A COLLECTION OF ESSAYS
FOR FACTUM FOUNDATION

We must expect great innovations to transform the entire technique of the arts, thereby affecting artistic invention itself and perhaps even bringing about an amazing change in our very notion of art.

Paul Valéry, 'The Conquest of Ubiquity', *Aesthetics*, 1928

Digital technologies are profoundly changing how we relate to art, from the ways in which we access and display objects to how we safeguard, restore, archive and even possess them.

The Aura in the Age of Digital Materiality explores themes emerging from the unprecedented potential of the meeting between digital technology and cultural heritage at a time when we are being forced to fundamentally rethink what we value, how and why. It brings together recent projects by Factum and a wonderfully diverse collection of essays, many written especially for this book, by collaborators and friends. Their widely different backgrounds and disciplines only illustrate the importance of this subject and the huge range of its relevance. Contributors include Hartwig Fischer, Director of the British Museum; Mari Lending, the author of *Plaster Monuments: Architecture and the Power of Reproduction*; Nadja Aksamija, Professor of Italian Renaissance and Baroque art and architecture at Wesleyan University; Egyptologist Nicholas Reeves; Pulitzer Prize-winning author Richard Powers; Shirley Djukurnã Krenak, Indigenous activist from the Upper Xingu; philosophers Bruno Latour, Brian Cantwell Smith and Alva Noë; Simon Schaffer, Professor of the History and Philosophy of Science at the University of Cambridge; architect Charlotte Skene Catling; Jerry Brotton, specialist in cartography and the Renaissance; and Chiara Casarin, Director of the Musei Civici di Bassano del Grappa.

Our world is at a crossroads. Not only are people at risk, but our cultural heritage is under threat from lack of resources, natural disasters, climate change, terrorism, mass tourism and war. There has never been a more critical time to use technology for preservation. If these high-resolution methods had been used to record Aleppo before it was flattened, the site of Nimrud or the Bamyan Buddhas before they were blown up, or Notre Dame before it burned, these examples of human creativity would not have been so completely lost forever. When Dresden was bombed, only photographs and memories remained. In the 21st century, we have the technological means to do so much: we urgently need to act now to record and preserve our cultural heritage for future generations. This book is a thoughtful and provocative call to action.

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THE AURA IN THE AGE OF DIGITAL MATERIALITY

RETHINKING PRESERVATION IN THE SHADOW OF AN UNCERTAIN FUTURE

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The project is part of the exhibition

LA RISCOPERTA DI UN CAPOLAVORO

12 March – 28 June 2020
Palazzo Fava, Palazzo delle Esposizioni, Bologna

A project of:

In collaboration with:

Under the patronage of:

Pontificio Consiglio della Cultura

Chiesa di Bologna

With the contribution of:

A collection of essays assembled by Factum Foundation to accompany the exhibition

The Materiality of the Aura: New Technologies for Preservation

Palazzo Fava, Bologna
12 March – 28 June 2020

'Factum Arte' can be translated from the Latin as 'made with skill'. Factum's practice lies in mediating and transforming material. Its approach has emerged from an ability to record and respond to the subtle visual information manifest in the physical world around us. Hundreds of decisions are embedded as material evidence in the process of making an object of any kind. Archaeologists are trained to read this evidence, as are forensic detectives at a crime scene. Patrick Blackett, an experimental physicist, wrote that his work was to 'cultivate an intimacy with the behaviour of the physical world' – this is an equally good description of Factum's aims.

Credits

This book has been assembled and edited by Adam Lowe, Elizabeth Mitchell, Nicolas Béliard, Giulia Fornaciari, Tess Tomassini, Blanca Nieto and Guendalina Damone.

