a well-known example because it has been widely studied in its built and social conditions, especially about gentrification (Alves 2016) and social-class structure using Bourdieu's theories (Borges Pereira 2018). This medium-sized city occupies a central position in its urban area, which is highly affected for it, following a natural urban process of growth by rings (naturally modified by geography and pre-existences) like many other cities in Europe.

The case studies belong to different municipalities (Porto, Maia, and Valongo) and they illustrate different urban contexts - the central compact city, the peripheral neighbourhoods, the secondary centres, and the spaces between them. They do not try to be exhaustive of all situations or a representation or summary of the urban area. They only have an illustrative character to apply the methodology, as well as to study if some of them are examples which do not follow a canonical centre-periphery distribution of quality.

Some of the case studies are well-known and deeply studied examples, such as the Bouça neighbourhood by Álvaro Siza (Vale 2018), the Cardosas Square (Alves 2016) and the social neighbourhoods of Amial and Paranhos (Borges Pereira 2016 and 2018). Though all these approaches and information have been taken into account, the aim of this research is the preliminary characterisation according to some basic variables. Thus, information about the housing developments has been homogenised on the rest of cases using open sources: e.g. cartography, press, and advertisements.

As mentioned, the research is focused on general and average qualities. Due to this, quite separate cases in the social space have been chosen to illustrate the methodology. Extreme examples (like luxury houses on the seafront and *ilhas,* precarious working-class settlements inside blocks) are avoided in order to not eclipse the less intense but more interesting inequalities between the examples.

Every ensemble of residential buildings is characterised separately by its c*entrality, material,* and *cultural-symbolic quality,* each of these properties measured in turn by several secondary variables, as previously mentioned. Each case is ranked among the others according to both secondary variables

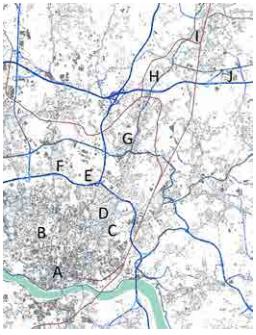
and main *qualities,* a simple and effective technique, which is sufficient and valid for this introduction. This binary comparison between specimens means a loss of accuracy (which is not needed) but avoids the difficult task of defining exact units and scales in the case of qualitative variables, making the research feasible. Criteria for each property and variable are explained hereafter, as well as the process and the empirical result. Naturally, other criteria could produce different results in the detail, but the general view is maintained if a secondary variable is deleted or changed in a further development, because the variables are quite interdependent (e.g. *centrality* measured in *time* depends on speed and *distance*).

3.1. Centrality

This property only depends on the site's location in comparison to a central point. Porto has a clear centre in terms of symbolism, tourism, and functionality: the area between the guildhall, the cathedral, and the points of maximum accessibility (Trindade e São Bento stations). One of the cases is in the middle of this area. For the others, the distance has been calculated using the tool *Directions of GoogleMaps*, with the option 'walking' and taking the first option. This distance is almost representative to the time by walking and on a bicycle. For the time in a private vehicle and on public transportation, these two options have been chosen in *Directions* on an afternoon on a weekday. Every case is ranked using the three variables (Tab. 1) and centrality (Fig. 4), using decimals to solve parities. Note that, evidently, the cases' positions by walking, on car, or on public transportation have variations.

3.2. Material quality

The technical qualities depend on buildings' spaces and characteristics (Fig. 3). A representative type of dwelling is used to measure size, habitability and energetic performance. The size has been calculated using its footprint area. The relative position in habitability is obtained by a comparison of spaces according to their shape, functionality, air, sun, and views. Finally, buildings are ordered by an indirect analysis of energetic performance: orientation, exposure, form factor, glazing ratio, window quality, and typical insulation. Every case is ranked using the variables (Tab. 2) and the material quality (Fig. 4).



Case Studies
A. Cardosas Square
B. A Bouça SAAL
C. Magalhães
D. Velasques Square
E. Paranhos
F. Amial
G. Casas Oliveiras
H. Corim
I. Ermesinde
J. Macieiras

Centrality C			(1) Car, (2) Bus/Metro/Train			
Nº	Distance	km	Time[1]	min	Time[2]	min
1º	A	0	A	0'	A	0'
2º	B	1,5	B	8'	B	15'
3º	C	2,4	C	15'	C	20'
4º	D	3	D	15'	I	22'
5º	E	3,7	E	16'	D	23'
6º	F	3,9	G	18'	E	27'
7º	G	5,5	F	19'	F	30'
8º	H	7,6	J	25'	G	34'
9º	I	9,8	H	27'	J	45'
10º	J	10,3	I	30'	H	48'

Table 1. Housing developments in the NW sector of Porto's urban area. Ranked by centrality. Source: Authors

3.3. Cultural-symbolic quality

This property was studied on the available information from visits, the external view (Fig. 3), the news, articles, and advertisements. In a representative type, the research studied social appreciation, value, and significance. The social appreciation has been analysed using public valorisation of the elements (news, articles). Value is a price on the market, according to real estate valuation (adverts). Coherence analyses the symbols, signs, and composition which generate meanings and defined a style. Cases are ranked using the three variables (Tab. 2) and this property (Fig. 4), solving parities by analogy.

3.4. Discussion of the results

The results presented together in the social space (Fig. 4) show the complexity of reality. Cases E/J/F are in the lower positions, cases D/A are in the upper ones, and the rest are on average around the diagonal, except case B, with non-material priorities. Thus, clusters can be found. The majority of cases do not occupy

Figure 3. Views of case studies in Porto's urban area. Source: GoogleMaps

Material quality Qm			
Nº	Size	Habitability	E. Performance
1º	D	D	G
2º	A	G	Hw
3º	C	A	D
4º	G	C	A
5º	B	B	C
6º	H	H	I
7º	I	F	J
8º	J	E	B
9º	F	J	F
10º	E	I	E

Cultural-symbolic quality Qcs			
Nº	S. Appreciation	Value	Coherence
1º	A	A	A
2º	G	G	B
3º	D	D	G
4º	C	B	C
5º	B	C	D
6º	H	H	H
7º	I	F	F
8º	J	E	E
9º	F	I	I
10º	E	J	J

Table 2. Case studies ordered by size, habitability, performance, appreciation, value, significance. Source: Authors

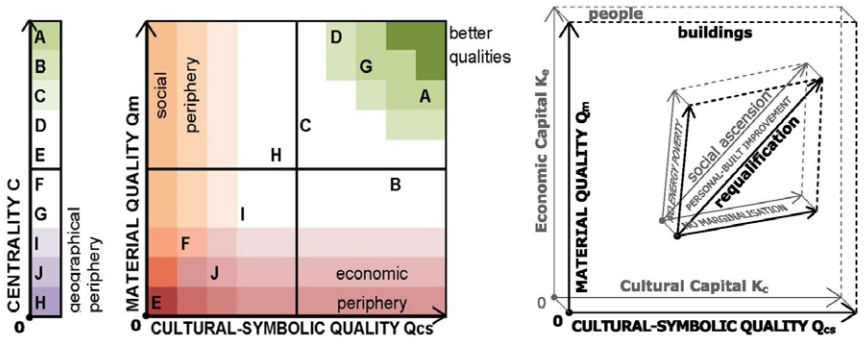


Figure 4, 5. Case studies placed in the quality space, superposition with sociological space. Source: Authors

the same place on the three axes: specimens with high qualities also have regular results in some variables. Specimens with low qualities do not coincide either, neither the different peripheries.

DISCUSSION OF QUALITIES' IMPLICATIONS IN SOCIAL SPACE AND CONCLUSIONS

As explained and exemplified, urban elements have a certain centrality, material, and cultural-symbolic quality, which are related to the capital of their users. Centrality contributes to social capital because it facilitates their users' relationships, especially with powerful people. Material quality of buildings is an economic asset for their users. Cultural-symbolic quality is evidently related to the homonymous capitals as explained before. Thus, constructions' and users' problems can be studied together and buildings' *requalification* (improvement of its qualities) can be linked to people's social ascension (Fig. 5).

This research can then evidently circumscribe three types of theoretical inequalities, such as *segregation,* (energy) *poverty,* and *marginalisation.* Thus, respective solutions appeared: accessibility improvement (infrastructures or services), material requalification (energetic rehabilitation), and cultural-symbolic requalification (symbolic renovation and interpretation). These three dimensions should not be neglected to get a real and holistic improvement. Architects should be aware of their social responsibility and limitations: buildings are major objects of distinction for their users, for good and for bad; but they are not the only one: other social measures must be implemented to reduce inequalities.

In conclusion, this theoretical and empirical research shows the applicability and relevance of Bourdieu's distinction in architecture and urbanism to study inequalities, especially in peripheries. Firstly, it validates this methodology based on buildings' qualities, unveiling social processes in architecture. Secondly it offers a clear representation of the results. Thirdly, it enables the discussion of buildings' and users' inequalities at the same time. And fourthly, it defines their problems - segregation, (energy) poverty, and marginalisation – and solutions - accessibility, material, and cultural-symbolic requalification. Finally, further developments should be made in several lines of research: quantification of the qualities per axis, the use of more variables, a deep analysis of the contradictions and effects of time, a deeper discussion of distinction's implications in architecture, and more case studies in different contexts.

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PAPER #8.10

UNIVERSITY-COMMUNITY PARTNERSHIP TO ADDRESS FLOOD RESILIENCE AND COMMUNITY VITALITY

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ABSTRACT

Inland communities are experiencing recurring flooding from rivers, smaller tributaries and stormwater stresses that are negatively impacting economic and community vitality issues. In the past decade, considerable efforts and funding have been devoted to integrated and innovative solutions to flooding in coastal communities. Although funding may be available to inland communities, application of these funds is limited. Efforts are needed to leverage funding opportunities to accomplish community vitality and flood resilience in inland, river communities. To achieve this, meaningful community engagement must inform a comprehensive portfolio of projects and potential design solutions.

The needs of inland communities in flood prone areas are addressed through a pilot study in Pennsylvania. A transdisciplinary team of researchers from architecture, Earth sciences, law, and philosophy has convened at the Pennsylvania State University, USA, and partnered with a local community in Pennsylvania to explore solutions for community resilience appropriate for regional impacts. This paper synthesizes our preliminary understanding of community-based needs and values, challenges, and knowledge necessary to inform meaningful solutions to economic revitalization and flood resilience. The actions presented - informed by community advisors locally, regionally, and statewide - are varied. Initial findings indicate that interconnected thinking about education, planning, and investment that is informed by research and communication may open doors for values-based, design-oriented project implementation that helps meet community needs while informing regional dynamics.

KEYWORDS

Flooding; resilience; pilot-study; actions; values.

INTRODUCTION

Engagement – with clients, owners, operators, representative building users, or larger community groups – is fundamental to architectural practice and education. Emerging concepts for *whole building, integrated or integrative design process* (WBDG, 7group and Reed, B. 2009) and *regenerative development* (Mang et al 2016) emphasize the need for diverse representation of design team members and stakeholders as central to addressing growing complexity in resilient and sustainable design. Indeed, the question of what to design needs to be driven by "dialog between researchers and user groups" through a process that is "collective," "iterative" and informed by place (Staub and Iulo 2011). Related to these concepts, *transdisciplinary research* has been presented as an approach to solve complex, system-based challenges (Max-Neef 2005; Brandt et al 2013; Irwin et al 2018).

> Transdisciplinary Research is defined as research efforts conducted by investigators from different disciplines working jointly to create new conceptional, theoretical, methodological, and translational innovations that integrate and move beyond discipline-

> specific approaches to address a common problem (Harvard, no date).

Transdisciplinary research is driven by specific, compelling problems and involves participation and integration of information across disciplines as well as non-academic 'ways of knowing' (Schneider and Buser 2018). Ideally, there is a mutually beneficial reciprocity for researchers and stakeholders. Most importantly, in the context of environmental change, transdisciplinary research serves a public purpose – solutions that positively impact the triple-bottom-line of sustainability and that are based on inputs of those impacted by the problems *and* the proposed solutions. Transdisciplinary research seeks solutions based on shared goals, individual contribution, interdependence, and common awareness of conditions. Strong partnerships are essential! This paper presents a University-Community partnership to address community vitality and evolving flood risks. A cross-disciplinary team of researchers from design professions (architecture and landscape architecture), Earth and climate sciences (geography, climatology, hydrology), law and policy, and philosophy have convened at the Pennsylvania State University with the support of the Provost's office and aligned with the University's Strategic Plan and commitment to *Stewarding our Planet's Resources.* This group, the Penn State Initiative for Resilient Communities (PSIRC) partnered with a local community – Selinsgrove, Pennsylvania - to explore solutions for community resilience for that community in the interest of regional (watershed-level) impacts.

1. CASE STUDY DESCRIPTION AND BACKGROUND

Flooding is the most frequent and damaging natural disaster for the State of Pennsylvania, USA (ReadyPA.gov). Flood impacts are exacerbated by more frequent and extreme precipitation events due to climate change and increases in development resulting in larger areas of land impervious to stormwater. Finding appropriate solutions to such impacts is difficult, requiring communities to navigate complex tradeoffs. Decision-makers, including designers, often lack timely access to relevant information and ways of facilitating community dialogue about trade-offs or community priorities. Direct engagement with affected communities can help to ensure that scientific resources address the issues most relevant to what the community values, that community members and decision makers have the knowledge they need to make the decisions that matter to them, and that the design solutions proposed are informed by both science and by the needs of the community. The initiative described herein brings together experts and engagement in a flood-impacted community along the Susquehanna River in Pennsylvania to address flood risk in the interest of community development. The pilot project includes two components: 1) working with a selected Pennsylvania community, the Borough of Selinsgrove, to develop a plan for community climate resilience; and, 2) broadly engaging with stakeholders and decision-makers about flood resilience in riverine communities. Since longevity of engagement and trust are essential to community engagement and collaboration, Selinsgrove was selected for this pilot, in part, because of a history of working with this community and at their request for continued assistance.

1.1. Selinsgrove, PA, USA

The Susquehanna River, its tributaries, and the encompassing watershed(s) are a key component of the regional economy and major contributors to pollution problems in the Chesapeake Bay Watershed. Selinsgrove struggles with similar issues to many other communities regionally. It is representative of many historically and culturally significant small urban centers and agrarian communities

in the Susquehanna River Valley. All are subject to flooding from the river, resulting in economic, environmental, and social stresses. In addition to the primary and more predictable flooding from the Susquehanna, there are several creeks and tributaries that are prone to recurring flooding and erosion that affects the larger watershed. Recently, properties not previously subject to flooding – including a new Borough building and public library – have experienced water inundation due to heavy precipitation and limitations of stormwater infrastructure. At the same time, the Susquehanna River is central to community identity and adds to the quality of life for the residents, as well as presenting a recreational destination for visitors to Selinsgrove and other river communities, contributing to community vitality.

In 2006 students and faculty at Penn State's landscape architecture program, through the Hamer Center for Community Design, designed a master plan for Selinsgrove that considered strengthening major corridors within the community and proposed streetscape and storefront improvements for the central business district area of the main commercial street (Market Street). In particular proposals for a vacated pharmacy building at the center of town were proposed, subsequently resulting in the development of a public plaza, the 'Commons,' now used for community gathering and events. In 2018, the Hamer Center was invited back by Borough leaders to discuss updates to the master plan. Discussions included streetscape improvements for Pine Street, the street intersecting Market Street and connecting the campus of Susquehanna University - a private college - to the commercial district and forging a stronger connection with the Susquehanna River. Borough representatives identified dying retail and the need for economic development as negatively impacting Downtown Selinsgrove. Priorities identified included the need to 1) build capacity for residential development; 2) build the image of a vital downtown; and 3) connect the downtown to Susquehanna University - located within walking distance of the downtown and a primary economic driver in the community. In addition to establishing connections between the downtown and campus, a regional planning approach was desired to address:

- Community quality of life;
- Historic and cultural resources;
- Economic revitalization;
- Human health and wellbeing; and
- sustainability.

The Susquehanna River is seen as central to opportunities for improved quality of life through recreation and as a resource to attract tourism. These opportunities cannot be fully realized without first addressing current flooding and risks associated with future flooding due to climate change. Understanding risks and developing potential solutions are informed by multiple decision-makers. However, deep uncertainty may exist "where decision makers disagree about the appropriate problem framing and how to characterize strategy tradeoffs" (Mayer et al 2017: p107).

2. METHODOLOGY AND LITERATURE REVIEW

Communities in the Susquehanna River Valley and throughout the Chesapeake Bay Watershed face increasingly complex resilience challenges. They have to make hard decisions to sustain their populations and historic downtowns built along rivers, to provide opportunities for economic development, and to ensure resilience to flooding in the face of deeply uncertain climate variability and change. Such decisions require communities to navigate complex trade-offs between competing values and objectives. Yet, decision-makers often lack timely access to relevant information (about flood hazards, for example) and a way to facilitate dialogue about trade-offs and value choices intrinsic to such decisions. Moreover, there is frequently a disconnect

between research and on-the-ground designed solutions that address needs and values and can be implemented by the community and sustained over time. Addressing these challenges requires bridging the gap between science and application through coordinated and interactive planning, community-oriented research, values-informed decision analysis, and design. It also requires an approach that fosters respectful communication and collaboration between diverse sets of experts and affected community stakeholders.

2.1. PSIRC team and approach

Launched in January 2019, Penn State Initiative for Resilient Communities (PSIRC) provides an environment of shared discovery where people can come together to address local resilience challenges of small, riverine communities vulnerable to flood risk. Working with local stakeholders and decision makers, PSIRC provides a way to leverage the resources of the Pennsylvania State University to help make an impact for local communities. By bringing together faculty, students, postdocs, and staff from multiple colleges, diverse disciplines, and established centers and institutes with decision makers and community members, this initiative works towards addressing riverine flooding and other related challenges to build more resilient communities in Pennsylvania and beyond.

PSIRC facilitates a research-driven, transdisciplinary, participatory approach to community resilience, bridging the gap between science and decision support through a solutions-oriented perspective. Borrowing integrative and regenerative design associated with the sustainable building sector and incorporating methods from decision support sciences, we apply a goal-oriented, action-based approach to inform more responsible, community-informed applicable solutions through productive partnerships of diverse professionals and community decision makers.

2.2. Description and rationale for developing mental models for decision support

> Decision support science is the systematic study of target systems intended to inform decision-makers, typically with respect to complex and uncertain situations, through a range of experiments, observations, and organization of empirical and theoretical research (Vezer et al 2018: p2).

Relatedly, "influence diagrams are a graphical tool for mapping the interaction of the various elements of a decision setting" (Hall 2010). Mental models and other forms of influence diagrams can be used as tools in risk- and decision-analyses to:

- Engage experts and others in the decsion-modeling process;
- Model how important decision factors interact;
- Identify key uncertainties that need to be "explicitly modeled" (Ibid).

They can also be used to determine how the public understands the problem and form beliefs about trade-offs. Climate risk management (CRM) strategies, such as those required to address flooding, "include variations of proactive and reactive plans" (Mayer et al 2017: p107) informed by multiple disciplines and areas of expertise.

> A mental model is an internal representation of external reality that is thought to influence reasoning, cognition and decision making. An individual's mental model includes their experiences, assumptions, beliefs and biases about the world (Mayer et al 2017: p108).

A mental model is a representation of how a person thinks about a particular phenomenon. "Mental models are the mechanisms whereby humans are able to generate descriptions of systems purpose and form, explanation of a system functions and observed system states, and predictions of future system states" (Rouse and Morris 1986: 351). Mental models

in the context of climate risk management are used to provide a basis for understanding what individuals and communities understand about the nature of the risks they face, and are used to interpret observations, organize beliefs, and make decisions in different contexts. According to Bessette et al (2017):

Mental models have long been used to analyze how the public uses scientific information and knowledge to form beliefs about risks like climate change. These beliefs are identified through a process of comparing two archetypal mental models: a layperson model and an expert model. Both models are constructed through experiences and social interactions.

Mental models can help to identify gaps or differences in the understanding of decision support scientists and community members. While mental model approaches are often used to identify knowledge that community members need in order to better understand the risks they face, they have also been used to help identify what community members value in order to ensure that scientists provide communities with the knowledge they need to make the decisions that most matter to them. Bessette et al report on the "role of values and worldviews in determining climate risk perceptions and decisions" (2017: p1994). They discuss an "augmented mental model research approach" - the *Values-informed Mental Model* (ViMM) [p1995], to take into consideration both experts' and laypersons' values. ViMM is designed to help ensure that scientific resources address the full range of issues that matter to the community.

2.3. Learning from coastal projects and application of methods to inland flooding

New Orleans, post-Katrina, is presented as a case study to test the ViMM method. The researchers conclude that:

> Just as mental model approaches are designed to identify gaps in understanding. ViMM is intended to help identify gaps in the values used by both the public and experts to understand risk factors and strategies. (Bessette et al 2017: p2002-2003).

Related efforts, engaging experts and the public, are needed to leverage funding and accomplish community vitality and flood resilience in inland communities. Although limitations in the New Orlean's study are identified, the study states that ViMM could "go a long way in informing decision-support processes" (Bessette et al 2017: p2003).

Some aspects of mental models may be generalized, for example, factors related to flooding (Aerts et al 2018; Calgary, no date). However, to be meaningful, decisions about design and implementation of strategies must be informed by specifics of place and appreciation of what the relevant communities value. Towards this end, PSIRC has been collaborating with partners in Selinsgrove to develop a ViMM to inform resilience measures most aligned with the realities of inland riverine flooding in small, agrarian communities. As a first step towards the development of a VIMM, a workshop was convened in Selinsgrove Borough with experts representing community decision-makers, regional and state agencies, and local universities. The purpose of the workshop was to gather information from community advisors on priorities and values associated with community resilience to riverine flooding and to identify factors contributing to community vitality. Following an introductory session, participants were split into one of four randomly assigned groups and circulated between stations to address the following questions:

1. What problems or CHALLENGES face small rivering communities like Selinsgrove or the surrounding region and watershed?
2. What ACTIONS should be taken, now and in the future, to achieve community resilience?

3. How can KNOWLEDGE and information be translated into action - specifically, what information do decision-makers have and what information do they need?
4. What do you VALUE and want to see for river communities in Pennsylvania and the region?

3. OUTCOMES AND DISCUSSION

Findings from this workshop are summarized below.

3.1. Challenges

Although some challenges related to flooding are well documented, there are other challenges to be considered with smaller, often disinvested, cities and communities. Local concerns about economic and community revitalization must take into consideration environmental concerns associated with the river, water quality and stormwater management. Although Susquehanna University is a major economic driver in Selinsgrove Borough, it also provides challenges; The University's population mainly lives and works on campus and is perceived as having little presence downtown. Currently, walkability and attracting/retaining businesses are challenges in the downtown area. Dwindling local tax base are a challenge in Selinsgrove Borough, especially since 50% of properties are tax exempt.

Environmental and infrastructure challenges are often addressed together or interchangeably since Impacts on water quality from stormwater and flooding are a leading challenge in Selinsgrove and other river communities. For example, transportation decisions impact walkability and affect local businesses; Development increases impermeability and strains stormwater infrastructure, while simultaneously constraining space for water quality and quantity control. Therefore, water quality (drinking water), urban stormwater management, and river health are local and regional challenges that need to be considered in relation to one another. Lack of coordination is a related challenge. To address environmental and infrastructure issues, coordinating across municipal boundaries is an issue (infrastructure often crosses municipal boundaries and upstream decisions can impact downstream communities and waterways). Lack of predictability and communication are flood-related challenges that result in deficits in preparedness, regional planning, and oversight of floodplains. In addition, a "sunny day" mentality, leading people to forget flooding happened, can pose a challenge to enacting proactive intervention, cause political inertia, and exacerbate local resistance to change.