All projects carried out by the Factum Foundation are collaborative and there are many people to thank. This is not the place to name everyone but some people have done a great deal to make all this work possible including: Charlotte Skene Catling, Otto Lowe, Tarek Waly, Simon Schaffer, Pasquale Gagliardi, Fondazione Giorgio Cini and everyone in ARCHiVe, Bruno Latour, Hartwig Fischer, Jerry Brotton, Roberto Terra, Cat Warsi, John Tchalenko, Manuela Mena, Peter Glidewell, The Griffith Institute, Emma Duncan, Lord Rothschild, Fabia Bromofsky, Ana Botín, Paloma Botín, Lady Helen Hamlyn, Ziyavudin and Olga Magomedov, Rachid Koraïchi, Andrew Edmunds, Colin Franklin, Ed Maggs, the Hereford Mappa Mundi Trust, Rosemary Firman, Philip Hewat-Jaboor, Helen Dorey, Peter Glidewell, Purdy Rubin, Fernando Caruncho, Susanne Bickel, Markus Leitner and everyone at the Swiss Embassy in Cairo, Jim Moran, Kathelin Gray, Johnny Allen, Bassam Daghestani, Mohammed Jameel, George Richards, David Coulson and the Trust for African Rock Art, Jeffrey and Veronica Berman, Ben and Donna Rosen, Clark Winter, Mauricio Torres Leclerc, Maria Golia, Anthony Sattin, Nicholas Penny, Mark Leithauser, Carole Patey, Michael Snodin, Silvia Davoli, Bill Sherman, Nico Schwartz, Julian Rothenstein, Ahmed Mater, Larry Keith, Jose Luis Colomer, Richard de Tscharner and the trustees of the Carène Foundation, William Ewing, Paula and Jim Crown, Sir Paul and Jill Ruddock, Jonathan and Jane Ruffer, Lindsay Stainton, Pippa Shirley, Juan Manuel Albendea, Casilda Ybarra, Jorge Coll, Ana Debenedetti, Gabrielle Finaldi, Stephen Clarke, The Gentle Author, Ali AlJuboori, Hansi Escobar, Ramon Blecua, Annette Warren Gibbons, Michael Jones, Rut Ballesteros, Rebecca Foote, Dinah Casson, Fabio Roversi Monaco, Richard Terra, People's Palace Projects, Shobita Punja, Sarah Thomas, Daniel Crouch, Fred Hohler, Sir Charles Saumarez Smith, Michael and Sarah Spencer, Aidan Weston Lewis, Nicholas Kugel, Pilar de la Béraudière, Dario Gamboni, Jorge Otero Pailos, Betsy Bolman, Ken Singer, Chiara Casarin, Matteo Lanfranconi, Mario Matthias Wivel, Chance Coughenour, Anna Somers Cocks, Bernardo Tortorici Montaperto, Clare Foster, Clemens Weijkamp and Raymond op het Roodt, Gabriele Finaldi, Jonathan N. Tubb, Phil Harvey, Roberto Grandi, Roger Law, Sarah Thomas, and many others who care about the preservation of the past.

And, of course, everyone at Factum Arte who works tirelessly to support the Factum Foundation and turn its vision into a reality.

This book is dedicated to Pasquale Gagliardi, who first got the ball rolling.

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PREFACE

Fabio Roversi Monaco

Fabio Alberto Roversi Monaco held the position of High Rector of the University of Bologna from 1985–2000. He is Emeritus Professor of Administrative Law at the same university. He conceived and realised the Magna Charta Universitatum and is founder and Honorary President of the Observatory Magna Charta Universitatum. He was President of Banca IMI, where he currently holds the position of Vice President. He was President of the Academy of Fine Arts in Bologna. From 2001 to 2013 he was President of the Cassa di Risparmio di Bologna Foundation and today he holds the position of President of the Society Museum of the City of Bologna.

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Putting the finishing touches to the facsimile of Veronese's *Wedding at Cana*, in Palladio's refectory on the island of San Giorgio Maggiore, Venice, 2007.

OPPOSITE

Detail from the predella of the *Polittico Griffoni*, painted by Ercole de' Roberti in 1473 and now in the Pinacoteca Vaticana, Vatican City.

FOLLOWING PAGES

Compianto sul Cristo morto (*Lamentation over the Dead Christ*) by Niccolò dell'Arca, c. 1463, situated in the church of Santa Maria della Vita in Bologna. The *Compianto*, which consists of seven life-size terracotta statues, was recorded by Factum Foundation using photogrammetry in 2019.

Thanks to the extraordinary collaboration of nine international museums, one of the greatest masterpieces of the Italian Renaissance, the *Polittico Griffoni* by Francesco del Cossa and Ercole de' Roberti, returns to shine in the city for which it was created, 300 years after its dismemberment between 1725 and 1731.

While the original panels will return home after the 100-day exhibition, their digital replicas will remain in the city. Thanks to the rigorous work and innovative technologies of Factum Foundation, the perfect reproduction of the polyptych will be able to be admired first in San Petronio, in the original chapel, and then within the Museo della Storia di Bologna, where it will remain indefinitely.

Already in 2012, Factum had created for the Museo della Storia di Bologna the impressive facsimile of the fresco showing the bird's-eye view map of Bologna from the Sala Bologna at the Vatican Apostolic Palace. This intervention was part of a larger project involving the recording of the whole room, which was intended to inform the restoration of damaged or incomplete areas and the reconstruction of lost fragments.