Many challenges associated with flooding are considered uncertainties and largely mirror regional and national concerns. These challenges are associated with lack of understanding and/or changing definitions of policy and regulatory environments.[1] Much confusion is associated with FEMA (Federal Emergency Management Administration). In particular, challenges are associated with misunderstanding of FEMA mapping, associated terms and practices, and the implications for development.[2] Moreover, many of the properties in the historic Borough were constructed prior to the initial Flood Insurance Rate Map in 1974 (pre-FIRM) and owners are now confronted with associated flood insurance requirements. Exposure to flooding and/or high and increasing flood insurance premium costs have personal and societal impacts, including potential for deferring flood management/mitigation that results in

[1] A forthcoming paper by Keller et al (2020) relates uncertainty to climate risks and presents a review of "challenges and avenues to overcome them."
[2] FEMA identifies and maps flood hazards and assesses flood risks to guide mitigation actions. Flood hazard mapping is the basis for National Flood Insurance Program (NFIP) regulations and flood insurance requirements. Reference: https://www.fema.gov/national-flood-insurance-program-flood-hazard-mapping
[3] Base Flood Elevation (BFE) is the computed elevation to which floodwater is anticipated to rise, as indicated on Flood Insurance Rater Maps (FIRMS) and flood profiles (FEMA.gov).

damages and/or abandonment of properties, further eroding the tax base and leading to community blight. Property owners willing to mitigate are challenged with questions about what mitigation strategies would lead to reduction in premium amounts, whether to use federally available funds to execute a mitigation project, and what standard they should design to (e.g. how high should a home be elevated above BFE[3] to ensure that they are safe from high water?). Even where FEMA maps are regularly updated, how these maps will change in the future is uncertain. These challenges are related to the most predictable impacts of flooding associated with primary rivers (the Susquehanna and its major tributary Penns Creek). Smaller tributaries (streams, creeks) present a lack of predictability with regard to flooding frequency and inundation levels under current conditions, let alone with exposure to increased rainfall and stormwater runoff. Finally, increases in development and stress on existing sewer and stormwater infrastructure is resulting in unpredictable flooding to properties located outside of documented hazard areas.

Funding is a consistent challenge related to community vitality and flood resilience. Limited or unknown financial resources and unclear benefits discourage people from complying with requirements and pursuing mitigation that could protect their property. Limited communication and coordination is a challenge to larger-scale planning and the ability to capitalize on available funding, contributing to a perception of less available funding from State and Federal sources. There are also challenges associated with aligning available funds with community needs: sources may not match local challenges, it is difficult to combine multiple funding sources in sensible ways, and local municipalities may not have the expertise, experience, or bandwidth to identify and take advantage of funding opportunities.

3.2. Actions

Planning, investment (funding), and education/ engagement are interrelated themes when considering actions to be taken now and in the future. There is a need for planning action across scales (physical and temporal) and jurisdictions. Such planning often must address complex trade-offs. For example, actions are desired that can increase development potential. However, these interests may be in conflict with actions to mitigate flooding. Maintaining floodways as open space- a preferred flood risk reduction measure- has implications for public and private properties, presenting immediate risk to buildings constructed in the flood zone and potentially creating obstructions and increased flooding for others. Moreover, allowing development to occur in designated open space could compromise a municipality's Community Rating System (CRS)[4], resulting in increased insurance rates for everyone with a NFIP (FEMA National Flood Insurance Program) policy. For action to occur at local and regional scale, engagement with and across several political entities is needed. Some actions, such as river and open space conservation, need to be addressed based on watershed rather than political boundaries. Moreover, action should be informed by how nature functions, investing more in green infrastructure (i.e. bioswales, raingardens) and less in grey infrastructure (i.e. storm sewers, pipes, culverts). To avoid conflicts in actions and to capitalize on available funding, coordinated planning that addresses local and regional needs and takes flood risk and uncertainties into consideration are important. Action related to education and engagement are important to understand potential results of planning decisions and to inform the public and decision makers. Research and communication of knowledge between groups (i.e. scientists, planners, community decision-makers and members)

[4] The National Flood Insurance Program's (NFIP) Community Rating System (CRS) is a voluntary incentive program that recognizes and encourages community floodplain management activities that exceed min. NFIP requirements. (U.S. Climate Resilience Toolkit)

is needed to bridge actions and must work across scales.

3.3. Knowledge

In order to communicate science to officials and the public, understanding change – what is changing and how – is essential. It is equally important that the science addresses the range of problems relevant to the community so that decision-makers can balance likely trade-offs. Science-related knowledge includes enhancing understanding of the temporal dynamics of floodplains, enhancing accuracy of watershed data, and contributing to knowledge of future flood projections to communicate uncertainties that can lead to better outcomes and actions. Education for the public and municipalities on the NFIP; mitigation strategies, options and costs; and watershed regulations are all identified as contributing to knowledge. Knowledge of mitigation strategies and best management practices (BMP), – when, where, what -contributes to knowledge for optimizing solutions. Accounting for knowledge must be carefully considered in the context of place and time; BMP for one location may not be ideal for another and today's BMP may not work under future conditions. Knowledge of BMPs that contribute to multiple objectives, such as flood control and water quality, is important. However, these objectives may be in conflict with community desires.[5] There is a need for knowledge related to adaptive strategies that account for future changes and current decision-making (for example, decisions related to structural elevation of houses). Knowledge contributing to understanding and identifying, leveraging and optimizing costs associated with BMPs and implications for property owners is necessary. These costs may include first-costs for design and implementation, but also long-term costs of maintenance. In Selinsgrove, knowledge is needed to inform about flood potential and impacts of local streams and tributaries and implications of upstream agriculture and land use, pre- and post-development conditions on waterway performance and maintenance.

3.4. Values

Values in Selinsgrove focus on two areas: 1) quality of life and 2) economic resilience. Quality of life are expressed in terms of health and well-being of the residents and the health of the local environment. This includes aquatic health, water quality, and preservation of recreational opportunities, particularly river recreation. Aesthetic factors such as protection of historical places and maintaining the charm of the community are also included under the category of well-being. Aesthetic value is equally connected to river towns' historic charm and to the environmental beauty of the area. The Susquehanna River, embedded in the history of Selinsgrove, is seen as key to quality of life for both recreation and natural beauty.

Economic resilience is expressed in the context of both individual and community needs, with a key focus being flood resilience. The emphasis on individual economic resilience concerns protection of property from flooding and creation of job opportunities. Community-wide economic resilience focuses primarily on the economic vitality of the downtown area as a key element of community economic vitality. Strengthening the relationship between the downtown and Susquehanna University is identified as a key component of economic resilience. In general, a thriving downtown, a strong tax base, and protection of property values are identified as economic issues of importance and value.

These two general areas of value are often seen as interdependent. The economic resilience of the downtown area is viewed as directly linked to community well-being. The values related to the health and beauty of the river and

[5] Strategies such as planting trees have potential for multi-objective benefit however conflicts may arise between installations that improve water quality (i.e. riparian buffers) or those that allow for recreational opportunities.

surrounding environment are, in turn, seen as linked to economic resilience since they attract residents as well as visitors. Flood resilience is identified as a key factor in both domains.

CONCLUSION

The workshop provided an initial forum to focus on flooding and community vitality to better understand the challenges, potential actions, knowledge gaps, and values at play. The thoughts shared by participants highlight the continued need for coordination and communication to address flooding in Selinsgrove and other flood-prone riverine communities. Going forward, focused research and enhanced communication of knowledge between groups (i.e. scientists, planners, community decision-makers and members) is needed. Moving from knowledge to action has the potential to reveal trade-offs, must account for uncertainty, and needs to bridge regulatory and political constraints. How to handle likely trade-offs between values can be a source of conflict but also an opportunity for dialogue, identification of additional knowledge, data and needs, and sound decision-making. Feedback on challenges, values, knowledge and actions will be used to inform and improve decision making processes. The PSIRC team is currently working on a mental model from the perspective of academic researchers that considers relationships between flood and community resilience. During the next phase of this work, community representatives will be interviewed to establish a mental model from the perspective of local experts.

> Comparing the two models helps to identify crucial gaps in understanding – by both groups, and focuses communication and outreach on the most relevant and meaningful information individuals need to make informed decisions. (Bessette et al 2017: p1993-1994).

In the interest of accounting for uncertainty related to climate change and climate risk, values will be embedded into the established Values Informed Mental Model (VIMM) and used as a tool for broader stakeholder engagement. An anticipated outcome of this initiative is to establish decision-support processes to inform a responsive and coordinated portfolio of information as a basis for the community to attract funding and undertake resilience planning and implementation projects.

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PAPER #8.11

BUILDING INDEPENDENCE

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ABSTRACT

During the summer of 2019, a team of eleven students, faculty and professionals with backgrounds in architecture, design and engineering traveled to Port Elizabeth, South Africa, where they partnered with local community members to design and construct an event- and maker-space from scavenged materials. This project was completed by eleven people in ten days, three days scavenging materials and designing and seven days constructing, and with a budget of only $1500 - facts which give the work resonance. To our partners, who live and work within post-apartheid communities of great need, the humble frugality of the project is not a nicety, but an essential attribute. For it is only through such limits that the work is able to shift from a tantalizing one-off that increases the community's dependence on outside support to a physical and inspirational foundation through which they might realize new works for years to come. If successful, this propagation will continue indefinitely, allowing the community to ostensibly rebuild itself using modest means, and without external support. The presentation proposed by this abstract will describe the process used to create the foundational maker-space, highlight the lessons learned through its execution and offer insight into how this process, and the resulting work, might be refined in the future.

KEYWORDS

Extra-legal communities; socially-responsive design; bricollage; viral propagation.

1. DEFINING EXTRA-LEGAL COMMUNITIES

First, a point of clarification: the architectural approach described by this writing is specifically designed to respond to communities that are often identified through their purported informality (re. informal settlements). However, to classify these settlements as such is misleading, as the communities so identified often have well-defined approaches to land ownership, construction and occupation. They are simply poorly understood, as they exist outside the formalized networks most professionals are trained to serve and, thus, understand. To form a more accurate definition, one might look to the core attributes of these settlements, as offered by organizations like UN-Habitat or the WHO (UN-Habitat, 2015, also WHO, 2000).[1] First, settlements of this type will be located on borrowed land, generally acquired outside the legal framework designed to support land transfer. And second, these settlements will be constructed outside the limits of the formal construction processes, built using unapproved plans and scavenged materials. Although both characteristics vary somewhat between settlements, they both remain inherently linked to the situation of those who occupy this settlement type – settlers who are coming to the settlement under some degree of duress, with scarce resources with which to reestablish their lives within a new location – and are thus universal within this settlement type. To operate well in these extra-legal settlements, requires that architects, engineers and other professionals

[1]The definition for informal settlement offered by the UN-Habitat Programme, which is arguably the definition most widely applicable, includes only two primary characteristics: informal settlements are illegally located and they are illegally constructed. It naturally follows that, now and in the future, most settlements will be extra-legal. (UN-Habitat, 2015, 3)

align their approach with these realities, in four ways (Shall, 2018).

1.1. Tenant One: Borrowed Land

The first tenant is linked to the fact that the occupants of extra-legal settlements do not have the means, nor need, to create their built environment using formal networks. The first supposition - the lack of means - requires little elaboration, as it is the chief motivating factor behind the occupants establishing their lives within this setting. The second supposition – that the occupants do not have the need to submit to the formally established processes - is linked to the fact that these developments are rarely fully defined, mapped or understood by the governing authorities (Thieme & Eszter, 2015).[2] They fly under the radar. This is, ironically, due to the fact that these settlements are generally quite large and grow very quickly - characteristics which prevent the governing authorities to define, map or even exert influence over these settlements (Thieme and Kovacs, 2015).[3] They are thus largely ignored, at least until a new development opportunity, safety concern, international scrutiny or other important event demands some measure of attention. The fact that these settlements will hide in the open, with rare, albeit intense, punctuations of unanticipated scrutiny and intervention, has a significant impact upon the architecture. In this settlement type, elements that only have value when stability of placement is ensured, such as foundations, massive construction types, or robust attachments to engineered infrastructures, are of less value than those that are transportable or inexpensive. This promotes the creation of architecture that is light, inexpensive, and without any undue investment in concerns that are permanently tethered to place.

1.2. Tenant Two: Scavenged Materials

The second tenant share a root with the first. That is, in shifting from an architecture anchored to place toward lightweight, inexpensive structures that address immediate need, the residents minimize the need for professionals to help design verifiable or complex structures and opens up the possibility of an architecture that is constructed almost entirely of scavenged materials using only simple tools and easily-learned techniques. This allows the occupants of extra-legal settlements to eschew materials such as of concrete and glass for much more accessible materials like tarps, corrugated metal, recycled plastic, straw, wood scrap and the occasional concrete block (Davis, 2006). Correspondingly, instead of building using well-studied and highly calculated joinery, as required by concrete, glass or steel construction, the extra-legal settlement favors joints that use more common techniques, such as wrapping, tying, or stacking. The resulting joints rarely require expert training to execute or specific pieces of hardware. Rather, the built work prioritizes connections that can be realized using whatever is at hand. This aligns the processes of construction, and the resulting tectonic, with the approaches favored by the bricolleur, not the architect or engineer – a point that will be made clear later in the writing.

1.3. Tenant Three: Social Capital

The third tenant naturally follows the first two: after all, if one is realizing a settlement using common tools and easily understood methods of construction instead of those requiring more expensive and less accessible tools and methods, then one is ostensibly trading techniques of construction requiring cranes, excavators, and other large-scale

[2]The implication has been that informal economic activities and by extension informal provision of goods and services were not only described as irregular, casual and potential precarious, but also outside the remit of state regulation and surveillance. Therefore, as urban slums are characterized by informality in all spheres of life, they become to an extent invisible to the state, especially in terms of public provisions." (Thieme & Kovacs, 2015, 18)

[3]In the shadows of rapid urbanization and economic liberalization across the world, the formation and demographic growth of informal settlements or 'slums' far outpaces the availability and capacity of urban planning." (Thieme & Kovacs, 2015, 1)

supports for those able to be realized through the infusion of more people. After all, one of the chief assets of simple tools and easily-understood methods of construction is their transferability. This asset, when married with the immense size and rapid growth of this settlement type, causes the residents of extra-legal settlements, and thus the settlements themselves, to align their value systems with physical capital first, then social capital, instead of economic or symbolic (Thieme and Kovacs, 2015).[4] Rather than purchase commodities, residents will often trade or barter; instead of accruing status (although this does occur once residents establish themselves), residents accrue associations and allies. This shift impacts the priorities of the built environment, emphasizing the ability to help generate social capital, instead of cultural.

1.4. Tenant Four: Viral Propagation

The fourth tenant is distinct in that it is not based upon the needs of a single occupant for a particular architectural approach, as was the case with the other three, but upon an architectural asset derived from the nature of the first three realignments. Specifically, the need to create lightweight, inexpensive architecture on land illegally acquired using borrowed materials, common tools and easily-understood methods creates a design approach that is perfectly situated to promote the rapid propagation of the settlement itself. This asset has, over time, become a core defining characteristic of the settlement itself, allowing the extra-legal settlement to grow at a rate that far outpaces the speed at which their legal counterparts are generated (UN-Habitat, 2013).[5] The rapidity of their expansion has also rendered obsolete the methods of design and construction favored by the architect, engineer and other supporters of more formalized networks. The scale of this growth, although problematic when propagating poorly conceived or unsafe architecture, this becomes a potential asset if well-formed architecture could be aligned so as to benefit from this rapid propagation network.

2. SHIFTING ARCHITECTURE TO SUPPORT EXTRA-LEGAL SETTLEMENTS

2.1. Movement One: Becoming Socially-Responsive Outsiders

The extra-legal settlement, thus understood, creates an obvious set of challenges for those professionals who wish to engage the residents of this unique community. The first challenge is associated with the fact that the extra-legal settlement is a natural by-product of the legal settlement – an unavoidable remainder created by the abuses of powerful actors who benefit most from the formalized system. The fact that these powerful actors have, historically, enlisted the talents of architects, engineers and other professionals to extend their influence and solidify their favored position, creates a difficulty whenever these professionals attempt to offer their talents to those living within extra-legal settlements (Crawford, 1991).[6] Much of the reason for this can be traced to the educational and professional structures used by these professionals, which have, over time, been calibrated to support one system at the expense of the other. The professionals, so

[4] "...what ties the rural and urban slum experience in relation to the nexus are the prevalence of social networks and social capital as the dominant albeit informal platform for self-organizing and provisioning that determine how things get done." (Thieme & Kovacs, 2015, 11)

[5] Informal settlements represent the largest and fastest growing urban condition on the planet. In fact, according to a 2012 UN-Habitat report, "since 1990, 213 million slum dwellers have been added to the global population." (UN-Habitat, 2012)

[6] "By distancing themselves from contractors and builders with economic control of the field, they (architects) also effectively repudiated the interests of moderate-income clients. Instead, the profession linked its professional identity to large-scale monumental commissions requiring wealthy patrons. This left architects dependent on the restricted group of clients who could afford to support their ambitions: the hoped for, but only occasionally awarded, patronage of the state (far less active than in Europe), but more often, the backing of large business and corporate interests." (Crawford, 1991, 30)

indoctrinated, become an extension of this unjust order (Shall, 2018).

It is important to acknowledge that this association persist whether or not it is acknowledged by the professional (Freire, 2010).[7] In fact, non-acknowledgement can create a naivety that is easily exploited by those who have historically benefited from the work of these professionals, as evidenced by the ways in which new work offered by these professional can fail to meet the needs of those residing within extra-legal settlements. The first failure type is linked to the importation of highly-engineered solutions from external contexts, without regard for localized conditions (UN-Habitat, 2015).[8] This prevents the offered solution, despite the fact that it is arguably well- designed for its stated purpose, from ever finding root in the community. This lack of anchoring can cause the community to reject the project. This rejection might assume the form of anything from indifference to the outright consumption of its offered assets in order to support better understood constructions (Thieme and Kovacs, 2015).[9] The second failure type is slightly more insidious, as it involves the purposeful shifting of resources dedicated to help extra-legal settlements to wealthier communities. Author Mike Davis terms this activity "poaching" and attributes it to the extra-legal settlement's lack of political influence, noting that "a consensus of urban scholars agrees that public- and state-assisted housing in the Third World has primarily benefitted the urban middle class and elites" (Davis, 2006).[10]

To address this inherent bias, requires that the design professional acknowledge this professional bias and then seek to create approaches that reverse the flows of knowledge and expertise. Instead of imposing highly-engineered solutions, optimized using imported values and quantifiable data sets, the designer must work with the residents of extra-legal settlements to understand the values and resources that are already present and then collaboratively evolve these assets in order to supporting a more sustainable, but perhaps less optimized, means of distributing assets like water, shelter, energy, education,

Figure 1. The Community Makerspace in Port Elizabeth, South Africa was constructed almost entirely of reclaimed materials, at a cost of $1500 in under 7 days by a team of 11 (Shall 2019).

[7]"It happens, however, that as they cease to be exploiters or indifferent spectators or simply the heirs of exploitation and move to the side of the exploited, they almost always bring with them the marks of their origin: their prejudices and their deformations, which include a lack of confidence in the people's ability to think, to want, and to know ...They talk about the people, but they do not trust them; and trusting the people is the indispensable precondition for revolutionary change. A real humanist can be identified more by his trust in the people, which engages him in their struggle, than by a thousand actions in their favor without that trust." (Freire, 2010, 61, emphasis mine)

[8]"Many upgrading approaches continue to inappropriately import solutions from other places without adapting operations to the local context. They are therefore unable to neither take full advantage of local knowledge nor develop city-wide /'at-scale' responses." (UN-Habitat, 2015, 3, emphasis mine)

[9]"Particularly when it comes to basic service provision, a form of 'malevolent urbanism' has generated across urban areas in the global South, where unequal access to and use of the city is prevalent. At the same time, a mosaic of actors, sectors, and initiatives seek to address the 'challenges of slums', usually purporting to work with local communities, but often misunderstanding how everyday practices and expectations might differ from externally defined development goals and impact measures." (Thieme & Kovacs, 2015, 1, emphasis mine)

[10]"Both 'poaching' and fiscal bias, of course, are expressions of the poor majority's lack of political clout throughout most of the Third World; urban democracy is still the exception rather than the rule, especially in Africa. ... A consensus of urban scholars agrees that public- and state-assisted housing in the Third World has primarily benefitted the urban middle class and elites, who expect to pay low taxes while receiving high levels of municipal services. (Davis, 2006, 68-9, emphasis mine)

medicine and information (Thieme and Kovacs, 2015).[11] Provided that this evolution – from localized conditions and understanding to sustainable address – are generated collaboratively, then the offered design will likely become an extension of local assets, leading to its adoption by the host community. Although requiring a constant, and sometimes uncomfortable, examination of professional and methodological bias, this tactics is quite effective, allowing the professional to put aside the mantle of either insider – which will never be an accurate description of their role or status – or outsider – which will only perpetuate the problems described above – in favor of becoming a responsible outsider (Freire, 2010).

To illustrate how this movement, as well as subsequent movements offered by this writing, might manifest within an architectural work, one might consider a small project recently completed in Port Elizabeth, South Africa. In this work, a small team of students, faculty and professionals partnered with local, South African community members to design and construct an event- and maker-space from scavenged materials. To realize the now-completed work in only ten days, the team had to focus our efforts on only those matters pertinent to our expertise and perspective. This required the team to first build a body of trusted, local experts who could supply much of the insight required to execute this project and then listen carefully to their perspectives and beliefs. Fortunately, internet-based communication tools allowed for this process to occur well before the team even departed. This allowed them to test, remotely, the judgments and perspectives of their partners against other points of view. Through this process, the team grew to trust their assembled body of local experts, and the experts, the visiting team. The team was also able to understand more clearly the situations in which their partners' knowledge was well-formed, requiring no elaboration from them, and where they might offer useful support. This created a dialogue through which all parties were able to understand which project parameters the visiting team should consider as controls and which were variable, open for development. Areas in which the local partners had deep experience – the choice of a particular site, the specific program requirements for the development, the initial inventory of materials and the core partnerships that would energize the project – were thus taken as accurate and assumed to be givens. Areas in in which these partners needed external experts to responsibly leverage their standing as outsiders to benefit the work

– which materials in the inventory had greatest value to the realization of the work, how the inventory might be evolved to better support the work, additional materials and supports that might help us to realize the work

– were viewed as variables, becoming the focus of the visiting team's design energies.