If the facsimile of the map of Bologna made it possible for the public to enjoy an otherwise inaccessible artwork, Factum's work with respect to the *Polittico Griffoni* has sought to restore the original arrangement of a dismantled polyptych, making it possible to appreciate the artefact in its original form.

Over the past 20 years, Factum Foundation has dedicated itself to documenting, monitoring, studying, and recreating the world's cultural heritage: from its initial work on Egyptian tombs, to the facsimile of the *Wedding at Cana*, to the re-materialisation of Caravaggio's *Nativity* (perhaps stolen by the mafia), to mention only a few of its projects.

The creation of reproductions or the digitisation of works, which has many and diverse uses, is of enormous importance today not only for the conservation of works of art, put at risk due to the natural passing of time or reckless human actions, but also for preserving the memory of certain contexts that no longer exist. This is the case for our project on the *Polittico Griffoni*.

Adam Lowe's entire work aims, with great intelligence, at an ever-deeper understanding of the material aspects that make up works of art. 'Every work of art is a dynamic object: it ages and changes, like people. It is not something immutable – it is a process.' Thus, for Adam, 'recording' the surface of a work is first and foremost a question of knowledge.

Ultimately, with the exhibition of the *Polittico Griffoni*, Factum allows us to reflect profoundly on ways in which digital technologies, in both physical and virtual form, are changing our perspectives on the *sharing* and *protection* of the evidence of the past.

INTRODUCTION

Adam Lowe

Adam Lowe is the Director of Factum Arte and the founder of Factum Foundation for Digital Technology in Conservation.

This publication focuses on Factum Foundation's work to promote the use of high-resolution recording, digital restoration and creative re-materialisation while bringing into focus the changing attitudes towards owning, sharing, preserving and displaying cultural artefacts. It accompanies two related exhibitions: *La Riscoperta di un Capolavoro* and *La Materialità dell'Aura* at Palazzo Fava in Bologna. *La Riscoperta di un Capolavoro* is focused on the reunification of the 16 original panels that still exist from the *Polittico Griffoni*, the altarpiece which stood in the Griffoni Chapel in the Basilica of San Petronio until it was broken up in 1725. The 16 tempera paintings by Francesco del Cossa and Ercole de' Roberti will be exhibited together with 16 facsimiles arranged in what is thought to be the original configuration of the altarpiece – allowing it to be seen as its patrons and makers intended. *La Materialità dell'Aura* examines the ways in which works of art are recorded, remade and presented.

The aim of the collection of thoughts and images in this book is to encourage reflection on the ways that digital technologies, in virtual and physical form, are changing our approach to the *pre*servation and *con*servation of the material evidence of the past. High-resolution digital recording and long-term secure archiving are the parentheses that are shaping this debate. If an object is recorded correctly it can be analysed, studied, shared and rematerialized for a variety of purposes. This approach to recording requires an understanding of different processes and is generating a host of new skills that are led by the technologies: composite photography, land-based and aerial photogrammetry, close-range 3D scanning, long-range scanning in colour and 3D, Reflectance Transformation Imaging (RTI) and photometric stereo, multi-spectral imaging and microscopy. The recording is the foundation of everything that follows. The data can then be used in different ways. In its digital form it can be made accessible worldwide where it can be used as both an educational and creative resource. It can be optimized and used for virtual, augmented, and mixed realities. It can be scientifically analysed for forensic purposes. It can become the source material for digital restorations that never touch the original artwork. It can be rematerialised using various 3D output technologies. It can be analysed with AI self-learning neural networks. It can inform exhibition display and it is leading to a digital connoisseurship based on a mix of fact and opinion, knowledge and evidence.

Twenty years ago, when Factum was being formed, there was a real excitement about what was possible. The 3D data recorded in 2001 in the tomb of Seti I set new standards that have still not been significantly improved in terms of 3D resolution and a correspondence between the original and the re-materialised surface. In 2007, when discussing the facsimile of Veronese's *Wedding at Cana* on his television show *Passepartout*, Philippe Daverio threw a copy of Walter Benjamin's famous essay *The Work of Art in the*

OPPOSITE

Render of the interior of the sarcophagus of Seti I, showing the figure of Nut, goddess of the sky, lying beneath the mummified body of the pharaoh. The sarcophagus is covered with text from the Book of Gates, which guides the deceased on their journey through the afterlife. The sarcophagus has been in Sir John Soane's Museum in London since 1824, when Sir John Soane purchased it from Belzoni.