2.2. Movement Two: Learning How to Practice as Bricolleur-Designers

The second shift required of the professional is based upon the aforementioned priority given to scavenged materials in the construction of extra-legal settlements. Here, instead of designing based upon an assumed set of ever-available materials, those operating in these settlements base their craftwork upon the idiosyncratic nature of whatever is at hand – a mandate that aligns the architect's approach more with the bricolleur than the engineer. The bricolleur, as distinct from the engineer who requires an inventory of pre-determined materials of well-known and highly specifiable attributes, operates with an ever-changing inventory of assets. Identified as a 'devious craftsman' by Claude Levi-Strauss, the bricolleur is able to perform a large number of tasks within a closed set of assets, much of

[11] Theime and Kovacs also urge those attempting to positively impact the conditions found within slums to reverse the "flows of knowledge and expertise so as to theorize the nexus from the slum, where inhabitants experience everyday relationships to water, food, energy and waste as integrated." (Thieme & Kovacs, 2015, 15, emphasis mine)

which will have been created from the remains of already completed acts of construction or destruction, instead of the demands of the current work (Strauss, 1968).[12] This aligns well with the manner in which extra-legal settlements are built and re-built – activities that are always completed using a stash of pre-gathered materials, the vast majority of which have limited pre-determined utility aside from broad notions of being inexpensive, lightweight, water-tight or durable. In this place, the chief task of the designer is to maximize the utility and expression of this finite set of resources. Massing and form, often foundational concerns within acts of architecture and engineering (due to need to maximize real estate valuations, capacities, and other quantitative attributes) must become subordinate, adjustable to the means at hand. Aside from limits that are determined in a broad sense based upon the available site (which is also a scavenged resource), the form of the work subordinates itself to the closed set of materials and whatever structural componentry one might find therein – components which forms a rare, and thus valuable, subset of objects within the stash. Similarly, program activities, another foundational attribute to the classically trained architect, must respond to the finite set of scavenged materials, shifting their placement and nature in accordance to the confines of this fixed resource. Even the tectonic of the work assumes a reactionary role, forged not from an assumed set of highly predictable and specifiable means but from highly idiosyncratic kit of of parts accumulated without knowledge of the project at hand (Strauss, 1968).[13]

This is not to state that ideas of form, massing, program and tectonic bear no influence upon the stash. Only that these values must find their expression within this finite assembly. Instead of dictating what is in the stash, ideas of form, massing, program and tectonic work to form a hierarchy of value within the previously heterarchical stash of materials. This valuation becomes a core task of the architect operating in the extra-legal settlement: to identify those components within the stash that bear rare attributes of immediate and fundamental value to the architecture, such as the ability to support weight, span distances without deflection, or provide an unbroken envelop, and

Figure 2. Purlin joint and mechanism for the sliding walls from reclaimed stock (Shall 2019).

[12]"The 'bricoleur' is adept at performing a large number of diverse tasks; but, unlike the engineer, he does not subordinate each of them to the availability of raw materials and tools conceived and procured for the purpose of the project. His universe of instruments is closed and the rules of his game are always to make do with 'whatever is at hand', that is to say with a set of tools and materials which is always finite and is also heterogeneous because what it contains bears no relation to the current project, or indeed any particular project, but is the contingent result of all the occasions there have been to renew or enrich the stock or to maintain it with the remains of previous constructions or destructions. The set of the 'bricoleur's' means cannot therefore be defined in terms of a project (which would presuppose besides, that, as in the case of the engineer, there were, at least in theory, as many sets of tools and materials or 'instrument sets', as there are different kinds of projects). It is to be defined only by its potential use or, putting this another way and in the language of the 'bricoleur' himself, because elements are collected or retained on the principle that 'they may always come in handy'. (Levi-Strauss, 1968, 17-8)

[13]"It might be said that the engineer questions the universe, while the 'bricoleur' addresses himself to the collection of oddments left over from human endeavors, that is, only a subset of culture." (Levi-Strauss, 1968, 19)

then to develop a design approach, manifest in form, massing, tectonic, and program, based upon these now valued assets. This architect then continues this process until all such foundational needs are met, at which point materials of lesser value - both in terms of the stash and wider community - are deployed to the greatest extent possible, so that more universally valued materials and components might remain in the stash for future projects (Strauss, 1968).[14] This shifts the influence of the design from larger-scale concerns to smaller, more subtle concerns that are able to elevate the utility and expression of the stash. Details, although required to be formed from common, readily-available tools so as to allow for propagation, thus become the focus of the design exercise. This tact, aside from supporting the obvious financial need for modesty, encourages an environmentally-sound approach to designing wherein the most complex and sizable materials are reclaimed and only the more minor components are modified, new or purchased.

One final component of the stash bears mention due to its unique influence upon the design. Often, when accumulating the stash, the bricolleur, or the bricolleur's partners in the case of many works within extra-legal settlements, will not only highly value components offering immediate and obvious value (structure and durability), but also to materials of unique, utilitarian character. Components offering industrially-produced simple machines – pulleys, levers, bearings, and other simple machines - are a clear example, as they allow future work to potentially align with fundamentals of physics without needing to creating complex items. Thus it is often the case that the stash of materials will include quite a few of these simple, industrially-produced machines. Although these idiosyncratic elements will often require a great deal of evolution in order to be of value to the project, they remain of unquestioned value, and thus bear a significant imprint upon the design approach.

To execute the work in South Africa within the given confines of the project - $1500, 11 people, 10 days – required that the team regard the materials already gathered to support the project as a finite set and function as bricolleur-designers. As such, the team's first act in the city was to learn everything they were able to about these materials. Every scrap was photographed, dimensioned and modeled in both Revit and Rhino. The team then tested this inventory of parts and brought this information to bear upon the knowns of the project itself: the dimensions and orientation of the site, the required turning radius for trucks delivering containers for future developments, and the absolute minimum acceptable parameters for the programmed spaces. The fact that the work had to be realized using only the given stash of materials – a stash that only contained so many items of any value to structural cladding concerns - greatly limited the set of potential formal approaches to the project, resulting in the relatively quick resolution of the overall massing of the work and allowing the visiting team to focus greater energies upon detailing the work in a manner that would maximize the value and effectiveness of the assembled parts. It was here that the group turned to precedents provided by architects operating in more formal settings. For example, the joinery of Thorncrown Chapel provided the team an approach to design that permitted them to use shorter purlins for the roof and the pivoting details of Tom Kundig, a method to allow a small footprint to support larger crowds and constructions. It is important to note that this last set of details, which required massive elements of the architecture to slide or pivot, were only possible because the local partners in the work had gathered axles from drivetrains and other unique elements, "just in case."

[14]"The elements which the 'bricoleur' collects and uses are 'pre-constrained' like the constitutive units of myth, the possible combinations of which are restricted … the decision as to what to put in each place also depends on the possibility of putting a different element there instead, so that each choice which is made will involve a complete reorganization of the structure." (Strauss, 1968, 19)

Figure 3. Constructing the mechanism for the rotating walls using scavenged bearings (Shall 2019).

2.3. Movement Three: Emphasizing the Generation of Social Capital

As earlier indicated, the architecture of extra-legal settlements, crafted in a context of scarce resources, with scavenged materials, common tools and simple techniques, naturally privileges social capital over economic capital or symbolic capital. Thus, to thrive here, the built environment must not rely upon economic capital for sustenance or growth. After all, these are settlements whose entire identity is founded upon a lack of economic resources and whose disadvantaged position is reinforced at key moments through clearing and other legitimate acts of physical force. This state of affairs somewhat distances the concerns of those residing within the extra-legal settlement from the cultural norms of the inverse cityscape, a value structure that directly led to their position of subservience, which, in turn, causes those residing therein to view these values with skepticism or outright disdain (Stevens, 1998).[15] Not surprisingly, this perspective can also cause residents to view engineers and architects, professionals who support the aforementioned cityscape through the creation of cultural capital, with a similar degree of negativity.

Instead, the residents of extra-legal settlements prioritize social capital, because it aligns more directly with the chief assets held by the residents and their built environment: namely, scale and replicability (Thieme and Kovacs, 2015).[16] That is, although the residents of extra-legal settlements have limited economic means, very little access to legitimate physical means, and only passing interest in symbolic structures, they have numbers – quickly growing numbers – and a unifying cause defined by their need to survive within a context stacked against them (UN-Habitat, 2012).[17] It is, thus, through social capital that the residents of extra-legal settlements might leverage their quickly growing numbers to overcome their lack of other resources to help ensure the survival of the settlements themselves, which are often too large for cities to easily eradicate, and improve living conditions.

The architecture can support this shift in several ways. First, the design can be articulated in a manner that leverages the fact that the built work is based upon simple construction techniques and common tools in order to expand the body of contributors. As earlier stated, the built environment of the extra-legal settlement is not the product of unique or exclusive means – a situation that would inherently limit the contributors to a very small set of professionals and force

[15] "For Bourdieu, power is the capacity to impose a specific definition of reality that is disadvantageous to others. The most obvious sort of power is physical force, but only a few groups use physical force. It is inefficient, and most societies grant the monopoly on the use of legitimate physical violence to the state. A second type of power is economic. The importance of this is obvious. Marxian theory holds that economic power is the only sort of power, and that all groups can be placed in some sort of social hierarchy, their places contingent on the amount of economic capital they control. One of of Bourdieu's major contributions to modern sociological theory has been to extend Max Weber's sociologizing and decisively demonstrate that this is not so, that there is a third, more potent and pervasive form of power – the symbolic. Symbolic power involves the wielding of symbols and concepts, ideas and beliefs, to achieve ends. "At the highest level, that of society as a whole, we call the field in which symbolic power operates 'culture'. It is Bourdieu's contention that the logic of the cultural field is such that is operates to create, legitimate and reproduce the class structure, a system of inequality." (Stevens, 1998, 59)

[16] "...what ties the rural and urban slum experience in relation to the nexus are the prevalence of social networks and social capital as the dominant albeit informal platform for self-organizing and provisioning that determine how things get done." (Thieme & Kovacs, 2015, 11)

[17] "Physical upgrading of slums with street networks and improved access to municipal basic services through augmentation of physical infrastructure has proven to make formidable positive social and economic changes in many cities. Socially, upgraded slums improve the physical living conditions, improve the general well-being of communities, strengthen local social and cultural capital networks, the livelihood generation opportunities, quality of life, and access to services and opportunities in towns and cities." (UN-Habitat, 2012, emphasis mine)

the community into a position of passively accepting (or rejecting) the offered solution. Instead, it is the potential product of the many hands, which not only allows the work to be executed more quickly and with less individual effort, but increases the community's vestment in the work and thereby generates greater connection between the individual members of the settlement. Collaborative construction generates social capital. And, provided that the means and materials remain accessible, the generation of social capital can continue for as long as the community seeks to expand or develop, potentially allowing the architecture's "liberating intention" to align with "the real practice of people in the exercise of their freedom" (Foucault, 2002).

Although the first year's work in South Africa relied more heavily upon the energies of the external team than will be the case in future years, as the project generates more social capital, there exist several examples of how the schools, clinics and other projects that come from this initial effort might be able to borrow from this work to generate greater participation, and social vestment. The first example was accidentally uncovered and is the result of the team not questioning the internal body of experts appropriately. Specifically, to dig the trenches for the foundation, the local body of contributors had used their extensive connections to the community to arrange for a backhoe. Unfortunately, the backhoe did not arrive the first day we had intended to excavate, as promised. Nor the second. Finally, on the third day, the team elected to dig the foundations by hand. The backhoe arrived the next day. Although the foundation remains a likely rare moment mandating some degree of external support (i.e. the concrete truck), this situation served to underscore an important point: namely, how important it is to replace rare, complex or expensive tools with simple tools and people whenever possible, in order to create a self-sufficient process and maximize the opportunities for the engagement of many. The second instance of the offered work supporting the generation of social capital is the fact that the most complex joinery and rarest components are reserved for operable walls – elements specifically designed to permit the inclusion of greater crowds in the work. Although this may, if replicated, become an instance of the architecture demanding unique tools or more skilled construction personnel (instances the design worked hard to minimize), this cost was deemed as a smart investment, as it will encourage greater participation, thus becoming an instance of the demands of social capital usurping the limits of the physical.

2.4. Movement Four: Building Toward Viral Propagation

The final movement is a culmination of the first three and is perhaps, the most essential attribute required of the architecture to ensure long-term sustainability. Within this community – a settlement that is propagating more quickly than formal structures can even map, let alone impact - the offered architecture must encourage its own propagation using the networks of exchange that already exist. Specifically, the residents surrounding the work must want to continually understand, borrow, and evolve the design approaches unearthed through the process of generating it. To accomplish this, the architect of extra-legal settlements must marry the three attributes earlier described – dialogical processes, accessible means and participatory construction – with two more attributes.

First, the architecture must be designed in a manner that allows for its simple dissemination to a wide audience using existing information exchange networks. This requires that architect break down the essential insights uncovered through design and construction process into memes: easily exchanged units of information able to flow through existing networks of information exchange within the community, through which residents learn key survival techniques, including how to

hijack electricity, find clean water or avoid the unwanted attention of the authorities. Properly articulation, this not only allows for easy transmissions, but permits the work to disseminate key points without using top-down project dissemination, which are both too slow to keep pace with the rapid growth of these settlements and assume a paternalistic hierarchy of knowledge transference. Through the meme, the architect's work moves from the creation of objects to the creation of objects of knowledge – material constructs that collect the wisdom of many and propagate virally (Shall, 2013).

Second, the architecture must allow for this now-expanded body of contributors to independently offer their ideas and simultaneously explore alternatives – a process that occurs quite often in the world of business. To illustrate, at the birth of a new technology (the automobile, the television, the Internet) there is often a rapid expansion in the number of businesses that grow around the promise of these technologies. Far more businesses than can succeed fight for supremacy, each attempting to offer the best product to the consumer. Over time, the consumer, through their acquisition of the offered product, judges some ideas to be better than others. As businesses respond to these trends, a Darwinian shift in investment emerges, until a much smaller set of products have each found a niche within the market (Surowiecki, 2005). Within the extra-legal settlement, this evolution would occur through the adoption of techniques and tectonics. Approaches that work well – joints that are simply executed, inexpensive materials that are easily acquired, or efficient construction approaches – would be quickly adopted, while ideas less efficacious would be ignored. Over time, this process would hone the design approach to such a degree that the new work, which would be generated entirely by the community, would far out-perform the offered architectural approach that instigated the entire process, created an effective architectural response hardwired to the conditions of the community (Shall, 2019).

Returning to the work in South Africa, although the illustrations for this fourth point will become clearer over time, there are already several indications that the propagation of the original work is already taking place. First, the interest created by the first installation has already resulted in the local partners receiving offers of new sites for development, new materials for construction and new sources of financial support. Second, the details from this first installation have already begun to appear in other plans and installations. This despite the fact that the installations in years two and three of the project will feature simpler means and more common materials. For example, the glue-lam beams created by the visiting team from reclaimed wood, despite being an effective use of scavenged materials, will likely be replaced in future projects in favor of simpler techniques that are more easily understood and evolved. Third, and perhaps most importantly, the number of potential collaborators in Port Elizabeth, and South Africa, has greatly increased due to the efforts of local partners and the successes realized by the first work. This will allow subsequent visiting teams to be matched with an equal number of experts from the community itself. More importantly, as the work continues to advance, the number of local collaborators will as well, until local residents are the primary support for the advancement of the work and the presence of a visiting team is no longer required. Instead of increased dependency, the architecture generates a healthy, self-sustaining structure of support – the type of structure that is required if the work of architects intend to increase access to food, water, medicine or education within extra-legal communities.

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PAPER #8.12

THE ISSUE WITH INCLUSIVITY: THE PROMOTION OF EQUALITY AND DIVERSITY WITHIN ARCHITECTURAL EDUCATION

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ABSTRACT

How can architectural education become more inclusive to facilitate the development of equality and diversity within the architecture profession and the built environment?
The Equalities Act came into force within the UK in 2010 and is designed to legally protect people from discrimination in the workplace and in wider society. There are 9 protected characteristics identified within the act which are: age, disability, gender reassignment, race, religion/ belief, sex, sexual orientation, marriage and civil partnership, pregnancy and maternity. This paper investigates inequalities in relation to these characteristics and how they manifest themselves within architectural education, the practice of architecture and the built environment.
I argue that the current lack of equality and diversity within the profession and within the practice of architecture is directly linked to the lack of inclusivity within architectural education and that if inclusivity is promoted within the education process it will improve equality and diversity in architecture as a whole.
This paper describes an Action Research Project which was undertaken as a result of identifying that within architectural education what we teach, how we teach and who we teach needs to be more inclusive. It discusses the what: curriculum, the how: teaching methods and the who: the students and hypothesizes that these three areas currently do not support the diversity of the future generation of architects or wider society.
Through a mixed methods approach, this study explored the attitudes and experiences of architecture students at both undergraduate and post graduate level from one School of Architecture. Participants took part in a questionnaire, interactive on line discussion board, participatory workshop and focus group where they explored issues around inclusivity, equality and diversity.
The findings demonstrate there is a desire to engage in issues of inclusivity, diversity and equality within the wider architectural curriculum and suggests a variety of strategies to support a more inclusive approach to architectural education.

KEYWORDS

Architecture; inclusive design; equality; diversity

INTRODUCTION

Within the Royal Institute of British Architects, RIBA, Strategic Plan 2016-2020, which outlines the focus and priorities for the RIBA, it states

> Our Purpose: To serve member and society in order to deliver better buildings and places, stronger communities and a sustainable environment.
> Our Values: Being inclusive, ethical, environmentally aware and collaborative underpin these strategic objectives and all we do. (RIBA, Advancing Architecture, Strategic Plan 2016-2020 2016)

It further states within its strategy 1.2 that to achieve this it will:

> Attract and retain the best and most diverse talent:
> Engage school-age students to inspire an interest in architecture
> Work with schools of architecture and practices to engage the next generation of architects in the future of the profession
> Support our members and Chartered Practices in overcoming the barriers to an inclusive profession. (RIBA, Advancing Architecture, Strategic Plan 2016-2020 2016)

And yet in 2019 the RIBA Graduate Attributes for Part 1 and Part 2 do not mention inclusivity or inclusive design and within the curricula published on line for all the Schools of Architecture in Scotland, there is no mention of inclusivity or inclusive design. Furthermore, it is recognized that there is a lack of diversity within the teaching staff within Schools of Architecture across the UK as highlighted in academic data from 2014-2015 where 70% of faculty staff were male and yet 45.4% of students were female. (Morrow 2016)
As Weisman reflects in her article 'Diversity by Design: Feminist Reflections on the Future of Architectural Education and Practice'

> How can an architectural education that continues to define professional expertise in relation to the history of white, heterosexual, Euro-American male consciousness prepare students to function as effective professionals in pluralistic communities? How will students be sensitized to "difference" when they are encouraged to suppress their own gender, race, and class identities in the process of becoming "professional"? (Brown 2016, 1)

The following areas for improvement have been identified:

- Increased opportunities for students to engage with issues of diversity and equality within the curriculum
- More challenges to design inclusively within the studio environment especially with regards to the diversity of the end users
- Development of teaching methods to support diverse learning methods which take into account the varying needs of the student cohort

If we agree that equality and diversity should be part of architectural education, the question remains how can schools of architecture become more inclusive and will this facilitate the promotion of equality and diversity within architecture as a whole?

1. CONTEXT

The problems of diversity and equality within the architecture profession are well documented by amongst others Despina Stratigakos in 'Where Are the Women Architect's' (Stratisgakos 2016) and Dr Harriet Harris et al, in 'The Gendered Profession – the Question of Representation in Space Making' (Morrow 2016). Equally The annual 'Women in Architecture' survey in the UK shows that issues of equality within the profession are getting worse with the gender pay gap widening at top level practices, 1 in 7 women architects experiencing sexual harassment and 9 out of 10 women stating that children hinder their careers. (ArchitectsJournal 2018)
If you then consider this discrimination along with other protected characteristics identified within the Equalities Act of 2010, it is concerning how exclusive architecture as a profession still is and the question remains why this is not being tackled within the education process. There is however far less documentation on the inequalities within the architectural education process and more specifically the curriculum and the ways of teaching architecture.
Morrow highlights this in her essay 'Architectural assumption and environmental discrimination: The case for more inclusive design in schools of Architecture' (Nicol 2000, 43-48) which draws on the DraWare

research project at the School of Architecture, University College Dublin, and suggests ways of making the curricula more inclusive.
It seems imperative that architectural education should be teaching inclusive design as a way to foster inclusion within the built environment as a whole. However, as Larkin highlights

> Despite this global shift in attitudes and policy in recent years, it is yet to transfer to a major shift in the education program of architects and designers. (Larkin 2016, 19)

This is further highlighted by the lack of inclusivity discussed within the RIBA Part 1 and Part 2 Graduate attributes (RIBA, Validations Criteria - Royal Institute of British Architects 2014) and within the curricula of many Schools of Architecture.
It can be argued that until the emphasis shifts within Schools from the desire to create intellectual and aesthetically pleasing architecture but to also include architecture that is fit for purpose and inclusive for all then we will not be able to tackle the inequalities that currently exist within the profession. Morrow agrees by stating

> Preoccupation with the new, the exotic, and the need to perform what Frampton (1991) calls 'acrobatic feats', are prevalent in the design studio and exist at the cost of everyday issues. (Nicol 2000, 47)

A simple approach to develop a more inclusive architecture within education would be to include within design briefs the need for their outputs to be inclusively designed. This often implicit but never explicit requirement would further strengthen the need for consideration and empathy for the diversity of the end users.
I identify Inclusive Design as the design of places and spaces that support the dignified access to and use for all as identified within the Equalities Act of 2010.

This definition builds on the description of inclusive design set out by CABE (the Commission for Architecture and the Built Environment) which states

> Inclusive design is about making places everyone can use. Inclusive Design aims to remove the barriers that create undue effort and separation. It enables everyone to participate equally, confidently and independently in everyday activities. (CABE 2006)

The question remains, if we encourage students to design with equality and diversity in mind, through the requirement to design inclusively within studio briefs, will this improve levels of inclusivity within the built environment in the future? Surely it's worth trying.
If we then also consider the traditional architectural modes of teaching centred on the master and student relationship to be in need of review to allow for a more inclusive learning environment, what could a new teaching model look like?
The 6 principles for a feminist pedagogy in the teaching of research methods set out by Webb et al (2004), are:

- Reformulating the professor – student relationship (from hierarchy to equality and sharing)
- Ensuring empowerment (for a participatory democracy)
- Building community (through collaborative learning)
- Privileging the individual voice (not only the lecturer's)
- Respecting diversity of personal experience (rooted for example in gender, race, ethnicity, class, sexual preference)
- Challenging traditional views (eg. The sociology of knowledge) (Cohen 2007)

These 6 principles provide a basis for an inclusive style of teaching that responds

to the increasing diversity of our student cohort. I experimented with these principles within the framework of the Action Research Project and analysed and reflected on the success of this different approach. Also by choosing an Action Research Project, it has allowed further feminist research approaches to be undertaken, namely giving power to the participants, through the use of an engagement tool and by conducting long 'interviews' through the workshops and focus groups to allow all voices to be heard. (Cohen 2007)

2. DESCRIPTION AND OUTLINE OF RESEARCH

The structure of the Action Research Project was developed to provide a broad range of data that focused on equality and diversity within architecture but also tested different teaching modes and as such a variety of methods were used. These are outlined in time order as:

- Briefing session
- On line anonymous questionnaire
- On line interactive discussion board – padlet page (anonymous uploads)
- Workshop 1 – 4 first year students
- Workshop 2 – 3 fourth year students and 4 fifth year students
- Focus group/ De Briefing session

3. PARTICIPANTS

Architecture students at both Undergraduate and Postgraduate level were invited to take part. Of the twelve participants who consented to take part and completed the on line questionnaire, 5 identified as male and 7 identified as female. 8 out of 12 self-identified as a protected character as defined by the Equalities Act of 2010 and 4 of these identified in more than one category. The almost equal number of male and females taking part in the study shows that it is not a gendered subject of interest but the high proportion of participants that identified as being part of a protected group I believe shows that first-hand experience plays a part in the interest of inclusivity, equality and diversity.