THIS PAGE

Pedro Miró using structured light scanning to record the statue of Idrimi in the British Museum, 2017.

OPPOSITE

Completed facsimile of the Tomb of Raphael from the Pantheon, 2020.

Age of Mechanical Reproduction over his shoulder stating that in a digital age we need to rethink the relationship between originality and authenticity. At a time when technology is moving very fast, this re-thinking is taking its time. While the arguments have moved on from Walter Benjamin's position that was important in the mid-1930s, a clear map of the new territory created by digital technology has yet to emerge. There is a vast accumulation of thoughts around the theme, but the 'aura' has remained more or less intact as the thing that separates an original from its copy. Jean Clair, the ex-Director of the Musée Picasso and the Venice Biennale, in his book *L'hiver de la culture* has argued that it is better to display replicas than to fill museums with deteriorating relics. The V&A's exhibition and publication *A World of Fragile Parts* (2016) took a general look at the value of copies while the ReACH initiative, organized by the V&A and the Peri Foundation, resulted in the publication *Copy Culture*, outlining important issues relating to data ownership, high-resolution recording and data sharing. The position of UNESCO, ICOMOS and other professional bodies is significantly out of date.

Walter Benjamin struggled to define exactly what he meant by 'the aura'. His choice of metaphor, suggesting both halo and radiation, is actually the opposite of the physical evidence that makes an object specifically what it is. Objects are the repositories of compounded ideas, thoughts, materials, evidence, transactions and the actions of time. They are the counterpoint of the ephemeral communications of today – they require time and reflection but they deliver complex insights – they reflect and redirect every thought we impose upon them.

Lithographically printed images of works of art will always lack many of the qualities of the original. New imaging technologies and 3D recording systems allow us to close the gap between an object and its reproduction. No copy will ever re-materialise everything that is in the original, but the closer the replication comes, the more can be

revealed. In part this will allow us to understand the decisions and materials that make the original, the way it has aged and decayed and the things that have happened to it over its lifetime. All things are in a constant dynamic process of change. Replicas not only help us understand and empathise, they can also encourage us to become aware of our temporal and perspectival limitations.

Digitality and auras have much in common; they are far from being discrete, stable and clearly defined. Digitality was once associated with the virtual but is becoming increasingly physical. Digital data is dependent on electricity and human input. For Benjamin the aura is intrinsic to, and emanating from, the object; in reality the aura is

projected onto the object by the viewer and is the product of our own perception of value, our beliefs and prejudices. When these change, the aura can relocate.

Digital technology can be used to accurately record different aspects of an object. The aura inhabits these spaces. The digital used to be virtual, now it has the potential to be both virtual and physical, greatly magnified facilitating closeness, penetrated with multi-spectral light sources revealing under-painting and allowing pigments to be analysed and re-materialised. Technology is evident in both the mechanics of the hardware and the elegance of the algorithms that shape the software. Both, in the hands of skilled digital artisans, are leading to new insights and understanding. When concepts are divorced from physical evidence they tend to disperse. Thoughts and ideas need to find their form: the written word, song, dance, music, performance, architecture, sculpture, painting and both tangible and intangible representation. They are always rooted in their time but accessible to those who look, listen and question. Walter Benjamin starts his essay with a quote from Paul Valéry's 'The Conquest of Ubiquity':

> For the last twenty years neither matter nor space nor time has been what it was from time immemorial. We must expect great innovations to transform the entire technique of the arts, thereby affecting artistic invention itself and perhaps even bringing about an amazing change in our very notion of art (*Aesthetics*, 1928).

Digital technology is bringing about that 'amazing change', but Valéry's prediction seems almost prophetic if you read what follows that quote in the original text:

> At first, no doubt, only the reproduction and transmission of works of art will be affected. It will be possible to send anywhere or to re-create anywhere a system of sensations, or more precisely a system of stimuli, provoked by some object or event in any given place. Works of art will acquire a kind of ubiquity. We shall only have to summon them and there they will be, either in their living actuality or restored from the past. They will not merely exist in themselves but will exist wherever someone with a certain apparatus happens to be. A work of art will cease to be anything more than a kind of source or point of origin whose benefit will be available and quite fully so, wherever we wish.