4. DATA COLLECTION

On-line Questionnaire

The on-line questionnaire which was completed by all 12 participants was designed to give a better understanding of the current knowledge, interest and experience of the students with regards to designing with equality and diversity in mind, inclusive design and inclusive teaching.

Questionnaire: Analysis and Findings

> "I think the most important skill as an inclusive designer, is the ability of reaching out, listening and understanding the needs of different user groups. Sure there are design legislations to aid in particular mobility impaired users but the field of inclusive design expands to other user groups as well. No one and no design device can be taken for granted. At no point in my time in education here I have been taught about the subject." (Questionnaire 2019)

Through analysis of the questionnaire it became clear that all had a sound understanding of what the definition of inclusive design was although it became apparent that the participants from the post graduate level had not worked on any projects that focused on inclusive design. This was different for the first year students who had been exposed to designing for people with disabilities in their very first project. As such the majority of students had developed their knowledge through either the staff run 'Missing in Architecture' lecture series titled 'Peripheral Visions' which invited guests

to talk about subjects on the periphery of architecture or through personal projects and peer discussions. In turn this resulted in the majority of participants (7 out of 12) feeling unconfident about being inclusive designers.

When considering the skills needed to be an inclusive designer there was a recognition that empathy, compassion and understanding were required although it was questioned whether this could be taught or whether this was inherent.

It was felt by the majority of the participants that inclusive design skills were either not taught at all, or could be taught better within the school (7 out of 12). The participants who felt these skills were taught well within studio were all in first year. I believe that this directly relates to the briefs set within first year where there was an emphasis on compassion, client and difference. It is understandable that through the explicit nature of the studio briefs these skills were seen to be developing and were able to be taught. This in turn support the assumption that through teaching inclusive design at University, it will promote inclusive design within the profession in the future.

With regards to the inclusivity of teaching the results were mixed, with some students feeling there was diversity of teaching staff and methods whilst others felt there was a lack of diversity. This I believe can be attributed to their personal experience and the stage of their educational journey.

When asked which areas of the built environment discriminate there were a wide variety of responses which centred around education, the built environment, construction industry and practice.

It became clear that the undergraduate and post graduate participants had very different experiences and feelings about the way they were being taught about inclusive design and how inclusive their educational experience had been to date.

Padlet Page: On line interactive discussion board

On completion of the questionnaire, participants were invited to populate the interactive discussion board with information relating to the research topic of inclusive design and equality and diversity within architecture and architectural education. The padlet page was set up to provide a safe place to raise potentially sensitive topics but also as an on-line resource. The intention was to identify an understanding of the current interest and knowledge of the research group and to create an interactive research tool which tested different ways of teaching and peer learning. It was also a useful test to identify whether this on line resource could be used within the curriculum.

Padlet Page: Analysis and Findings

The padlet page was a success and has continued to be used by the participants after the workshops were complete. There developed a sense of community for the members of the page and led to further discussions out with the study.

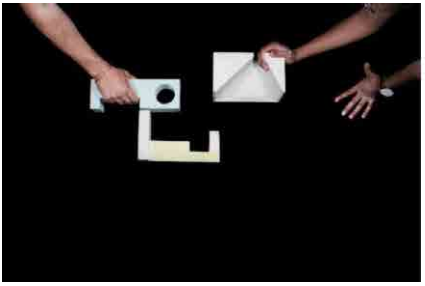
The information uploaded on the padlet page and the finding from the on-line survey were collated and through using thematic analysis a series of themes were identified for discussion within the workshops.

The themes identified for discussion were as follows:

- Gender
- Race/ Ethnicity
- Disability and the ageing population
- Mental Health
- Elitism

Within the participatory workshops a model was used as an engagement tool where participants were

asked to collaboratively explore the five themes identified through a physical artefact. The intention was that the model would act as a tangible teaching tool to create a collaborative response and as a participatory tool acting as a discussion starter. This design artefact was designed to draw out tacit knowledge on the themes identified and the participants' relationship with the built environment.



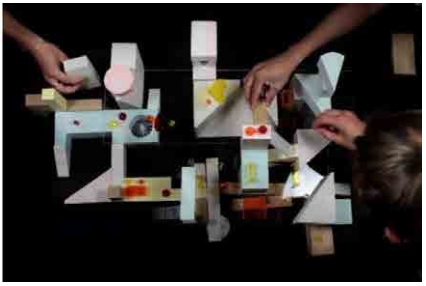


Figure 1, 2. Responses on Perceived Effectiveness of Green Infrastructure. Source: (Author 2020)Figure 1 + 2: Engagement Tool: The Institute of the Everyday. Source: (Missing in Architecture)

The engagement tool was a model called 'The Institute of the Everyday' and was designed as a collaborative piece where I worked with students to create an interactive model which investigated the inequalities that exist within society and how they manifest themselves within the built environment. This was done as part of a collective for which I am a co-founder called 'Missing in Architecture' and the model has been part of a series of exhibitions throughout Scotland.

5. WORKSHOP 1

The first workshop consisted of 4 first year students. From the outset the participants were keen to use the engagement tool and were happy to work together to develop collaborative responses to the themes identified. The discussions that developed around each model were mainly focused on the built environment and the profession with less emphasis on architectural education. This can be seen to be as a result of their limited exposure to the architectural curriculum to date.

Through the use of colour and the different shapes and materials of the blocks, the participants were quickly able to construct a narrative which identified the issues of gender that exist within the architectural profession. With regards to the identification of gendered spaces the discussion extended to the public realm and feelings of security.

On the second theme of disability and the ageing population, again the participants worked well to develop a collaborative response to the theme. As the discussion developed themes around mental health were also discussed. The physical representation focused on the lack of dignity and the thresholds within the built environment that supported able bodied individuals. The participants were comfortable to talk about the three topics and drew on personal experience and tacit knowledge to develop their response.

When asked to consider race and ethnicity within architecture and the built environment,

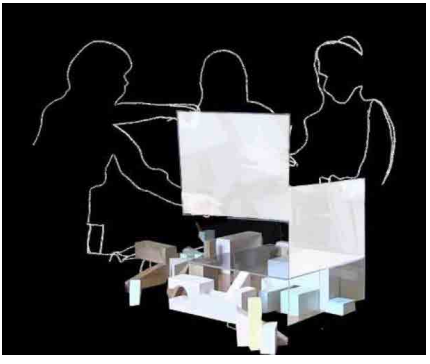


Figure 3. Workshop 1: responding to issues of gender. Source: (Isabel Deakin)

there was a hesitancy to engage with the topic although half the group identified as BAME. There was a general feeling that the built environment was not discriminatory and although the profession was predominately white, it was not a subject that the participants felt they had knowledge of to be able to discuss it in detail.

6. WORKSHOP 2

The second workshop consisted of 7 participants, three fourth year students and four fifth year students. Unlike the first workshop there was a hesitancy to engage with the model and the participants were less willing to work together on a single piece and found it easier to discuss the themes in a wider sense without the need to construct a narrative or use the engagement tool to explain their views.

The discussion showed a depth of knowledge on the subject of inclusivity, equality and diversity within architecture as a whole but focused mainly on architectural education. There was a sense of frustration at the lack of support within current educational systems to allow the participants to further their knowledge and be supported in their interests around these themes.

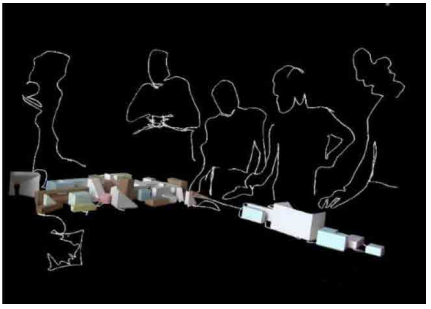


Figure 4. Workshop 1: responding to issues of gender. Source: (Isabel Deakin)

The discussions that developed around the theme of gender were similar to the first workshop and the model that was constructed had used a similar narrative to establish the form although this was not done collaboratively. The discussion focused more on equality within the profession and work/life balance with issues of exploitation within practice being highlighted.

When discussing disability and the ageing population the group recognized the awareness that disability extended beyond the physical. There was a hesitancy to establish how architecture could positively support other non-physical disabilities and a general agreement that this was an area which was not discussed within their architectural education.

The theme of race and ethnicity was an area that these participants felt strongly about. They related this to the lack of diversity and transparency of their education to date. There was a desire that the architectural education as a whole should be de-colonialised and that this should be done throughout the curriculum encompassing history and theory and studio practice. There was also a feeling that without a more diverse body of staff with different specialist areas the participants' interests and specialisms could not be supported.

The engagement tool was successful as a teaching tool and a discussion starter. By allowing the participants to build something it facilitated the discussion and in some cases the building blocks were used as safety blankets, and were hugged when discussing sensitive topics. The different interactions due to the size of the group showed that this type of teaching method is best used with smaller groups who can work closely together but is a valuable tool to allow a variety of voices to be heard.

7. REFLECTIONS

On completion of the workshops, both discussions were transcribed. Thematic analysis was then undertaken with areas of interest identified for further discussion at the focus group.

The focus group consisted of 7 participants with a mixture of participants from each of the workshops. Through the use of post-it notes we discussed ways to develop the curriculum to support a more inclusive architectural education. This was designed as a way to create a positive conclusion to the volunteers' participation within this Action Research Project. It was also designed as an informal discussion where prompts from the workshop were used to facilitate conversation and post-it notes were issued to allow for comments to be made even if the participants were not comfortable discussing them.

The participants were all very vocal and happy to discuss and question one another and there was no hierarchy within the group although they were from opposing ends of the education system. This correlates with the feminist principles which formed the basis of the structure for the project. The participants suggestions for the curriculum and conclusions from the workshop were analysed and the recommendations draw on these discussions.

The design of the Action Research Project itself was also testing a diverse range of teaching methods that supported a feminist approach to pedagogy. The success of this can be seen from the engagement of the participants. Many of these teaching approaches have now been tested further within the wider teaching practice within the school.

My recommendations centre on development within the studio environment and are as follows:

- Diversification of the reading lists, precedents used by staff and approaches to architecture and design especially when developing studio briefs
- Amend curriculums to support inclusive design and to include client's needs in the aims of the course
- Diversify the teaching styles to support a diverse cohort
- Development of peer support groups and mentoring schemes to support exchange of knowledge from a diverse cohort
- Develop inclusive design principles that should be embedded in each studio brief to support designing inclusively within the studio

Although this Action Research Project was based in one school these suggestions extend to the wider architectural curriculum across many Schools of Architecture.

CONCLUSION

The conclusions and recommendations were developed through collaboration with the participants of the project and through creating a supportive environment and through using diverse teaching methods it allowed for a sense of empowerment amongst the participants and individual voices to be heard whilst always respecting the diversity of personal experience. (Cohen 2007)

Steps are being made through the current diversification of the studio briefs within the undergraduate and postgraduate course at the Glasgow School of Art and the development of the wider curriculum across the Mackintosh School of Architecture. This can be tackled at a micro level within individual studio briefs, reading lists and inclusive teaching practices of individual tutors as suggested in my recommendations but also should be developed at an institutional level and a policy making level.

The next generation of architects should be challenged to design holistically with the highest regards given to the inclusive nature of the built environment and the diversity of the end users. They should be given the tools and the opportunity to do this and for this to be taught through more inclusive teaching methods which allow the students individual specialisms to be nurtured and supported.

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PAPER #8.13

DESIGN GUIDELINES FOR COMMUNITY SPACES IN HOUSING

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ABSTRACT

What should architecture be like to meet people's needs and create and strengthen communities? This is the question we are trying to answer in this paper.
To do this, we need, first, to be able to name what the needs of the human being are, and Manfred Max Neef helped us to do so. According to this renowned economist, peoples' fundamental needs are the following: subsistence, protection, affection, understanding, participation, leisure, creation, identity, and freedom.
None of these needs can be satisfied in isolation, showing that human beings are intrinsically interdependent, that is why we are fated to live in community. This idea is central for feminist economy, that is why we also integrate this vision in our work, particularly, the contribution of Amaya Pérez Orozco, who collects, in turn, the idea of a good life or good living (sumak kawsay, a Quichua term that has become a central concept of a political debate around the commons and our relationship with nature).
Likewise, we have also been inspired by collaborative housing (co-housing) that, on many occasions, have been designed to meet the needs of the community, experimenting extensively with shared spaces.
With all this, we have developed a proposal that identifies the aspects to be considered in the design of housing to meet human needs and place the community in the center.

KEYWORDS

Housing; architecture; design; guidelines; care; community space; multifunction; mix of uses.

INTRODUCTION

Housing and community on a human scale

Our main objective is to promote an architecture that meets human needs and facilitates people to enjoy a good life, with a special emphasis on the importance of the community in this matter.
We take Amaya Pérez Orozco's definition of good living or good life:

> It must be a notion that responds to the basic conditions of existence of vulnerability, interdependence, and eco-dependence; Have a multidimensional understanding of well-being and understands that this is an incarnate experience, but always lived collectively (Perez Orozco 2014, 229). (own translation)

Architecture must face the challenge of what should be like to build for a good life, providing solutions and addressing the issue from an architectural point of view.
We take the community as a starting point to address the issue of human needs because the community is where these needs are to be met. Therefore, we are so interested in shared spaces: they are essential if we are to question the classic division of productive/reproductive work and the current isolation of the homes.
We are particularly interested in common and intermediate spaces since they are places that are shared and from which we could expect much more. In our environment, these spaces are generally small, untapped, and devalued. However, they can play a particularly important role both in responding to individual needs (collectively managed) and

in providing meeting places where personal bonds between neighbors are to be created.
We are not so interested in attention or conciliation or in the division of labor as productive and reproductive. We prefer to ponder over the vulnerability of life, its precariousness, the human interdependence, and the conditions needed for a good life. All human beings are vulnerable and interdependent, and we must be taken care of throughout our lives, sometimes more than others. As Pérez Orozco says:

> (...) directly associated with feminism, we think that life must be thought of from its vulnerability and interdependence, dismantling the false, harmful, and masculinized chimera of self-reliance as an existential objective and its hidden mirror of immolated and feminized dependency. For us this objective is fundamental: taking out responsibilities from households, putting them in the common and the visible, dissociating the task of sustaining the life away from femininity, ending the sexual division of work and, ultimately, building how this is going to be done in terms of collective and democratic responsibility (Perez Orozco 2014, 226).

The fundamental needs

There is no doubt that it will not be easy to land when jumping from a notion as wide as good living. That is why we use the work of Manfred Max Neef to make specific proposals. Max Neef was a Chilean economist, political scientist, and environmentalist of international reputation. One of his main contributions is in his book Desarrollo a Escala Humana (1986), where he proposes a matrix in which he identifies the nine fundamental human needs. The main postulate of the proposal offered in this book is the following:

> The life quality of people will depend on the possibilities that people must adequately satisfy their fundamental human needs (Max Neef 1986, 16).

Max Neef identifies the following needs: subsistence, protection, affection, understanding, participation, leisure, creation, identity, and freedom. Nine may seem few when we tend to think that human needs are endless. This is, according to the author, because we assume incorrect assumptions:

> It has been believed, traditionally, that human needs tend to be infinite; that they are constantly changing; that vary from one culture to another, and that they are different in each historical period. We believe that such assumptions are incorrect since they are the product of a conceptual error. The typical mistake that is made in the literature and analysis about human needs is that the fundamental difference between what is really needed and what is satisfying of those needs is not explained. It is essential to make a distinction between both concepts (...) for both epistemological and methodological reasons (Max Neef 1986, 41).

To clearly understand what fundamental human needs are, Max Neef differentiates between needs and satisfiers. This can be easily understood with two simple examples: if subsistence is a necessity, food is a satisfier; If affection is a necessity, friendship is a satisfier. Max Neef formulates these two postulates like this:

> First: The fundamental human needs are finite, few and classifiable. Second: The fundamental human needs (such as those contained in the proposed system) are the same in all cultures and in all historical periods. What changes, through time and cultures, is the way or means used to meet the needs (Max Neef 1986, 42).

Now, the author adds:

> (...) there is no biunivocal correspondence between needs and satisfiers. A satisfier can contribute simultaneously to the satisfaction of different needs or, conversely, a need may require different satisfiers to be met. These relationships are not even fixed. They can vary according to time, place, and circumstances (Max Neef 1986, 42).

The author assumes universal character of these needs because, although we lack empirical evidence to prove it (as he acknowledges), "nothing prevents us from talking about its social-universal character, as needs whose realization is desirable to anyone, and whose inhibition, also for anyone, must be undesirable "(Max Neef 1986, 53).
Max Neef does not talk about good living; however, we think that his approach is close to this concept because he has an integrative approach to the fundamental needs, and he is concerned about what he calls the quality of life. We have opted for this author when developing our methodology because he offers a tool, a matrix, that can be very useful for an architectural intervention for it takes human needs from a broad point of view (beyond material needs and including subjective ones).
Our work has been, precisely, to apply this matrix to the built space to make specific proposals for the construction or modification of spaces to create the basic conditions of good living.

The satisfiers

Satisfiers vary depending on the context, that is, human beings have found different solutions for the same need. However, the approach or perspective with which that solution is given may not be positive. Thus, Max Neef describes a series of negative satisfiers that prevent in the long run from satisfying the need for which they were created because they generate a false sense of satisfaction, or because they make difficult or do not favour the satisfaction of other needs. An example of a negative satisfier would be armaments to meet the need for protection. In architecture, gated communities are an example of this, houses that are isolated from their environment and that prevent the free movement of its inhabitants. Or zoning in urban planning, separating or segregating uses (normally associated with production), to the detriment of security or conciliation.
The positive satisfiers are what Max Neef calls synergetic, and they are "those who, by meeting a particular need, stimulate and contribute to the simultaneous satisfaction of other needs" (Max Neef 1993, 64-65). An example would be food (preparation, consumption, distribution, commensality, etc.), which satisfies more needs than feeding, for example, being a way of establishing bonds with other people, identity, or affection. An example from the architecture would be the squares, synergetic places par excellence, since they carry out many activities and respond to various needs: it is a place for meeting, play, market, community activities, festivals, etc.

Synergetic spaces

This perspective of synergistic satisfiers helps us think about spaces that fulfil more than one function. This is especially relevant if we think of intermediate spaces - those places that, for example, connect spaces that have an assigned function. Between the street and the house there are spaces that are only thought of as passages (and because they have no major interest, the tendency is to reduce them as much as possible). Let us think about making these spaces visible and giving them, identity and we will see that they may serve many more functions, for example, to foster interaction between the neighbourhood and the community.
This will also make us think of a more permeable relationship between the private and public spheres. The houses and the

people living in them shall not be isolated from their community; we should have to be looking for reducing unwanted isolation that is so frequent in our cities.
It is also about promoting non-hierarchical or multifunctional spaces, places in which life happens, with its complexity, uncertainty, and disorder.
We can imagine neighbourhoods that integrate the communal with mixed programs where the houses are supplemented with working spaces (thus responding to the needs of subsistence and creation), health services (to respond to those of subsistence and protection), educational and participatory cultural services (for understanding, leisure, participation, and identity). Environments that integrate several generations (responding to the needs of protection, affection, understanding, participation, and identity), different beliefs (identity, freedom), that allow and invite people to participate, to express themselves (creation, freedom). Environments in which the community is organized to collectivize care (affection, participation, identity).
In the collaborative housing movement, the ideas of integration of productive and reproductive activities, and the collectivization of care are well established, so that intermediate spaces, meeting places and multifunctional spaces become particularly important. It would be interesting to be able to spread these practices of collaborative housing to other environments with no need to build from scratch but to introduce them into existing spaces.
It is also important to make visible, recover and strengthen the practices that are still carried out spontaneously in certain environments that generate suitable spaces for meeting, exchanging, creating bonds, and favouring the creation of a sense of community.
We are aware that the built space is only one of the necessary ingredients to have a healthy community, but also that it can be a serious obstacle. Community life mainly needs people. Therefore, we want to think of the architecture for the creation of community as an architecture that creates environments that invite people to occupy them, as a kind of gardening for butterflies whose objective is to create environments that attract and invite them to stay.

1. THE DESIGN OF THE SPACES FOR A COMMUNITY

The design of spaces for communities consists of three parts:
1. Community
2. Activities in community spaces
3. Characteristics of community spaces

In Community we address the issue of what the characteristics of a community should be so that it responds to the fundamental needs.
In Activities in community spaces, considering the kind of activities that shall be possible to carry out in them, we find four types of activities: community creators, expansive, functional, and expressive.
And in Characteristics of community spaces we identify the aspects and elements that are necessary for these spaces so that they fulfil their function in the best possible way. We identify structural, technical, quality, accessory, and subjective characteristics.
Next, we will develop this proposal in detail.

1.1. Community

The built space, the architecture, is not enough to solve the lives of people and groups in a satisfactory way, but it is a necessary condition. Similarly, an ideal space is of little use if the community does not have certain characteristics if it does not foster certain values. There will be little use for well-designed meeting spaces if the inhabitants have no desire to interact with each other.
We describe here some of the characteristics that these communities should have, always keeping in mind that our goal is to

get communities prepared to respond to fundamental needs.
1. The community should facilitate or guarantee good treatment among people in the community so that they feel cared for, safe, heard, respected, and accompanied.
2. The community must keep in mind that not all people are equal, that they are not at the same vital moment and are not in comparable circumstances.
3. For the community no to enclose itself and isolate or become too dogmatic it would be suitable to have an appropriate size, feed the feeling of identity, maintain a good relationship with the environment and be open to change.
4. The community should have agreed rules of coexistence, systems of participation in decision-making, management, and maintenance. It must also have a good internal communication system and an adequate transmission of its values.
5. The community should be open to the neighbourhood, to the town, to the city, that is, to be permeable to its surroundings.
These aspects and those we develop later should be considered only as an initial proposal to think and debate how we want our communities to be.

1.2. Activities and community spaces

Spaces should not be designed for exclusive use (dining room, sleeping room, etc.), thus confining the number of possible uses to the number of available spaces. So, as there are many significant activities specific to fundamental needs, the spaces of a community must be prepared to welcome, facilitate, and promote these activities. Some of them will need exclusive spaces (or at least quite exclusive), but many others can be done in a multitude of different spaces, if these are suitable.
It is also important to consider the environment in which the community is to propose activities to the neighbouring people and not allocate space to activities that can be carried out nearby.
We define four types of activities and we have thought of them in spatial parameters:
1. Community creators: meeting, sharing, communicating, or talking, exchanging, and sharing.
2. Expansive: for enjoyment and personal development, such as reading, throwing parties, physical exercise, games, exploration, meditation, relaxation, etc.
3. Functional: activities that are part of the daily routine of our lives such as cooking, doing laundry, watering, hanging clothing, cultivating, making small repairs, etc.
4. Expressive: for example, exhibiting, painting, drawing, weaving, embroidering, writing, dancing, playing music, giving shows and in general any type of artistic or personal expression that can be carried out within the community.

1.3. Characteristics of community spaces

The community spaces are based on the idea of the synergetic satisfiers described by Max Neef. Sharing spaces must be conceived as an opportunity and enrichment, not something that has to be done precariously and in places of bad quality. Thus, the activities that are developed and the people who participate should be able to enjoy and share without creating annoying situations and discomforts.
To have spaces of good quality, they must have certain characteristics. In this section, we identify and list some of them.
The structural characteristics establish the general parameters in which the others must be developed. We have identified the following:
- Multipurpose / transformable / adaptable
- Permeable
- Multidirectional
- Not hierarchical
- Sufficient
- Appreciated/qualified

Finally, we describe other technical and quality characteristics.

1.3.1. Multipurpose / transformable / adaptable

Multipurpose spaces allow creating spaces for people doing different activities to meet and melt. It also allows us to share experiences and knowledge and to increase the use of the spaces because there are more possibilities of use in time and in the type of activities.
These spaces might have different uses at different times, but they can also be spaces that host different activities simultaneously, without causing trouble. In fact, this simultaneity should be an opportunity to enrich activities by expanding and completing them, and, above all, to create opportunities for the relationship between people: carrying out collective activities reinforces relationships and the sense of community.
The furniture must also allow different use and be placed in various and unforeseen provisions.

1.3.2. Permeable

By permeability we understand the opposite of bunkerization, both of households and communities. Without compromising a clear delimitation of both the home and the community, it is essential to nurturing a certain porosity of both the community and its environment and the homes and their communities.
Thus, the uses and activities carried out in a community must contain the potential to open up to the environment, or host other people's activities; in the same way, it would be necessary to favour the passage of outsiders, at least in certain spaces.
Regarding the activities that are normally done at home (preparing food, caring, cleaning, sewing, painting, etc.), there must exist the possibility of carrying them outside, thus breaking the isolation to which they are usually confined. This allows us to share them, to support each other, or simply carry them out accompanied while weaving community. On the other hand, the community would also need access to the houses: if they were more penetrable it would be easier to know if someone needs help, support. Here we will have to face the delicate task of delimiting where privacy ends and where isolation begins, or where support ends and the invasion begins, something that, most likely, depends on people and circumstances.
Some use or activities require a certain degree of isolation so that this permeability is not always convenient. However, it may be the case that this need for isolation or privacy is necessary only at specific times.
Permeability requires, among other things, that there is a visual relationship between the spaces, as well as easy accessibility (free of obstacles such as walls, gates, impenetrable doors, etc.) that use porous delimiting elements.

1.3.3. Multidirectional

People can tour buildings or spaces following an objective or according to the use or the activity. Allowing different directions can create unexpected encounters between people who go to different places or who do different activities.

1.3.4. Not hierarchical

With non-hierarchical space we mean avoiding the existence of spaces that determine the place that people must occupy, putting some above others. A meeting room can take different forms, and these may or may not be hierarchical. There is no doubt that the way in which space is designed, in which its furniture and distribution are arranged, condition the way in which people relate to each other: a rectangular table instead of a round one; chairs in a circle instead of rows; flat ground instead of stands, etc.

1.3.5. Enough

It is important that the spaces are sufficiently large so that the functions are not restricted and that there is room for change or adaptation, for improvisation. Having enough space (considering that enough is a totally subjective term) is not having to compete for it, not having to discard a significant activity due to lack of space, or leaving a certain group of people without space (as often happens with teenagers, but that can be applied to any other group).
To have enough space is to have spaces in which activities can be carried out in a functional way and with enough comfort. Having enough space is also important to feel comfortable in any space. It provides quality to life.
We need to have enough space to be able to carry out simultaneous activities so that they are compatible, something particularly important, for example, for caring activities, which are often carried out simultaneously with other activities.

1.3.6. Appreciated/qualified

It is important to give the value they deserve to certain spaces and certain activities, in particular to those that allow people to meet, establish relationships, foster mutual support and develop as individuals; these places and activities that encourage that the works for maintenance and reproduction of life leave the confinement of the home. It is well known that in many countries the laundries are not inside the house but in a common room. This is fine, but it is not so fine to place it in a dark and sinister basement. The laundry room, if it is a nicely designed, in an open, bright, and cosy space, can help to dignify the activity and to promote interaction between its users.

1.3.7. Other characteristics

We have classified the rest of the characteristics like this:
- Technical
- Quality
- Accessories
- Subjective

The technical characteristics are those that affect the habitability conditions, the physical aspects that must guarantee the well-being and comfort of people. We highlight the following:
- Thermal comfort
- Acoustic comfort
- Ventilation
- Accessibility

Quality characteristics refer to the impact on the mood of the people and the way in which they condition the relationship between them. In these we highlight the following by way of example, since the list may be longer:
- cosy space
- sheltered space
- spaces that generate a sense of security
- space that guarantees privacy
- convivial and friendly space
- outdoor spaces
- evocative spaces
- etc.

That is, the spaces we build or modify must be designed to have this good impact on those who inhabit them, avoiding creating inhospitable, cold, impersonal, suffocating, or insecure places.
When we talk about accessories, we mean these elements that populate or dress the spaces. These accessories must have the same purpose as the structural and techniques characteristics: they must favour the coexistence of different people and activities, improvisation, adaptability; they have to help generate pleasant, stimulating environments; to provoke encounters, exchange, dialogue,

communication, creativity, and imagination. Here we can only mention a few examples since the list could be endless, and each community will require different accessories to meet their needs and fulfil their wishes:

- moving elements
- places to sit
- means of expression
- internal and external communication tools
- plants
- games
- adaptable separation elements (curtains, screens, etc.)
- etc.

Finally, when we talk about subjective characteristics we refer to those aspects of the spaces that allow the development of subjectivity, identity, free expression, adherence to the community; spaces that allow spontaneity, diversity; spaces that we feel belong to us, that represent us, with which we feel identified and in which we find something of ourselves.

FINAL CONSIDERATIONS

We would like to finish by pointing out that another design of residential buildings is possible and exists. A design that is capable of surpassing the idea of bunker homes, where common spaces cease to be anonymous steps to go from one functional place to another; which considers common spaces as an opportunity rather than as a problem; that uses these spaces to weave community and generate life; and that gives these spaces visibility, uniqueness, and value, and also spares no resources to provide them. We believe that a building articulated around good common spaces (common resources, after all) improves people's quality of life, not only because it allows them to access resources that would otherwise be unattainable individually, but also because it represents the opportunity to weave those nets that are so essential to us in order to achieve a good life. If interdependence is our characteristic feature, let us make it a virtue and not a flaw.

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PAPER #8.14

DISENTANGLING RELATIONAL SPACE: ADDING INSIGHTS OF THE EVERYDAY LIFE OF CHILDREN TO THE PROCESS OF URBAN RENEWAL

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ABSTRACT

This research focuses on facilitating contemporary urbanity from a user central position, based on the creation of space. This research is approached from a perspective formed within the disciplines dealing with the production of space and based on the relational paradigm (Harvey 2004; Massey 2005; Löw 2016). It aims at developing new approaches to the construction of- and additions to the current urban archives on which spatial policy- and design frameworks are based. By bridging social and spatial knowledge in an empirical research of the case Muide-Meulestede in the city of Ghent (Belgium), it tries to transcend universalism by accurate location-bound knowledge, and deliver new entries to the spatial professional to tackle design challenges in contemporary Flemish urban conditions.
The paper describes the process of creating insights into the relational space of children in function of the development of an "age-friendly Recreational Structure" for the Muide-Meulestede district. It gives an overview of used methods to expose the local relational space of children living in the district, the knowledge contribution that a relational approach can offer to existing "urban archives" and how this knowledge can be used within a process of urban renewal.

KEYWORDS

Relational space; citizen centered design strategies; localism; socio-spatial limits; multiplicity.

INTRODUCTION

We live in a world in continuous transformation. We experience it from within a global sphere in which we have to actively relate ourselves to themes as the global economy, politics and climate uncertainties. This fluid world is characterized firstly by the unprecedented possibilities that globalization offers us, but also by the search for universal standardization (Stables 2019) to reduce the complexity that arises from this. As a response to globalization, there is a growing awareness of the value of the here and now, of the city, the neighborhood and the street in which we live (Madanipour 2003). More and more attention is paid to our daily life and its environment (De Certeau 1988) as our personal center of our global existence. In a world, where the network society (van Dijk 2012) organizes itself at the speed of lightning, reformulates, expands and merges into something else, and creates the right conditions for a wide diversity of social movements (Nicholls 2008). This is the field where the contemporary spatial designer, developer and policymaker have to position themselves, spatial professionals who are responsible for the development of the stage where all these dynamics take place.
This research is focusing on an actual process of urban development within the District Muide-Meulestede part of the city of Ghent, located in the Flemish region as part of Belgium. It focuses on a development process initiated by a collaboration between the residents of the neighbourhood and the urban services of the city, in response to the large-scale developments taking place around the neighbourhood. It starts from the desire

of the residents to have more control over their daily living environment, but also to take responsibility for it. In addition, it gives shape to the ambition of the city to develop a city, based on a participatory trajectory, to the needs of- and tailored to its residents.

This form of localism (Davoudi and Madanipour 2013) can be interpreted as a countermovement to globalism, as it offers the citizen the opportunity to give substance to its individual position within the global themes on a human scale. But it can also be interpreted as a countermovement to standardization, the reduction of the real complexity of the city in policies and design frameworks, where the need for knowledge of the local (Kuukkanen, 2012) has faded into the background.

With this in mind, the available urban archives as spatial theorezations, used and made by the spatial professional, seems to be not sufficient within the contemporary model of urban renewal. Space can no longer be treated as the container of materiality as a contrasting background for social activities (Harvey 1973). The socio-spatial qualities of space form the conditions of daily life. Space not only functions as the context of the social life it includes, it can be described as social-based spatiality. Space forms the stage (Foucault 1980, Soja 1989, Heynen 2013) for the processes that take place on it, where these processes describe their stage at the same time. This concept of space reflects the relationships between the individual, object and group (Gurvitch 1971, Massey 2005, Löw, 2017), space as a stage facilitates interaction and this interaction defines space.

This research looks for a new approach to create space based on the actual complexity that space as a stage includes. As a reaction to the reconstruction of New Orleans after Hurricane Katrina, Peter Marcuse described an approach, he called 'critical planning' to explore and to give answer to the actual complexity, which arose from this crisis situation. This research is building on the three steps of 'critical planning' he developed: expose, propose and politicize (Marcuse 2009). To expose this complexity, the research starts not from the perspective of the absolute space, the physical appearance of space, but from the relational space. The concept of relational space is approached from different disciplines (Harvey1973; Soja 1996; Massey 2005; Madanipour 2010; Heynen 2012; Tornaghi and Knierbein 2015; Löw 2016), this research starts from the position and the concept of space, that is used by the spatial disciplines (Khan, Moulaert and Schreurs 2013) and defines space as an active parameter. Insights in the relational space, are not the goal, the goal is to develop a new approach to the process of making space. This process of making space has a location and it includes a defined number of processes, it relates different collectives, individuals and objects. In this way the research has the aim to go beyond the high level of abstraction that the current process requires. From an anthropological and geographical focus on middle-range theorization (Merton 1968), within a perimeter actual processes can be identified, and mutual relationships can be mapped to expose the local relational space (Ong 2011). This research therefore does not lead to a universal set of variables to analyze a certain perimeter, a universal theory or method (Law, 2004), but to an approach to grasp the contemporary urbanity in order to create space and adjusted to the spatial professional.

This paper describes a case which explores the possibilities of a relational approach within a process of urban renewal in a Flemish urban context. This case is dealing with an actual project of city renewal, in collaboration with the city of Ghent. We focus on a part of this process: the development of an age friendly recreational structure directed to the neighbourhood Muide-Meulestede. It is a project with the ambition to deal with the actual complexity of the neighbourhood, developing space tailored to a broad diversity

of social groups, instead of just designing space for all. The case serves as a living lab to the research, where it uses this process as a case study at the same time. The paper starts with a description of the concept "age friendly recreational structure", how the framework of the research contributes to this development, and its meaning to the research. Next, it focusses on the methodology that was used to expose the daily patterns of children in the public space. It gives an overview the representation and projection of the material. The paper ends with the significance of this approach for a development process and how it contributes to the "propose" and "politicize" phases.

1. MULTIPLICITY AS A CONDITION FOR THE DEVELOPMENT OF AN "AGE-FRIENDLY RECREATIONAL STRUCTURE"

The concept, space as a stage, is the basis for the development of the "Age-friendly recreational structure" for the Muide-Meulestede district, which is currently being developed within a multi-disciplinary partnership between various city services and to which the research actively contributes.

The concept "age-friendly recreational structure" refers to the "play space web" (Dekeyser 2007; Gill 2019), a policy document used by various Flemish municipalities and developed by the Flemish NGO Kind & Samenleving. This policy document functions as a planning instrument, at the scale of a neighbourhood, which determines the playability and child-friendliness of space within current and future developments. A "play space web" focuses both on guidelines for the provision of child-friendly space, it creates guidelines to how this space can be designed, but it also maps the neighbourhood for child-related mobility issues. This instrument forms a framework for the design of playgrounds and contributes to the larger framework of urban development.

The idea of the "age-friendly recreational structure" was coined in a urban policy document that was devised by the city service of the city of Ghent "urban renewal". It is based on the hypothesis that an integrated approach to a recreational structure provides added value for the diversity of users of the public space, but also that this approach can lead to an instrument that can have an impact on a diversity of scales in the process of spatial development. The application of the concept is experimental, it creates its shape within the living lab of this research in the collaboration with the city services.

The word age-friendly in "age-friendly recreational structure" represents the ambition to make the public domain accessible and attractive for various target groups that are located in all age groups from young to old. The word recreational indicates a focus on activities that fall outside the daily obligations. The word structure in "age-friendly recreational structure" stands for the ambition to develop "1" structure instead of various structures aimed at individual target groups or different use. Together, these words in the title of this project represent a new approach to urban development, which seems evident, but in practice it is not.

The development of one structure for various target groups starts from the fact that these target groups are going to share space and relate with each other within this space. The space in which this takes place is read differently by each target group and each target group sets its own requirements and wishes for this space. The development of one structure for various target groups, assumes that the reality in which these various views of different users are coming together in the public domain and thus dealing with the multiplicity (Massey 2005) of space.

Within the classical approach, this multiplicity is disentangled based on the representation of the various target groups by the different city services involved in such a process. From the perspective of the individual city

services urban policy is made applicable to a local context. This leads to a form of urban development that is based on a standardization of reality and ignores the local interests of the users of the space. It is an approach based on statistics, it focuses on a statistical availability based on proximity in which the relative aspect (Löw 2017) is not recognized. This form of urban development comes from a perspective in which all the nuances of daily life have been extracted and reduced to policy rules that serve as conditions for the urban environment. This approach uses the single perspective of the target group that represents an urban service. This statistical approach offers few reasons and conditions for entering into relationships with other services and the target groups they represent.

The development of an "age-friendly recreational structure" requires a new approach which exceeds the limitations of the individual city services. Such an approach starts from a different notion of how we learn and debate the city. In order to meet the spatial demand, and in this case to learn the motivation for recreational use, of a diversity of users and to coordinate these, they must not only be mapped, but we must also learn the conditions to these spatial demands. Just like the motivation, these conditions are specific to a target group, are social based. The conditions provide insight into the behaviour of choice, of target groups to make use of the recreational facilities that the neighbourhood offers them. The knowledge of both the motivations and the conditions for behaviour in the public domain, gives an image of the actual use of facilities in an existing and of a future situation, in which not the spatial presence but the spatial use is central. The knowledge of the conditions can be used for strategic interventions in the space or interventions in the relationships between different target groups.

These conditions cannot be derived from analyses of absolute space or relative space, but they result from the processes or routines that describe these two forms of space. The research focuses on this concept of space, in which processes are normative. It starts from the relational approach to space that David Harvey described as follows: 'The relational view of space holds there is no such thing as space outside of the processes that define it. Processes do not occur in space but define their own spatial frame.' (Harvey 2004). A process, like a routine as walking the dog through the park, manifests itself in space and time. The relational space interconnects with the absolute space, you are walking with the dog through the absolute space which is all around you. The extent to which the absolute space becomes significant to a process, is determined by the ordering forms of proximity (Löw 2017), the relative space. You are walking in the park, the space outside the park becomes irrelevant for this routine. A process not only relates to space but also to other processes, during your walk, maybe you or your dog will interrelate with others in the park, while you are sharing space and time. Relational space is not only pre-structured by the absolute space but also by adopted conventions, power relations (Foucault, 1977), formed by other processes. You know that you and your dog have stay on the paths and are not allowed to cross the flower beds. Different processes active in the same absolute space creates forms of multiplicity (Massey 2005). Your dog could be interested in the ball, some children are playing with, But to avoid a conflict you are taking another route. Understanding the city by its relational space starts with accepting the multiplicity of space. This approach asks for knowledge of spatial qualities, spatial relations and power relations experienced by individual users of a certain place. It asks for knowledge of the absolute, relative and relational space and its interconnections.

Understanding space from a relational approach starts from understanding the various individual processes present in

space: the daily patterns of everyday life from the different perspectives of individual users of a certain place. To develop an "Age-Friendly Recreational Structure", the task of the spatial professional is not only to switch between the various layers and scales of the absolute space, but also to be able to switch between the various perspectives on this space from the multiplicity exposed by the relational space. In case of the development of the age-friendly recreational structure, knowledge of these perspectives is present at the individual (social) urban services. But the objectives of these urban services and thus the methodologies used to develop insights of these perspectives do not provide knowledge of the spatial aspects of these perspectives.

The concept of relational space generates a new perspective and offers opportunities to reflect on the existing city. As such, the relational approach embodies the 'expose' step within the 'critical planning' , which Marcuse described. Knowledge of relational space creates opportunities to not only understand the multiplicity of space, but to actually work with it in the 'propose' and 'politicize' steps of the process of urban renewal.

2. EXPOSURE OF THE RELATIONAL SPACE: THE DAILY RECREATIONAL SPACE OF CHILDREN IN MUIDE-MEULESTEDE.

To clarify the forms of knowledge that can be exposed by insights into relational space within a given perimeter, this paper describes a study of the recreational use of space by children between the ages of 6 and 12, within the limits of the Muide-Meulestede district. The importance of the position of children in the urban planning process is actively embodied by UNICEF in its goal to develop child-friendly-cities (UNICEF 2020). The freedom of movement of children in an urban environment is more and more compromised by the increasing perception of traffic- and social dangers, which limits their spatial options. Children become more dependent on the accompaniment of their parents in their daily routines, with a result that their voice is less and less heard in the planning process (Freeman and Tranter 2011). This observation gives reason to include the spatial use of children as a minimum condition to the process, the same applies to the spatial use by the elderly within the development of an age-friendly structure.

The research of the recreational use of space by children took place in 2017 and was done with support the two primary schools present in the neighbourhood and had a total of 54 participants spread over 3 age categories: 6-8, 8-10, and 10-12 years. The applied methodology was based on the mental mapping (Lynch 1960) of the recreational space that the children use in their daily life. The mental maps served as the conversation starter for a short interview, focusing at the experiences of the space, the limits of the used space and what these limits determine. The drawings and the interviews were used a to create a perspective tailored to the children to analyze the absolute space, to define limitations of the relative space (Löw 2017) and to understand their behavior in spatial use through insights of the relational space (Giddens 1984). The findings from the study were reflected and further refined in workshops based on a photo voice (Wang 2016) methodology and walking interviews (Evans 2011) in which both children and local agents were involved.

The children were asked to draw their daily environment, with their own house in the street in a central position. They received a canvas that shows an empty street, a plastic drawing template that contains a number of archetypes of dwellings and spatial facilities, which can be used to draw, local situations of the Muide-Meulestede district and pens in various colours. A drawing focusses only on the elements the children give an importance do draw. Different colours are used to describe elements they like, hate or

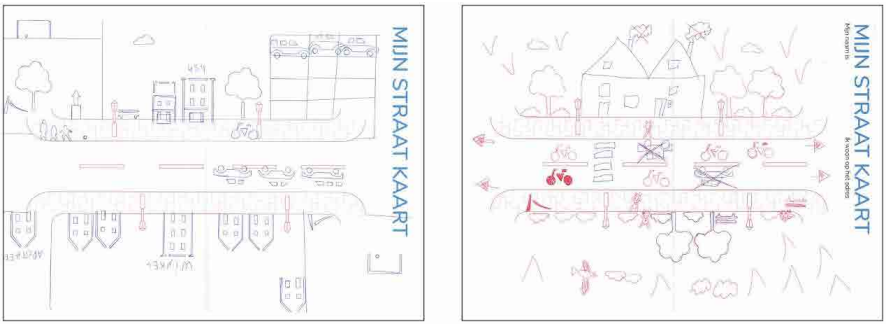

Figure 1. Examples drawings children. Source: (Author 2017)

would like to improve. To start this exercise a drawing was shown as an example, where the considerations within this drawing were also indicated. This drawing served as an example, but this explanation also functioned as a moment to ask a number of structured questions to the participants in an informal way. This exercise took 20 minutes, after 20 minutes the children were asked to describe their drawing. These short conversations gave the possibility to question uncertainties or to delve deeper into specific elements coming from the drawing or the conversation.

This method was developed based on a number of objectives: an attractive format in which children want to participate based on their own decision; a format that can be completed within the attention span of children from 6 years old; a format to which children who cannot yet write can contribute; a structured approach with sufficient liberties that gives space to the unpredictable ideas of children; a format that focuses on the current situation and does not raise expectations about future developments; and a format that bridges social and spatial knowledge in a single exercise. The used method was directed to children form the age 6-12 years and living in the district Muide-Meulestede. As a method to grasp relational space, it is focusing on the spatial stage the children are using in their daily recreational process. The method provides clear results to the spatial use, and the social and spatial conditions that form the conditions of this use. The method exhibits deficiency in the aspect of time that is inextricably linked to a process and therefore the relational space. Time is individual and the children each have their own sense of time, which is difficult to grasp in such an exercise. But time is also an essential component to relate different processes or routines, of the children or other user groups. The research therefore proceeded from assumptions to imposed benchmarks over time due to external influences, such as school times, dinner time and bed time.

3. ENTANGLING RELATIONAL SPACES: INSIGHTS IN THE SHARED SOCIAL AND SPATIAL LIMITATIONS OF SPATIAL USE.

The results of this study firstly provide an accurate image of the recreational use of space by individual children. It provides insight into when, where and why they use the collective space in the neighbourhood. The use of space responds primarily to the will and the need to play and by this to expand their limits and to challenge themselves physically and socially. But in addition, it also gives an impression of the overall spatial qualities of the neighbourhood: in many

cases, children indicate that they do not have access to private outdoor space in their home environment. The collective outdoor space serves as an extension of the private space. The outdoor space is therefore part of their process that they go through every day. In addition to playability of space, many children attach importance to places to withdraw, alone or with friends; they look for qualities that are not available in their private space.

The research also shows the differences between target groups in their spatial demands. First there are clear differences between the use of space by boys and girls. To give an example, in the study, boys indicate that they use public space for spontaneous meetings, where girls more often plan their use of public space to meet with friends. Cultural differences are also noticeable. For example, certain children with a Turkish background are mentioning they are allowed to stay outside much later in the summer then the children with a Belgian background, but they also have a much wider reach in the neighbourhood. Age, as a reflection of the degree of social and spatial knowledge a child acquires while playing, also counts as a factor that determines the use of space. However, we can state that this factor is in case of children living in Muide-Meulestede less important than you might expect (Dekeyser 2007).

The specific individual spatial demand that is exposed reflects the spatial qualities of the neighbourhood. This demand corresponds

Figure 2. Example spatial analysis output workshop children . Source: (Author 2018)

to the statistics of the neighbourhood (Stadsmonitor 2017), it corresponds to the very high population density and development rate. But unlike these statistics, the results not only have a signaling application, they provide a detailed image of how these individual users act according to the opportunities they have in time and space.

By not only analyzing the individual disentangled relational space, but also how different relational spaces relate to each other, new knowledge layers of the neighbourhood can be developed, which relate social and spatial aspects to each other and have their origins on various scales. The children's drawings described the space that was considered to be their relational space, but by doing so they also described which space does not belong to their relational space. With this they indirectly drew the limits of their relational space.

Where the demand of space was briefly discussed above, the entangled data gives an impression of how the children give substance to these spatial demands within the possibilities the neighbourhood has to offer. By combining and relating all spatial limits of the individual drawings, an image of boundaries in the neighbourhood was created, which can be explained by the spatial context, but also by the power relationships that it results (Giddens 1984). It gives an accurate image of spatial boundaries in the neighbourhood that are supplemented and reinforced by mental boundaries. These mental boundaries describe the actual accessibility of a place for the children living in the neighbourhood.

These mental limits are in many cases determined by interpretations of safety. The theme of safety arises in relation to the mobility issue which is arising when bridging the distance between the front door and a suitable place to recreate in the collective space. Forms of spatial safety also arise in the research, relationships between the living space and the public road, unclear spaces with little social control, unsafe situations at a more detailed level, are determining factors that can influence the play of children. Another factor is social safety, multiple use of space can have both a positive and a negative impact on the presence of a specific group in space. The research shows that lively places with overlapping use in space and time are the most attractive by a diversity of user groups. These places are provided with various forms of social control due to the diverse use; it makes the places predictable and gives the feeling of trust and safety. Spaces that have multiple uses, but where this use does not overlap in time, in the way that the relationships between this use are unclear, are more likely to be labelled as unsafe.

This sense of security is essential for the children's use of space. This sense of security should not only be present with themselves, but also with their parents, their friends and their friends' parents. Safety thus determines the mental boundaries within the neighbourhood and thus the accessibility of the facilities available for the children. In addition, it largely determines the attractiveness of a space for daily use as an extension for the private space.

The children in the study indicate that the attractiveness of a playground is not determined by the facilities available, but by the aforementioned factors: accessibility and safety. These factors determine their use of space, only when they can choose between different spaces that meet these conditions in the same way, they have the opportunity to choose the most attractive facilities. This means, for example, that the children are playing soccer on an open field with trees as goals, which is only a hundred meters from a soccer field facilitated by the city. For many children, attractive places in the neighbourhood are places that are challenging on a spatial or social level. These spaces do not necessarily correspond to the spaces designed for them, when these

spaces do not meet the basic requirements to use this space.
These limits describe the conditions of how children deal with physical and mental borders, with spatial and social risks and gives an image of their personal goals and interests. These conditions find their form in elements in absolute space, relative space and the power relations that shape their relational space and can often be described in terms of accessibility, safety and attractiveness. These themes itself are already in the picture in the process of urban renewal, but the relational approach adds a detailed layer of socio-spatial conditions to these individual themes. It creates an understanding of the perspective of how children use the public space and creates an image of the spatial demands of a social group without an own voice in city planning.

CONCLUSION

Insights into the conditions of the use of space, both spatially and socially, open up opportunities to influence the process of facilitating the staging for our daily life. The relational approach is based on a multiple use of space and exposes the conditions of this use and in this way it creates insights on challenges and opportunities arising from spatial and social issues. With this, a relational approach contributes to the urban archives that originates in accurate local knowledge of the end-user's actual use of space. It delivers user-central data and therefore goes beyond forms of standardization. These conditions are recognizable by the residents, but that does not mean that they experience them consciously. Insights into the conditions offer opportunities to adjust the stage of daily life to the conditions, but it also provides the framework to reflect. Shared exposed insights of this knowledge by policymakers, designers and local residents make the process accessible and democratic. This knowledge forms new guidelines that encourage new urban alternatives to be proposed within both top-down and bottom-up approaches. These guidelines therefore not only function as a design framework, but also as a framework for reflection and can be applied in these two capacities within a participatory strategy.
However, the main benefit of this approach lies in understanding and getting a grip on the multiplicity of space. The case described in this paper shows the disentangling of the relational space of one relatively homogeneous focus group and what we can learn from the individual perspectives within this focus group. As such, this provides a knowledge contribution to the current process, but it also describes relationships to other focus groups. In order to develop an age-friendly recreational structure, other groups must also be addressed. The research is based on the hypothesis that a relational approach can create an understanding of existing processes of other focus groups as it did in the described case, but above all, that it can make the multiplicity of space more transparent and provide an innovative foundation, for the "propose and politicize" steps. Further research within the case study, directed to focus groups like the elderly, or youth, will be needed to provide an answer to this hypothesis.
As part of the expose-step within the 'critical planning' approach of Peter Marcuse, the relational approach exposes the motivation and conditions of the actual use of space. This step of the research is not necessarily participatory, but it makes the process accessible in the phase where proposals are developed. These proposals are captured in policy documents after, on the one hand, an assessment by urban policy, but on the other hand, the assessment of a proposal against the exposed conditions within a participatory trajectory. In this way it completes the circle of a form of spatial development, which stands for a dynamic, accessible and therefore democratic process.

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PAPER #8.15

THE NEW FORMS OF RESIDENTIALITY FOR THE SENIOR "INCLUSIVE" HOUSING

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ABSTRACT

In recent years, the issue of inclusion has taken on a central role in the European political debate so as to introduce welfare instruments and strategies dedicated to different sections of the population. Among these, the most vulnerable in situations of fragility not necessarily, and not only, of an economic nature deserve more attention. We are referring to the elderly, whose definition should be reviewed both considering their chronological age - in 2050 1/5 of the world population will be over 60 (WHO, 2015) - and above all considering the aspects linked to the needs of each "kind" of old people. The needs are dictated by the economic, social and physical conditions of each Senior: all elements that must be considered in order to operate within the different urban regeneration processes both involving individual buildings and entire areas of the city. We can talk about Senior Housing, but this doesn't mean creating entire buildings or neighborhoods of elderly people only, but working to design new forms of residency where the elderly can be included as leading actors, not as extras. In line with the principles of active aging, already proposed by the WHO at the end of the 1990s, autonomy must be stimulated and fed as much as possible until high and intensive levels of assistance are requested. To do this we need to work on developing new housing models where integration and intergenerationality can be the founding pillars. In this contribution some projects realized in Europe will be described, considered as case studies for the purpose of research, with the aim of highlighting the strengths and strategies that led to their elaboration.

KEYWORDS

Active aging; aging in place; non exclusive society; senior housing; social housing.

INTRODUCTION

Talking about Social housing means dealing with a multitude of welfare strategies and interventions in the residential area: the adjective "social" makes the issue complex and inquisitive in many aspects. Generally placing this adjective before the word "housing" allows to characterize this activity with respect to the users it is intended for both as regards its architectural-urban planning and for the methods of access to housing it creates. Social housing could be defined not as a category of housing but as a path for housing aimed at the inclusion of social categories for the satisfaction of their primary needs. Under the light of demographic trends, social categories would seem to expand to include new emerging "classes". The population in Europe is the highest average age in the world and more people live over the age of 65 and up to a very old age, significantly increasing the number of older people. Worldwide, the number of people over 60 has doubled compared to 1980 but the forecast is that, by 2050, it will quadruple the number of over 80 compared to now and that people over 65 will outnumber children who are under the age of 5[1]. Of course, a cause-effect relationship cannot be established between longevity and degree of self-sufficiency: despite aging, it invests the world population horizontally, there are peculiarities due to intra-individual and inter-individual differences (Fernandez-

[1] "Are You Ready? What You Need to Know about Aging .", World Health Organization, 2012.

Ballesteros , 2008) also taking into account the relationships of individuals with external factors related to the socio-cultural context . In Italy the speech of Niccolò Marchionni, Full Professor of the University of Florence and Director of the Cardiovascular Department of the Careggi Hospital, has had a significant impact during the 63rd National Congress of the Italian Society of Gerontology and Geriatrics (SIGG): "A 65 year old today has the physical and cognitive form of a 40-45 year old from 30 years ago. And a 75 year old that of an individual who was 55 years old in 1980 ". This, in addition to being a confirmation of the general aging of the population, also sheds light on another aspect linked to longevity: the well-being.

Well-being is an indicator of an individual's quality of life and a series of internal and external parameters contribute to its definition: physical, social and economic characteristics by the internal aspects and characteristics of the urban architectural environment by the external ones. Borrowing a term used in biology, we could speak about habitat by including within it all the relationships that are established between internal and external elements, determining internal qualities, external qualities and social qualities (Tacchi, 1995). Well-being must be sought and changed with the passage of time: the registry age, in fact, marks the boundary between one class of needs and another. The class of needs reflects on the choices that concern the sphere of living: an over 65 person will have more time to spend at home and less need for a large house; at the same time, however, it seeks the best possible accommodation conditions. In addition to having a very low coefficient of use – an over 65 is living alone or with a partner - a large house in terms of surface area also has higher maintenance costs and more housework to do. So here is a choice: move in search of a new accommodation or improve the conditions of the current accommodation? The choice is not easy and does not always and only depend on a condition of "will".

1. A SPECIAL POINT OF VIEW: THE ACTIVE AGING

The theme of residential construction connected to the needs of senior users has been the subject of numerous insights in literature; given the complexity of the topic, it is unthinkable to carry out an all-encompassing synthesis of the many facets that we have tried to analyze, but we can try to systematize the knowledge acquired to enrich an approach, in certain cases immature, that can be spent on new strategies . Thus, a sort of latent debate is fueled between the design disciplines, as regards the physical and technical aspects concerning the possibilities of using spaces, and the human sciences in a broad sense (Tacchi, 1995). If on the one hand talking about residence means investigating an area with which we all deal daily, on the other hand talking about residence for specific types of users - senior - activates a series of considerations involving apparently collateral disciplines such as gerontology and medicine, in addition to sociology and anthropology. A decisive role was certainly played by the greater trust in prevention campaigns, the search for greater well-being, a more conscious diet and the progress of socio-cultural conditions. The social factor is decisive and must also be considered in the light of another factor, the state of health: it depends on the level of autonomy - or ability to perform daily actions without the help of another person. If it is natural that the level of autonomy can follow a decreasing course over the years and is sometimes inevitable, it is desirable to maintain the state of self-sufficiency – partial or total – in spite of non-self-sufficiency. Here comes a concept that establishes the first focus of the theme: the active aging. Already in the late 90's the World Health Organization had introduced a positive

concept of healthy and active aging defining it as "a process that allows individuals to realize their potential for physical, social and mental well-being through the whole course. existence and taking an active part in society, while providing them with protection, security and adequate care when they need assistance"[2]. Active aging depends on various factors: material conditions and also social elements that individually influence the behavior and feelings of individuals. The interactions of these factors influence how a person ages; many aspects of the urban environment and facilities reflect these factors are included in the structure of an inclusive city. This concept introduces the second focus: the environment, that is, everything that surrounds the individual over 65 from the micro scale - accommodation - to the macro scale - territory. It is appropriate to reflect on accommodation: generally the building heritage is "created" and made functional especially for young people - new and potential buyers - while the elderly, not finding the answer to their needs, have only solutions, if there are limitations to everyday life, of moving towards sons or to social welfare structures which, in the case of elderly accelerate the aging process (Morena, 2013). This has resulted in a reinterpretation of aging in place by long-term care and the elderly housing industry: the latest result of this reinterpretation is the emergence of different residential forms that offer facilities and assistance to people more elderly so that they can live in an environment of their "supported" knowledge (Frank, 2002). In this sense, barrier free interventions and user friendly interfaces at the basis of AAL - Ambient Assisted Living technologies play a fundamental role: they present themselves as a technological infrastructure integrated into the built environment with the main purpose of helping without invading. "A rethinking of the relationships between the elderly and their home is underway, made of targeted interventions that respect the consolidated habits of the user but which, at the same time, can be supportive in daily life" (Nobili, 2019). An ad hoc technology that brings together the various devices and sensors installed in a domestic environment - IOT - can become a potential sustainable solution. "The added value of the new systems lies in the ability to store and process data on domestic activities by collecting information on abnormal changes in the routine for identifying sensitive changes in behaviors that can be interpreted as a signal of prevention (Falasca, 2019). The attention given to the senior user for accommodation, in light of the considerations on active aging, are ineffective if the intervention is not included in a wider system that affects the city itself, the neighborhood or the block. Not so much the inclusion of the senior category in the territory, but its non-exclusion becomes the real mission of the social residence for the elderly. The same urban regeneration should start from this: the urban voids, the degraded places in which it intervenes are places where a community has suffered lacerations that must be mended. Urban regeneration policies involve local communities allowing the collective forces to converge in the realization of shared projects to answer to real needs of the social groups: it allows the improvement of the living conditions "of the inhabitants "living in uncomfortable situations, guaranteeing everyone an equitable condition of social cohesion"(Garsia, 2005). The feeling of belonging to a community is fundamental for social senior housing interventions not only within the individual building, but above all in the relationships that are established between the individual building and the buildings around, between the single building and the commercial activities present and between the single building and the mobility network. At the base, the desire to create a relationship network between the inhabitants should be maintained and nourished: the non-exclusion

[2] The translation was reported by the document "Active Aging . A policy framework", World Health Organization, 2002.

of senior users who choose the aging in place option is therefore punishable if its presence is foreseen within larger projects that have as their mission the "grounding in the community and the home as a place of stability and continuity" (Morena, 2013).

2. TAKING ACTIONS FOR THE SENIOR: STRATEGIES AND POLICIES

To reinforce the considerations just proposed on the issue of active aging and on the aging in place strategy, there are a series of measures in Europe aimed at protecting the senior category through residential and home-based experiments. The aging is connected not only at the age of the individual and to their needs, but also includes the relationships of individuals with external factors. If the main mission of active aging is to maintain an adequate level of independence of the individual for as long as possible, then the field of application of senior housing, understood as the main intervention strategy for the application of this principle, it will concern individuals who are still self-sufficient or partially self-sufficient. If this distinction operates on a biological level, it is necessary to make some considerations also on two other limits to deal with: social fragility and economic fragility. Social fragility derives mainly from a consumerist cultural concept that leads to seeing the elderly as a product that, being unable to offer 100% of its resources, is unknowingly isolated from society. As regards economic fragility pension systems and welfare policies play a fundamental role. All these aspects are in consideration within the strategies in Europe aimed at the realization of senior housing interventions which, for the important social impact, we will call as "social senior housing" interventions. The overview of the strategies will concern some European countries and will serve to return an updated picture of the dynamics in progress but also to deepen their strengths. Even if each strategy must be seen in the reality to which it refers, their set can be considerate as a horizon to strive and overcome to improve and implement the needs-performance approach for senior users. The strategies identified for the senior users self-sufficient, can be summarized in the following residential models: multigenerational homes, residences with facilities, social housing. Multigenerational residences provide for the cohabitation, in the same building complex or district, of people belonging to different age classes: the most widespread generational combinations are those that involve the cohabitation of elderly and students. These types of residences build a network between young and old made up of relationships and assistance with the aim of promoting common activities and promoting mutual support and learning. The model is widespread in several European countries including Belgium, France and Germany. For Belgium and France, the promotion of the model by associations deserves attention instead for Germany the phenomenon must be seen within a more complex system such as that of the funding program, born in 2006 and taken up in 2017, of the German Federal Ministry for the family, the elderly, women and youth with the goals of intergenerational work, voluntary involvement and social assistance at local level. The broad scope of the program provides for financing through an integrated system of European, national and municipal funds for the construction of the Mehgenerationenhauser, homes dedicated to users of different age groups. In France it is also spread the residential model of the RSS - Résidence Service Senior - senior housing for self-sufficient people with facilities in support of daily life. This type of residence, though it will develop a standardized housing model - multifunctional building consisting of residential units and community spaces - can be implemented with superstructures customized services, which can be distinguished in three types:

basic facilities, supplementary facilities and à la carte facilities. An innovative residential format, which diversification is based on the quantity and type of facilities offered and the size and type of housing, which have aroused the interest of many operators managers of real estate: Domytis and Cogedim, as for example. Despite the specificity declared for the senior target, we are faced with residences that do not differ, both from a functional and formal point of view, from ordinary homes; a trait that distinguishes them from all those residential forms designed for the elderly with heavy medical-health incursions. In Europe, alongside the RSS, there are also the so-called viviendas dotacionales in Barcelona. The "viviendas dotacionales" for the elderly are hybrid residential complexes (Cocco, Pibiri, 2011) which have facilities for the neighborhood on the ground floor and on the upper levels accommodation living and common areas. The recipients are self-sufficient over 65 users and the access is via social rent plus a supplementary fee for maintenance. These types of achievements are part of larger programs which involve various partners such as: the Consorci Metropolità de l'habitatge and the Agencia de l' habitatge de Catalunya. A decisive role is played above all by the consortia which, through the involvement of specific areas of the metropolitan area of Barcelona, are responsible for enhancing facilities and housing policies, helping to improve and accelerate interventions in terms of housing availability. The product resulting is like the French residence with facilities but with a public management, which lodgings are within the programs vivienda protected from, and are often part of redevelopment projects and urban regeneration. In respect of social housing, there is the case of Italy with the so-called Integrated System of Funds. The integrated fund system (SIF) is one of the lines of the National House Plan[3] which provides for a series of measures aimed at increasing real estate assets to be carried out with the involvement of public and private capital to be allocated to disadvantaged social categories. At national level, the SIF is managed by CDP Investimenti Sgr and is constituted by the Investment Fund for Living (FIA), a fund of funds. The FIA was established by CDPI sgr on October 16 , 2009 with the aim of realizing affordable housing, intended for the so-called "gray belt", i.e. families not able to satisfy their housing needs on the market, but with incomes higher than those. which entitle you to public housing assignments. Being a fund of funds, the FIA also involves local funds which have local stakeholders as co-investors, primarily local banking foundations, but also Regions, Provinces, Municipalities, Cooperatives and private partners. The tendency to invest in the "social" sector has the consequence, together with ethical and social aims of these funds, that the groups are enlarged to include to news as resident students, temporary workers and not last, the elderly. They present themselves as a "house with facilities" in which the medical aspect is reduced or even absent, going only to be configured where the user requests it. The strategies mentioned so far, although different in shape, have the same contents and, above all, have a common goal: to offer a valid alternative to the self-sufficient elderly person that is not a nursing home or a hospital but can contribute to the maintenance of a certain degree of autonomy and independence, in line with the principles of active aging.

3. DISCUSSION AROUND HOUSING

Beyond the *formae habitandi* - single location and multigenerational cohabitation - strategies in place in Europe has as same result a product widely shared and replicated: the residence with facilities. Although with different definitions depending on which country - RSS, Social Housing for the elderly

[3] The national housing plan, also known as "Piano Casa", was created with the aim of "guaranteeing the minimum essential levels of housing needs for the full development of the human person throughout the country".

- the content is the same: all housing forms are constituted by a set of apartments designed and built for the elderly users with a series of facilities - basic or accessories - that can be provided either by the network of inhabitants itself or by external personnel or by a combination of the two figures. The integration of the residence with the facilities must be seen on a double scale: an internal staircase that allows to understand the integration of the facilities with the accommodation itself (INDOOR FACILITIES) and an external staircase that contemplates the system of relations between the residence considered in its complexity - accommodation and facilities - and the territory in which it is located (OUTDOOR FACILITIES). The buildings, in fact, are generally located in central and non-isolated areas connected by urban infrastructures - bus and underground lines - and in areas served by commercial activities and other facilities useful to the person such as post offices and banks.The only differences can be seen in how they are realized and how they are accessed or rented by users; in fact, if for Italy and Spain the issue of the elderly is seen above all from a social point of view, giving priority to situations of past frailty by offering new housing and social inclusion opportunities, in France the RSS seems to have exceeded the limit imposed by the social residences to offer themselves as a semi-hotel service open to all by delegating their offer of facilities to the choice of the individual user. The theme of integration in the territory can be seen as a common trait d'union for the building types present in the countries covered by the following in-depth

Figure 1. Case study in France, specific features to understand the integration in the neighborhood

analysis with reference to: the RSS in France, the interventions in northern Italy for housing for the elderly and programs of redevelopment that contemplate the dotacionales viviendas in Barcelona. The characteristics of the RSS[4] , among those considered as object of study, can be summarized as follows and they can be found in the specific table above (Fig. 1):

• They are large residential complexes made up of no less than 100 apartments, of varying sizes, with typologies ranging from one-room apartments to three-room apartments;

• On average 10% of the total consistency of the useful surface is destined to areas for common activities;

• The monthly fee depends on the location, while the facilities remain unchanged: rental tax, concierge service, internet connection, telephony, free access to areas for common activities;

• The offer of facilities can be expanded with the activation of optional packages created specifically for specific needs.

In Italy, with the variety of building types and housing models, the real social and economic challenge of this sector seems to address the infrastructures of the facilities useful both to the recipients of the accommodation and to the settlement fabric in which they are inserted. What is often underlined[5] and emphasized in the social housing interventions aimed "also" at the elderly is the desire to create a network of relationships between the inhabitants - end users of housing facilities - to strengthen their belonging to a community. Although contextualized to the context to which they

Figure 2. Case study in Italy, specific features to understand the integration in the neighborhood

[4] The study was conducted on a series of residences proposed by Domytis for the elderly; 10 of them are distributed in 3 regions of France - Ile de France, Nouvelle - Aquitaine, Provence - Alpes- Côte d Azur and Bretagne.

[5] The Social Housing Foundation operates throughout Italy, having activated a network of collaborations ranging from Cassa Depositi e Prestiti. Among the projects that have been studied: Borgo Sostenibile (Milan), Co-housing for the elderly (Milan and the Polo Fondazione Frassoni (Lecco).

refer, some common features can be fount in the table above (Fig. 2) and they can also be stated:

• The residential complexes have modest dimensions in terms of buildings with an average of 18 accommodations;

• Each building has spaces for internal and external common activities and integrated day centers also open to the inhabitants of the neighborhood;

• Accessibility to housing occurs through inclusion in specific rankings that refer to the municipal body, in particular to welfare and social policies, and which provide for the provision of a controlled rent that also includes the portion of facilities, internal to the 'building, available to users;

• the Social Manager has the role of Property Facility Manager, who takes care of the general management of the complex even its maintenance. The roommates also have the possibility of being able to take advantage of home facilities such as nursing care, home shopping and accompaniment for leaving, according to their needs and in ways that will be defined within the same form of housing.

The Municipality of Barcelona, in order to respond to the demand for public residential construction, allows to create, in areas destined for facilities, minimum housing at a calm rent for elderly over 65[6]. Among the characteristics of these complexes and the insight above on the specific table (Fig. 3):

Figure 3. Case study in Spain, specific features to understand the integration in the neighborhood

[6] The viviendas dotacionales are houses with useful facilities both for the inhabitants of housing and for the inhabitants of the neighborhoods. Among the projects being studied in Barcelona: the EMBT study in the Ribera, by Joan Callis and Pia Wortham in the northern suburbs of Barcelona and Sergi Serrat in the east of the La Clota park in Barcelona .

• Residential buildings have a significant impact from the point of view of population density with an average of 65 dwellings;
• The complexes have community spaces useful for the daily life of users where it is possible to take advantage of facilities such as: laundries, meeting rooms, multipurpose rooms and libraries;
• The buildings have a strong "integrative" character since their own access takes place from public spaces - a market, a square - to underline the strong inclusive character of the intervention;
• The facilities to users of the " viviendas dotacionales " are managed directly by the municipal social facilities, which deal with the cleaning of the accommodation and their ordinary and extraordinary maintenance.

While there are common points in terms of building typology - the integration of housing with facilities is a transversal and replicable model in different realities - the substantial difference between the building products is generated in the target audience of the recipients to whom these residences are intended. This consideration poses a simple but not obvious question for three similar cultural realities to which it refers: can the over 65s be considered a "personal" or "social" category?

CONCLUSION

It is impossible to give a sure answer to this question: first of all because positioning oneself on one or the other answer would mean refuting all the premises that have been made on the elderly category, second because it would only serve to fragment a current problem which can be to give an answer only through the systematization of knowledge and experiences so far. If it is true that European societies will have to live with the aging process of the population, even if there be a stationary aging, everything would end from the quantitative point of view but not from the quality. This is demonstrated by the rise in the investment trend and the strengthening of its link with the real needs associated with the natural course of life: "[...] an important aspect that the process of implementing new residential forms will have to therefore taking into consideration will be to prevent the consequences of aging in order to lengthen self-sufficiency as much as possible"(Bologna, Sichi , 2018). The achievements in the Senior Housing sector due to the greater attention to a growing social category are increasingly in line with the principles of active aging and seem to aim, for self-sufficient or partially such users, to offer more and more housing solutions customized to the specific needs of the user. The fact of having identified a model common to different experiences in the European panorama constituted by the union of housing with common facilities and supplementary facilities suggests a precise will of the policies in place: to offer, as a basic, a functional model to the needs of individuals that points to the prolonging independence by fighting isolation and loneliness and providing the possibility of integrating this solution with additional case by case facilities. All attention revolves around the senior user and his needs to be met through the performance of the habitat in which it will be inserted: the policies in support of these actions are therefore presented as tools to achieve this goal making the question on the their social or personal characterization. If the characterization is secondary, their presence within the same process is certainly of primary importance: in fact we have seen, especially in the Italian and Spanish cases, that the inclusion of Senior Housing projects in specific programs for housing leads to specialized paths from which, with the involvement of all operators, quality and functional products can be obtained. The implementation of these programs should converge on the transversal inclusion of public authorities and economic operators, as well as other specialized figures: "Greater

possible synergies between the private and private-social sector to improve the housing conditions of the elderly through territorial planning, housing construction and financial support for the less well off "(Tacchi, 1995). An entire system tailored to the target of the recipients that it is desirable to include in a welfare program that take actions in urban regeneration, to obtain results centered on the need to give concrete answers to real needs. The urban context, place of such actions, should not be underestimated: the same realities in which they will be inserted can themselves be instruments of social, urban and economic reconnection. If the objective to aim for is clear then the strategies that can be pursued become multiple and aimed at creating flexible housing forms that affect both the design choices and the forms of management of housing mobility (Morena, 2013). Connected to a dynamic society that tends to aging, these, over time, may continue to make substantial changes in all relevant sectors: housing policies, the regulatory body, the operators involved, the selection of criteria for selecting interventions, the extension of the framework of design-architectural choices and, last but not least, the inclusion of new forms of residential accommodation among the rental opportunities based more and more on social inclusion and the generational mixing.

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RE-VIEWING REFUGEE SPACES: THE CASE OF MARDIN, TURKEY

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ABSTRACT

At present, over 70 million people are displaced by war and conflict worldwide. Unfortunately, this number has increased sharply because of the war in Syria. Since March 2011, which is the date when the civil war in Syria started, more than 13 million people have fled from their homes in Syria, with 6.6 million becoming refugees in other countries.
While many countries in the world receive an increasing number of refugees, the spatial practice related with hosting refugees on the move and in various forms of habitation has found diverse, new and improvised forms. These forms reflect a vast landscape of negotiating spatial practice along formal regulations, informal initiatives, enforced policies and spatial exploitations.
Turkey is the country, which hosts the biggest Syrian refugee population in the world. According to official records, there are approximately 4 million Syrian refugees living in Turkey in 2019. 26 camps have been constructed in various cities in Turkey in this process; however, only 1.8 % of the Syrian refugees have resided in these camps, the real problem being related with the "urban refugees" who live outside these camps. In fact, as of 2020 only 7 camps have remained in 5 cities in south-eastern and southern regions of Turkey. (goc.gov.tr)
In this atmosphere full of dilemmas, the diverse reinterpretations of values of belonging and attachment have to be negotiated, and architecture, planning and other related fields need to challenge both the ongoing praxis and take part in shaping the premises within the socio-spatial context for a growing refugee-originated population. The aim of this paper is to re-view the refugee spaces in Turkey, taking the case of Mardin in southeast Turkey as an example, and to re-think the functions related to shelter, site and settlements in crisis responses.

KEYWORDS

Refugee; asylum seeker; physical environment; Turkey; mardin.

INTRODUCTION

> "We're just living on the edge of life. We're always nervous, we're always afraid..."
> Mariam Akash, mother-of-nine, whose husband was killed by a sniper in Syria

Refugee problems, related to having to flee from the country of origin because of the fear of persecution, conflict or generalized violence for reasons of race, religion, nationality or membership of a particular social group, have been a concern for the whole world for a long time. Displacement is even a wider problem, because this comprises also the process of having to flee to different parts of the same country. At present, over 70 million people are displaced by war and conflict worldwide, 58% of which are internally displaced (migrationdataportal.org). Unfortunately, this number has increased sharply because of the war in Syria. Since March 2011, which is the date when the civil war in Syria started, more than 13 million people have fled from their homes in Syria, with 6.6 million becoming refugees in other countries.
Turkey is the country that hosts the biggest Syrian refugee population in the world. According to official records, there are 3.585.198 Syrian refugees living in Turkey in 2020 (goc.gov.tr) Since 2011, the year

when massive migration from Syria started, 26 camps have been constructed in various cities in Turkey, where basic services such as education and health have been met. However, only approximately 1,8% of the Syrian refugees have lived in these camps, and the real problem has been with those "urban refugees" who live outside these camps (Erdoğan, 2019). Since the refugees have preferred to live in urban areas, only 7 camps have been left in 5 cities in Turkey at present (goc.gov.tr).

As the refugee crisis is affecting the whole world, the actions taken by the refugees, authorities, the public and private stakeholders need to be understood within a broader field of spatial discourse. In fact, architecture, planning, and other related fields need to challenge both the ongoing praxis and take part in shaping the premises for the future accommodation of a growing refugee-originated population. Because of the new contextual challenges, the architectural profession has to re-think the functions related to shelter, site and settlements in crisis responses. In many studies on migration and integration of refugees in their new destination, it is mentioned that the most important challenges faced by the immigrants (refugees) are related with the sense of belonging and identity. The refugees' problems are rarely considered in the context of spatial issues. Therefore, the intention of this paper is to reach a general framework that highlights the shelter/spatial/housing problems faced by refugees in urban areas (outside of the camps) based on a case study carried out in Mardin,Turkey in 2019.

This paper aims to investigate the conditions of urban refugees who live outside the camps and the spatial problems that the refugees face in their daily lives. The paper starts with a general background about the migration process of Syrians, and its influences on the whole world, especially in Turkey. Then six refugee houses in Mardin, Turkey are evaluated as case studies. Finally, findings of the field study and interviews are summarized and a general framework is provided for evaluating the spatial problems of refugees in Turkey.

1. HISTORY OF THE REFUGEE CRISIS IN SYRIA

The 1951 Refugee Convention spells out that a refugee is someone who "owing to a well-founded fear of being persecuted for reasons of race, religion, nationality, membership of a particular social group or political opinion, is outside the country of his nationality, and is unable to, or owing to such fear, is unwilling to avail himself of the protection of that country." (UN General Assembly, 1951)

Syria's civil war is the worst humanitarian crisis of our time. Half the country's pre-war population, i.e. 13 million people, have been forced to flee their homes, and approximately 400,000 Syrians have lost their lives in nine years of armed conflict, which began with anti-government protests before escalating into a full-scale civil war. (france24.com)

Anti-government demonstrations began in Syria in March of 2011, as part of the Arab Spring. Pro-democracy protests erupted in March 2011 in the southern city of Deraa after the arrest and torture of some teenagers who painted revolutionary slogans on a school wall. After security forces opened fire on demonstrators, killing several, more took to the streets. The unrest triggered nationwide protests demanding President Assad's resignation. The government's use of force to crush the dissent merely hardened the protesters' resolve. By July 2011, hundreds of thousands were on the streets across the country. Thus, in a few months, army defectors had loosely organized the Free Syrian Army and many civilian Syrians had taken up arms to join the opposition. Divisions between secular and Islamist fighters, and between ethnic groups, continue to complicate the politics of the conflict.

Families have struggled to survive inside Syria or make a new home in neighboring

countries. Others have risked their lives on the way to Europe, hoping to find acceptance and opportunity. And harsh weather conditions make the life of a refugee even more difficult. At times, the effects of the conflict can seem overwhelming, leading into the destruction of even World Heritage Sites, such as Palmyra (Figure 1) (Figure 2).

Figure 1. Palmyra Temple of Bel in Syria Source: (https://www.reuters.com/news/picture/palmyra-before-and-after-isis-idUSRTSCQPG)

Figure 2. Before and After, Destruction of Palmyra Temple of Bel in Syria. Source: (https://www.bbc.com/news/world-middle-east-34111092)

1.1.The situation of Syrians caught in the war

More than four million Syrians have registered or are awaiting registration with the United Nations High Commission of Refugees, that leads the regional emergency response. There has been an immense growth in the number of refugees since the beginning of the conflict. In 2012, there were 100,000 refugees. By April 2013, there were 800,000, which doubled to 1.6 million in less than four months. There are now 6.6 million Syrians scattered throughout the region, making them the world's largest refugee population under the United Nations' mandate. This situation is considered as the worst exodus since the Rwandan genocide in 1994.

According to the United Nations, more than half of all Syrian refugees are under the age of 18. Most have been out of school for months. The youngest refugees face an uncertain future. Some schools in various countries have been able to divide the school day into two shifts and make room for more Syrian students. But there is simply not enough space for all the children, and many families cannot afford the transportation to get their children to school. The youngest are confused by their experiences, lacking the sense of safety and home they need. The older children are forced to grow up too fast, finding work and taking care of their family in desperate circumstances (unhrc.org).

Many Syrian refugees have fled across the border into Turkey, overwhelming urban host communities and creating new cultural tensions. However, there are also Syrian refugees living in Jordan and Lebanon, which are the region's two smallest countries, with weak infrastructure and limited resources. There are also many Syrian refugees in Iraq, in addition to 6.7 million internally displaced Iraqis.

Hundreds of thousands of refugees have also attempted the dangerous trip across the Mediterranean Sea from Turkey to Greece, hoping to find a better future in Europe. Not

all of them make it across alive. Those who do make it to Greece still face many challenges — resources are strained by the influx and services are minimal.

1.2. Means of escape from Syria

Thousands of Syrians have fled from their country since 2011 (Figure 3). People often decide to finally escape after seeing their neighborhoods bombed or family members killed. Most of them have fled to neighboring Turkey, Lebanon, Jordan, and Iraq while thousands also end up in more distant countries of the Caucus, the Persian Gulf, North Africa and Europe. The risks on the journey to the border can be as high as staying in Syria, i.e. families walking for miles through the night to avoid being shot at by snipers or being caught by soldiers who will kidnap young men to fight for the government.

Figure 3. A photo from the days when thousands of Syrians have fled from Syria. Source: (https://www.aljazeera.com/news/2018/03/eastern-ghouta-exodus-largest-syria-year-war-180316053942233.html)

2. THE SITUATION OF SYRIAN ASYLUM SEEKERS IN TURKEY

The Syrian refugee crisis arose as the Turkish government was in the midst of overhauling its immigration system to meet international—and, particularly, European Union—standards. The implementation of these reforms has limited Turkish authorities' capacity to manage the Syrian inflows, and as a result, management of the crisis was left largely in the hands of national organizations working on the ground, in camps, without larger policy guidance. Meanwhile, formal immigration channels, including recognition of refugee status, remain restricted to Europeans, while non-Europeans receive temporary protection status and are expected at some point to resettle in a third country.

The difficulty of sheltering the world's largest refugee population is reflected in Turkey, whose open door policy to refugees for a long period of time, shields European nations from a migration crisis far worse than the one they are struggling with now. As some European governments turn to police and barricades to stem the flow of migrants, Turkey has continued accommodating almost 4 million people from its war-torn southern neighbors.

Turkey is the country which hosts the biggest refugee population in the world. As authorities from the Migration and Politics Research Center in Hacettepe University remark, the Turkish society approaches the Syrians in a much more positive way than any other country in the world and the social acceptance level of the Syrians is much higher. Of course, people in Istanbul, where approximately 550.000 Syrians live, complain about the Syrian beggars, however there are many more Syrians in Istanbul, and people are not aware of them. When the war first broke out in Syria in 2011, Turkey believed tens of thousands would cross its 900-km (560-mile) frontier. Since then, fighting has engulfed the country and Islamic State militants have exploited the chaos to impose brutal, medieval-style rule across large parts of both Syria and Iraq. According to the Turkish authorities, approximately 40 billion dollars have been spent on humanitarian responses, which includes some of the best equipped refugee camps, including schooling, healthcare and social services.

Turkey has implemented an "open door policy" since the beginning of the Syrian crisis, and has not rejected the Syrians who want to come

to Turkey. However, they are not accepted as refugees, but rather as asylum seekers under the heading temporary protection, which does not cover the natural rights of refugees. This situation has caused the Syrians in Turkey to be without any status.

In fact, while Turkey provides for the basic rights of Syrians, they do not have the right to work legally in Turkey in general, even if they are educated. Although the government has decided to allow employment for Syrians, upto 10% of the total number of employees in a work place, thousands of Syrian refugees work illegally in the Turkish garment industry where child labor, low wages and poor conditions are common. Syrians also have problems related with education, although the Ministry of Education in Turkey tries to resolve this issue.

The Syrians are not sure how long they will be allowed to stay in Turkey according to the temporary protection status. Proposals such as sending the refugees to a secure region to be established in northern Syria does not convince the Syrians because of cases such as Srebrenitsa in Bosnia-Herzogevina, where 8000 people were killed in 1995, even though it was declared to be a secure region by the United Nations Security Council.

The government of Turkey has spent more than 40 billion dollars for the refugees in the last nine years. On the other hand, the support that has arrived from international community is much less. The European Union has offered money to the Turkish government in return for keeping the refugees in Turkey, but this cannot be considered as ethical because this load is not only financial, but also has political and social risks. The European Union has to develop a joint migration and refugee policy with Turkey, which plays a key role in this process. Actually, the present situation cannot last long. If European Union closes its doors to the refugees, or tries to prevent them from leaving Turkey, the number of refugees will increase in Turkey.

Turkey is considered by many refugees as a transit country. However, this is a difficult situation for a country because this means that it functions as a bridge, and yet only 10% of the refugees go to other countries, while 90% stay. Since the possibility of passing through gives people the hope of going to other countries, more refugees arrive, increasing the number of refugees.

In 2017, AFAD conducted a field study about the demographic views, life conditions and future expectations of Syrians in Turkey. In the report of the field study, there are comments about when and under what conditions Syrian refugees will return to Syria. According to the results, approximately 22 percent of refugees in the camps and about 16 percent of refugees outside the camps never consider returning back to Syria (AFAD, 2017).

In Turkey, Syrian refugees are settled densely in certain cities. It can be seen in Figure 4, that there are ten cities which refugees have generally chosen to settle. Most of these cities are at the Syrian border of Turkey (goc.gov.tr).

Figure 4. Distribution of Syrian refugees by provinces in mid July 2020, Turkey Immigration Department. Source: (https://www.goc.gov.tr/gecici-koruma5638)

2.1. Life in camps

Some of the refugees continue living in camps. Jordan's Za'atari, the first official refugee camp that opened in July 2012, gets the most news coverage because it is the destination for newly arrived refugees. It is also the most concentrated settlement of refugees: 76,143 Syrians live in Za'atari, making it one of the country's largest cities (UNHCR Za'atari Camp Fact Sheet, 2020). The formerly barren desert is crowded with acres of white tents, makeshift shops along the "main street", sports fields and schools for children.

A new camp, Azraq, was opened in Jordan in April 2014, carefully designed to provide a sense of community and security, with steel caravans instead of tents, a camp supermarket, and organized "streets" and "villages." It hosts 36,785 Syrian refugees at present (UNHCR Azraq Camp Fact Sheet, 2020).

Iraq has set up a few camps to house the influx of refugees who arrived in 2013, but the majority of families live in urban areas. In Lebanon, the government has no official camps for refugees, so families have established makeshift camps or find shelter in the derelict, abandoned buildings.

In Turkey, there is an acceptance that, although inconvenient, Turkey must help its neighbor. 26 camps where basic services such as education and health were met, were constructed in various cities in Turkey, especially in border cities, receiving positive comments from the United Nations Development Program (Figure 5). At present, however, there are only 7 camps in 5 cities (Hatay (3), Kilis (1), Adana (1), Osmaniye (1)) in Turkey, since most refugees prefer to live outside the camps (goc.gov.tr).

Although the refugees who live in the camps are considered as needy, the living conditions of the refugee camps coordinated by AFAD were praised according to a report published in The New York Times on Feb. 13, 2014. The Öncüpınar Camp in Kilis province, a camp where 2,053 shipping containers have been converted into housing units, was particularly commended in the report. It was described as "clean," unlike many other refugee camps in the world, and the residents of the camp thanked the Turkish authorities (Hutzler,

2014). On the other hand, some researchers argue that better living conditions could be provided for refugees living elsewhere in the country with some of the funds spent on such camps. The legal status of the refugees is one of the most problematic issues in Turkey. Turkey has become a party to the Geneva Agreement of 1951 with geographical limitations, as a result of which Turkey can give the refugee status only to those coming from Europe, which means that the migrants from Syria are considered as asylum seekers, and not as refugees.

Figure 5. Temporary Shelter Center in Gaziantep/ Syrian Refugee Camp in Gaziantep. Source: (http://www.referansgazetesi.com.tr/haber/gaziantepten-23-bin-suriyeli-yolcu-haberi-32439.html)

2.2. Life outside the camps

Some Syrians know people in neighboring countries, who can open their houses to them. But many host families are already struggling on meager incomes and do not have the room or finances to help as the crisis drags on. Thus, refugees find shelter wherever they can. Families live in rooms with no heat or running water, in abandoned chicken coops and storage sheds. Most refugees must find a way to pay rent, even for derelict structures. Without any legal way to work in Turkey, Jordan or Lebanon, they struggle to find odd jobs and accept low wages that often don't cover their most basic needs. And language is a barrier in some countries, such as Turkey.

The lack of clean water and sanitation in crowded, makeshift settlements is an urgent concern. Diseases like covid-19, cholera and polio can easily spread, becoming more life-threatening without enough medical services. In some areas with the largest refugee populations, water shortages have reached emergency levels; the supply is as low as 30 litres per person per day — one-tenth of what the average American uses.

In Turkey, the majority of refugees have tried to survive and find work in urban communities, despite the language barrier. In fact, according to research findings, only 1.8% of the Syrian refugees live in the camps in Turkey (Erdoğan, 2019). The biggest difficulty of refugees living outside the camps is accommodation because these people cannot find the necessary money to pay their rent. The second major difficulty is finding employment. The legal status of the refugees is another problematic issue.

Based on the authors' research, it has been hypothesized that if the destination has a common language, common religion and similar cultural identity like refugees, immigrants (refugees) do not face problems such as belonging and sense of identity. In order to verify this argument, the city of Mardin in Turkey was chosen as the field study because the city is located on the Syrian border, with a similar cultural background as Syria. Furthermore, the majority of the inhabitants living in Mardin adopt the same religion and speak the same language as a second language (Arabic, Kurdish). However, it has been found out that, despite this socio-cultural resemblance, Syrian refugees in Mardin still face many problems, especially in relation to housing (shelter) issues.

3. THE CASE STUDIES IN MARDİN OLD CITY CENTER

Mardin is located on the border of Turkey and Syria, in southeast Turkey. Mardin city center

area (landscape) is a candidate for UNESCO World Heritage List since the city's landscape and houses have a unique character (Figure 6). Since people from different ethnic origins have lived together in Mardin in tolerance with each other throughout history, Mardin is referred to as 'the city of tolerance' in many publications.

Figure 6. Mardin Landscape General View. Source: (https://www.farmasi.web.tr/farmasi-mardin/)

After the recent Syrian Civil War erupted in 2011, due to the geographic proximity and cultural similarity, a huge number of Syrian refugees have chosen to live in Mardin. According to official documents, the number of Syrian refugees living and working in Mardin in 2018, was 92.971 (goc.gov.tr). The Syrian refugees have settled mainly in two districts in Mardin, i.e. Artuklu and Kızıltepe. Since the authors have decided to concentrate on the shelter problems of refugees with low socio-economic conditions, Artuklu was chosen for the pilot study, because the district consists of the old city center where the house rents are relatively cheaper than other districts of Mardin. The city center of Mardin has been the heart of economic activity and social relations since the establishment of the city. In addition to its economic importance and owing to its place in the collective memory of the city, this district has conserved its aesthetic and social values. Besides, because it has a pedestrian area that is not suitable for vehicular traffic, this district is one of the city's most attractive public places for both inhabitants and tourists. In spite of this fact, inhabitants of Mardin generally do not prefer to live in this district. In accordance with these preferences, apartment blocks started to rise on the outskirts of the historical city center in the 1990s. At present, the majority of inhabitants have chosen the new settlement called Yenişehir (which means New City) to live. These developments have caused a demographical change in Mardin. Muslim Arab or Armenian and Syrian Christian families have vacated the area, while other ethnic groups (Kurds and Arabs) who come from villages have settled in the city center (Küçük, 2013). After 2011, the Syrian refugees have caused another demographic change. All of these developments have also led to social/cultural transformations in the city of Mardin. Refugees have been spatially clustered in some neighborhoods of Mardin old city district. For this paper, six houses of refugee families, that are located in these different neighborhoods, were chosen to be examined as case studies, as a pilot study. We expect to continue our research including other houses of refugee families in the future, to get a better understanding of the situation.

3.1. Spatial dimensions of the case studies

As mentioned above, the city center of Mardin was chosen as an area for conducting a pilot study that sought knowledge about the housing problems of Syrian refugees with low socio-economic status. The study focuses on Syrian refugees with poor economic condition since it is obvious that this group would have more problems related with shelter and living in their new surroundings than the refugees with high socio-economic situation. In this pilot study, structured face to face interviews were carried out in the houses of these families in the historical area (inner city) of Mardin, detailed photographs were taken to document each house, and sketches were made in relation to the plans of the refugees' new houses in Mardin and the old houses that they used to live in Syria. The sketches of the

old houses of refugees were drawn without scale in interviews, according to the refugees' explanations. Thirty questions related with the socio-economic, and physical issues were asked to two people in each house (total 12 people). The questions in interviews were about the city of Mardin, their new houses in Mardin, their old cities, and the houses where they used to live in. Below, the sketches and photos of the six refugee households are sorted, the findings of interviews and observations are summarized (Figures 7, 8, 9, 10, 11, 12).

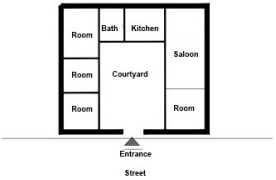
Old House in Syria Before War	House in Mardin/Household No 1
 Location: Al Hasakah	
The photos of House 1 in Mardin	
	
Refugee Household No 1	

Figure 7. Refugee Household No 1 (drawings and photos by Merve Güleryüz Çohadar)

Old House in Syria Before War	House in Mardin/Household No 2
The old house in Syria could not be described by respondents. They only explained that their house in Syria was huge and warm, had 2 bedrooms, one saloon and a courtyard. It was located in Damascus (Women Refugee, 36 and Man Refugee, 45). Location: Damascus	
The photos of House 2 in Mardin	
	
Refugee Household No 2	

Figure 8. Refugee Household No 2 (drawings and photos by Merve Güleryüz Çohadar)

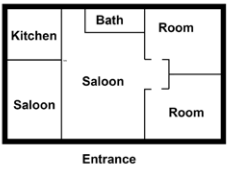
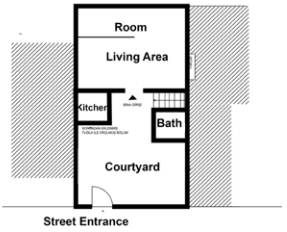
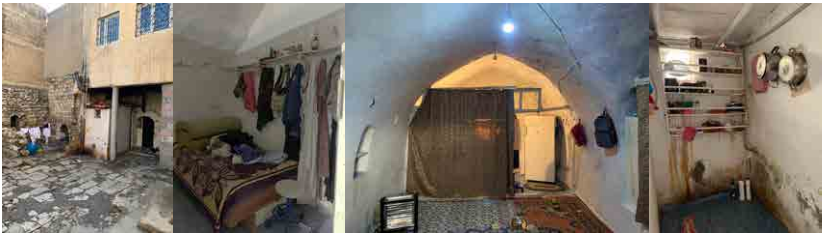
Old House in Syria Before War	House in Mardin/Household No 3
 Location: Al Hasakah	
The photos of House 3 in Mardin	
	
Refugee Household No 3	

Figure 9. Refugee Household No 3 (drawings and photos by Merve Güleryüz Çohadar)

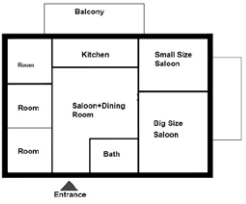
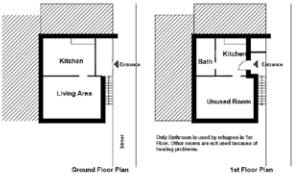
Old House in Syria Before War	House in Mardin/Household No 4
 Location: Al Hasakah	
The photos of House 4 in Mardin	
	
Refugee Household No 4	

Figure 10. Refugee Household No 4 (drawings and photos by Merve Güleryüz Çohadar)

Old House in Syria Before War	House in Mardin/Household No 5
 Location: Al Hasakah	
The photos of House 5 in Mardin	
 **Refugee Household No 5**	

Figure 11. Refugee Household No 5 (drawings and photos by Merve Güleryüz Çohadar)

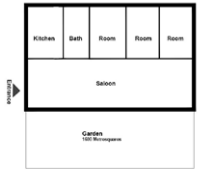
Old House in Syria Before War	House in Mardin/Household No 6
 Location: Al Hasakah	
The photos of House 46 in Mardin	
 **Refugee Household No 6**	

Figure 12. Refugee Household No 6 (drawings and photos by Merve Güleryüz Çohadar)

3.2. Evaluation of the case studies

As it has been stated in the introduction, a questionnaire was conducted and observations were made to reflect the current situation, and to evaluate the problems of refugees in Mardin, Turkey. According to observations and interviews, it can be concluded that the physical living conditions of the six visited houses have a lot of problems that prevent the refugees from maintaining their lives in a healthy way.

As a result of this questionnaire, it can be pointed out that the biggest difficulty of refugees living outside camps is accommodation, because these people cannot find the necessary money to pay their rent. The second major difficulty is finding employment. The legal status of the refugees is another problematic issue.

In interviews, a question was asked to understand why the refugees did not choose to live in refugee camps. All respondents answered this question by indicating that they do not want to restrict their freedom. However, they mentioned that living in urban areas has its own difficulties, such as finding affordable housing.

In observations of the field study, especially the inadequacy of the bedroom areas was noticeable. There were no special spaces defined as bedrooms, as 5-6 people slept next to each other in the same room. In fact, in household no 3 there were no additional rooms except the living area. It was seen in the visits of household no 3, that a type of curtain was used to divide the space (living area) and create a special area for bedroom (Figure 9). Household no 2 and 4 had an additional room, but the refugees could not use these rooms since they were not suitable physically, and had heat insulation problems and broken windows (Figure 8) (Figure 10). As seen in the plan sketches, the main rooms of houses were defined as 'living area's, since, these rooms were used as daily living room, main visitors' room, dining room during the day, and as a bedroom during the night. In interviews, all refugees complained about insufficient space of their houses.

Unhealthy conditions were observed in the inadequate plumbing pipes and sanitary systems in the kitchens and bathrooms (Figures 7, 8, 9, 10, 11, 12). As can be clearly seen in the pictures above, there are heat insulation problems in the houses. The respondents said that they do not have the financial means to replace the broken glass with a new one, thus they try to eliminate the transmission of heat to a small extent by pasting cardboard to the broken glass areas. Another physical problem faced by the refugees in their houses is the lack of water insulation and the moisture problem arising from this.

All of the houses that were investigated were discovered to have rent prices lower than other houses in Mardin. In fact, Syrian refugees mentioned the low rent prices as the reason for choosing to live in this area. All respondents mentioned their main problem as 'lack of money'. They emphasized that they will be happier if they have enough money to paint the walls, develop insulation, and repair their houses.

By comparing the old and new houses of the refugees (Figures 7, 8, 9, 10, 11, 12), it was observed that the old houses in Syria have sufficient spaces for all family members. Old houses of the refugees have at least two bedrooms. In fact, some houses even have two living rooms (saloons) (Figures 9, 10). In interviews, the Syrian families explained that there were no unhealthy conditions in their old houses in Syria. Another question in the questionnaire focused on whether they felt like foreigners in Mardin. All respondents answered this question that they do not feel themselves as a foreigner, since the majority in the city speaks the same language and embraces the same religion with them, in addition to the fact that they have many relatives living in Mardin from the times before the war. Previous studies have pointed out

that social networks play a very important role in the immigration process of people (Boyd, 1989; Ritchey, 1976; Elrick, 2005; Elrick and Ciobanu, 2009; Epstein, 2008; Fawcett, 1989; MacDonald and MacDonald, 1964; McKenzie and Rapoport, 2007). In these studies, strong evidence is provided regarding the effects of friends and relatives, networks, on migration flows. It can be said that the Syrian refugees' social networks in Mardin have a facilitator role in their integration process with the city. Although they do not feel as foreigners, they have emphasized the fact that they preferred to communicate with only their relatives and Syrian friends rather than local people.

CONCLUSION: EXPECTATIONS FROM PROFESSIONS RELATED WITH THE BUILT ENVIRONMENT

According to the results of the case studies, there is a strong need for rethinking the refugees' life conditions in the context of physical issues. In general, refugee families that have economically low income, often cluster around poor neighborhoods, and have to live together in small houses under unhealthy conditions. It is obvious that better regulations on rental rates and public housing systems are needed. Currently there are no public housing opportunities besides refugee camps in Turkey. Syrians coming to Turkey, who intend to remain outside the camps, can live in a city where they are registered. Therefore, refugees who choose to live outside of the camps need to provide their housing expenses themselves.

In this context, the expectation from the government is the development of comprehensive policies for integrating the refugees with the society. In fact, it has been nine years since the war started, and there are still hundreds of thousands of children who do not get proper education, and many refugees have to work illegally to sustain their living. Since the government in Turkey expects the refugees to go back after the war is over, no strategic plans are made for the refugees; however, the fact is that most of them will not go back. Because refugees have left their homes and their countries, they have a deep sense of placelessness, making place attachment and sense of belonging the key elements in integrating and connecting them with the city.

In the world, the sheltering problems of refugees are generally tried to be solved by building temporary shelters in isolated camp areas which are located outside the cities. Unfortunately, this approach leads to many problems. Isolated refugees face economic and social problems, while authorities face many problems related with the economic sustainability of the camps. Also, there are some organizations that have a mission to improve the lives of people displaced by force, by providing affordable temporary shelters; however, most of these efforts are not sustainable. To solve refugee problems, people need to find more permanent solutions. Architects, city planners and people from related disciplines should develop designs to contribute to the integration of the refugees with the host country. For instance, there are many unused, idle buildings in cities, which may be transformed into shelters for refugees; in this way both unused buildings can be revitalized and a sustainable solution to refugee housing problems can be provided. Furthermore, refugee housing problems should be seen as a social housing problem of low-income families. Traditional social housing projects mostly are built and sold or rented by governments and local councils. However, there are some alternative approaches to build social housing projects such as incremental housing. Incremental housing can be defined as a gradual step-by-step process whereby building components and parts are improved by owner-builders as money, time, or materials become available. This type of alternative approaches should be considered while planning houses and

settlements for refugees. Future research on these areas should be done in order to create more specific solutions and guidelines for this issue. Our study is a pilot study, and our aim is to make a more comprehensive study by increasing the sample number in the future.

In conclusion, it can be emphasized that the activities of refugees, authorities and the public and private stakeholders need to be understood within a broader field of spatial discourse. The diverse reinterpretations of values of belonging and attachment have to be constantly negotiated, and the architectural, planning and other related fields need to challenge both the ongoing praxis and take part in shaping the premises within the socio-spatial context for a growing refugee-originated population. In this context, institutions related with the architectural profession and architectural education have a responsibility to re-think the functions related to shelter, site and settlements in crisis responses.

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9

CONCLUSION

A RESTLESS, NON-CONFORMIST AND ADAPTIVE DISCIPLINE

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Architecture is probably the most pragmatic and adaptive of arts. Undoubtedly this is due to its scientific side. And it is also presumably the most restless and non-conformist science, being that unmistakably connected to its artistic aspect. Simultaneously, the discipline of all those who have devoted their lives to the design and construction of human habitat has frequently become the materialization of human aspirations, values and priorities. A society maybe can lie in many different manners, but its architecture always reveals the truth. Therefore, most likely the pragmatic and adaptive, but also restless and non-conformist research in architecture which we are having nowadays is the best evidence of a society which voluntarily or involuntarily, consciously or unconsciously prioritizes these features and is more demanding than ever.

The long tradition of research in architecture existing in many institutions all over the world has rather recently been complemented by the encouraging of research, also in architecture, in almost any university. However, funding is not proportional to this promotion at all yet, also in architecture once again. While still solving some apparently minor but actually relevant matters such as clearly differentiating research by design and pure research, research in architecture is enjoying the daybreak of what promises to be a fruitful era. The conferences on research in architecture jointly organized by the European Association for Architectural Education and by the Architectural Research Centers Consortium constitute a middle aged venture awaited with enthusiasm every two years by the fellowship of the European and the North American associations. The 2020 edition to be hosted by the Higher Technical School of Architecture of the Polytechnic University of Valencia was announced on May 31, 2019 in Toronto (fig. 1) during the ARCC 2019 International Conference and on August 30, 2019 in Zagreb during the EAAE Annual Event and General Assembly.

Figure 1. Presentation of the EAAE-ARCC International Conference and 2nd VIBRArch in Toronto

The event was received with interest and satisfaction by both the American and European researchers. Some of them were quite familiarized with the Valencia International Biennial of Research in Architecture, best known for its acronym VIBRArch, whose second edition would be merged with the EAAE-ARCC joint venture on this special occasion.

The call for abstracts for both full papers and posters was issued on September 16, 2019 and its deadline was set on November 11, 2019. Having been extended one week two hundred and ninety-five proposals for full papers and posters were received. A Scientific Committee composed by two hundred and fifty people from the five continents and with a remarkable 60,40% percentage of women, reviewed thoroughly of the proposals. Authors were accordingly informed by the end of the year. Accepted abstracts should turn into full papers or posters and be submitted by February 17, 2020. But during this period the coronavirus disease had already started beating the world up and its ferocity would be soon felt from east to west. However uncertainty did not affect at all authors and the percentage of full papers and posters submitted was even higher than in other similar events without such a powerful sanitary interference. Wisely intuited by the leaders of both organizations, travelling would turn into something difficult, dangerous or blamable within days or weeks. Therefore and on March 24, 2020, with Italy, Spain and other European countries already applying home lockdown, the conference was postponed to late fall 2020. The whole calendar of the event was remade adapting it to the new dates and once again the resilience of architecture researchers proved itself. Everybody stuck to the event. Nobody surrendered. After an extremely tough spring, on June 10, 2020, the new dates and a blended modality including the possibility to attend online or face-to-face was announced (fig. 2).

Figure 2. Board announcing the new dates of the EAAE-ARCC International Conference

Full papers and posters had been reviewed by the Scientific Committee during that period. Authors were notified. When lucky, those who had been directly accepted toasted, and those who were required amendments submitted them by September 14, 2020. At the very end, one hundred and fifty-five papers and one poster made their way through and were accepted for presentation during the up to seven parallel sessions. These are the works which have been included in these proceedings distributed in the frequently mentioned eight thematic areas.

The first of these thematic areas was titled "devising, representing and narrating the city". Up to twenty-six papers were finally accepted and presented during the conference. Authors tackled aspects as diverse as the broader perspective and view of the city, its representation and reading, both theoretically and by means of interesting examples in Asia, Europe or America, its geometry, the way in which their relevant assets are inserted and presented, and finally even challenging software and techniques to help analysts and planners.

The second thematic area focused on "living in urban landscapes". Likewise twenty-five papers and one poster had been accepted and, therefore, were given the chance to be presented during the event. Authors dealt with a vast range of topics, but certain areas received a special attention and many papers concurred. It is the case of the simultaneous work with different scales of the city, the relevance of green areas and connection with nature, or the meaning and understanding of representative public spaces and infrastructures.

Being the third thematic area, "the new faces the old" hosted up to twenty-two full papers focusing on the frequent and unavoidable coexistence of new elements in preexisting contexts, frequently with historical value. The contents of this block reveal an undoubted nowadays interest on the adequate knowledge, attitude and cautions for an architect when being commissioned a brand new project in this kind of contexts. Likewise it is also easy to detect a tendency to defuse the confrontation of new architecture with old architecture by accepting that this fact has been constant in the history of cities and a great bunch of good practices can be studied.

"Restoration, conservation and renovation" was the fourth thematic area. Seventeen full papers were accepted and finally presented during the conference. The set of works reveals up to four areas of interest concentration nowadays. The first is a classical one focusing on theories and the adequate previous analysis and data collection. The second one encompasses frequent successful case studies which provide future practitioners a fair set of options about how to tackle future commissions. The third area places value in works which were not considered heritage until recently such as infrastructures, certain historical neighborhoods or rather recent architecture. Finally, researchers specialized in this matter begin to welcome peers which embrace the discipline not from a theoretical, historical or design aspect, but from a purely structural, conditioning or material point of view, establishing occasional bridges to the topics of the fifth thematic area.

This fifth block focused on "a future based on technology". Seventeen full papers succeeded through the different reviews in order to be included in the proceedings and presented in the different parallel sessions. It cannot be denied that sustainability and the measuring and performance of any single parameter connected to it are taking a leading role day after day. Simultaneously, matters such as ventilation, climate comfort and lighting are becoming a relevant welfare parameter nowadays and many researchers are specializing on them. Finally building materials, techniques and structures still keep a meaningful group of academics doing their research on them. However their approach switches increasingly from new constructions to the renewal and preservation of existing ones.

The sixth thematic area was devoted to "smart cities vs. tech cities". The seven full papers finally accepted and presented focused mainly in data collection and analysis in order to make it useful for a variety of aspects involving mobility, energy efficiency or indoor comfort.

The seventh thematic area entailed up to twenty-five full papers focusing on "new professional practices and research practices" which put a special emphasis on the variety of work and research fields which architects have recovered or discovered recently and mostly after the 2007 financial crisis. To start with many papers placed a special value on pure research as a necessary and appropriate job opportunity for architects. Areas of knowledge discussed in other thematic areas were included here as well, such as comfort, sustainability or circular economy. But specific fields such as psychology, sociology, virtual environments and synergies between research and teaching were also presented.

Finally, the eighth and last thematic area focused on "participation processes, diversity and inclusiveness". Up to sixteen full papers were accepted to be in these proceedings and to be presented during the conference. Despite some examples of these trends can be found throughout history, the works presented in this block are devoted to what may be is one of the most genuine phenomena of our time. Peculiarities of public participation were discussed in different contexts and a special focus was placed on the design of urban spaces and buildings for underprivileged groups which historically have received limited attention.

The richness of matters attended is perhaps the first and most obvious conclusion. Architecture has become a huge discipline encompassing many specialist areas and fields of practice which resist being detached from the central core as it happens in other disciplines such as medicine. This diversity is understood in our case as richness and not as a problem. The developing of the conference evinced what is one of the most productive features of architects. We are curious people and we are interested in whatever has something to do in where people live and how people live whatever it is. But this colorful and varied panorama also revealed some patterns which are becoming more and more habitual and could be understood as the key issues of our times regarding research in architecture:

- Transversality is taking the scene. Most of the papers could have been included in more than one thematic area since their topic and approach frequently responded to a transverse and open-minded attitude. The full papers themselves or the fruitful debates developed after the presentations during the parallel sessions placed value on the concurrence of different approaches from different fields of expertise, cultural backgrounds or disciplines. Definitively we do trust in interdisciplinary studies and activities (fig. 3) to safe better results in whatever architecture has to confront or undertake.

Figure 3. Participatory workshop organized by the French studio Quatorze in Paris

- Western countries are almost already and sufficiently built if we consider their current needs. The migration of people to urban areas cannot be denied and obviously involves certain requirements to be attended

by a huge variety of stakeholders were architects must have a decisive role. But frequently maintenance, renewal and fair distribution of assets and resources provide better solutions than brand new expansive plans.

• Futuristic visions get little attention. New designs when innovative are almost always the result of a search for a better comfort, a more sustainable or respectful approach, a holistic understanding of the situation or any other attitude which is the polar opposite to the wish to get the attention exclusively by means of pure novelty.

• Respect is an increasingly often concept and is taking the lead over other factors such as profitability or personal recognition which are understood as unacceptable in many contexts. Respect for our heritage, understanding it not just as the assets with specific, individual and acknowledges artistic value, but as all what we have inherited from previous generations. Respect for everybody, especially for those collectives who have been traditionally disadvantaged or even non-cared, and for those who are still to come. And consequently, respect for the planet, ever more understood as a fragile entity which needs to be understood and protected.

• Care as an active attitude following respect. A meaningful percentage of researchers in architecture are devoting their time to see how they can care any individual of the society depending on their circumstances, or how they can care and heal the environment by means of actions such as circular economy or cooperation.

The work which was got the Best Paper Award during the farewell ceremony is a magnificent evidence of set of values which this conference has revealed as the undeniable sign of the times when it comes to research in architecture and therefore when it comes to what is relevant to nowadays society. Authored by Madlen Simon, University of Maryland (fig. 4); Shaimaa Hameed Hussein, Al-Nahrain University (fig. 5); and Gregory Weaver (fig. 6), University of Maryland; was titled "Designing Better Cities Together: Global inter-university partnership model for architectural education addressing the United Nations 2030 Sustainable Development Goals".



Figures 4, 5 and 6. Madlen Simon, Shaimaa Hammeed Hussein and Gregory Weaver

Having foretold the fact that most of the audience would attend the conference by means of the online option, as many segments as possible were scheduled in the European afternoon and evening since American attendees would face obvious and meaningful inconveniences in attending sections arranged during the European morning. Therefore six out of seven scheduled parallel sessions of paper presentations were arranged accordingly and only the last one when just European authors had been included was arranged on the European Saturday morning. For some attendees it happened to be their first online conference and despite the fact that it took a while for many of them to get used to the particularities of Teams® (fig. 7), which was the communication platform chosen for all online segments, debates were extremely fruitful and day after day everybody switched off his or her laptop with the feeling of having learnt important facts, having met interesting people and possible future collaborators, and above all the feeling of being participating in something important, something relevant, something absolutely committed to improve people's lives.

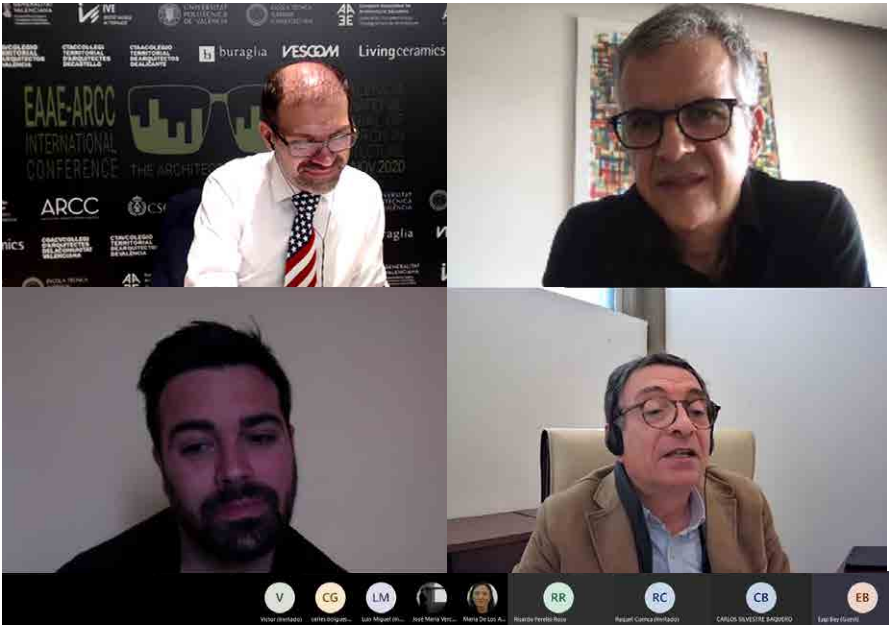

Figure 7. Participants at the online parallel session held at room A on Saturday, November 14, 2020, at 10:00

The success achieved in the nine previous editions of the joint conference – Montreal in 2002, Dublin in 2004, Philadelphia in 2006 and 2018, Copenhagen in 2008, Washington DC in 2010, Milan in 2012, Honolulu in 2014, and Lisbon in 2016 – was achieved once again in Valencia in 2020, being the most convincing argument for all the audience to focus on the next edition to be held in Miami in 2022. Until then we have two years of work in meaningful adverse conditions because of the global health crisis caused by the coronavirus disease. But architects are not only curious as previously mentioned and committed as easily deducible when being observed. Architects are basically optimistic people. Optimism is intrinsic to architectural teaching, practice or research. Nobody decides to become an architect if he or she does not have the wish of improving the world and the conviction of being capable of it through effort and dedication. The variety of tools available nowadays, the boundless amount of knowledge achieved by humankind along with the powerful set of mechanisms to access it, and mostly our renewed priorities, personal values of ways of doing (fig. 8) guarantee a worthy and fertile service of research to architecture and, consequently, of architecture to the society and the planet.

Figure 8. Participatory workshop organized by the Spanish studio El Fabricante de Espheras in Villena, Spain

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