While Valéry was imagining the internet, Benjamin mused on the progression from woodblock to lithography and then onto photography, silent film and talking cinema. He considers what is lost between the performance of an actor on stage and the stars of the screen. In an essay on mechanical reproduction the concept of performance could apply to copies of paintings and sculptures as much as music and theatre. In this context Alois Auer's remarkable work at the Imperial Printing Works in Vienna in the 1840s (when electricity was making the photo-mechanical revolution possible) is significant. In Auer's environment of curiosity and experimentation, driven by the commercial potential of mass media, image and form were merging and the physical nature of things was being examined and celebrated. The discrete patterns of coloured dots that formed the printed image sat alongside continuous gradations of tone that contained the seeds of the digital revolution that has brought with it a host of materialisation methods that can be loosely called 3D printing.

FOLLOWING PAGES

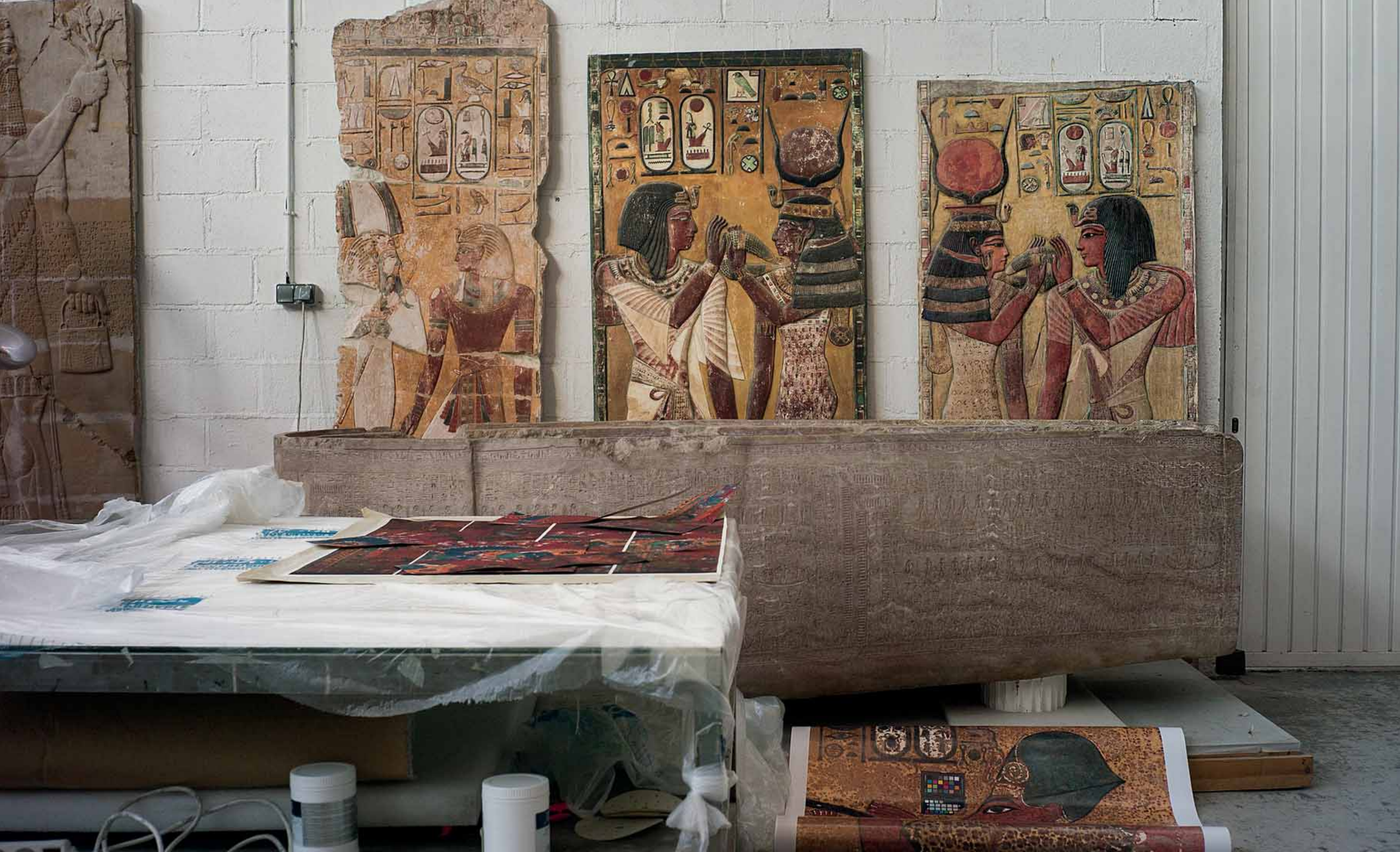
Back to front: a test for the facsimile of the *Martyrdom of St Matthew* by Caravaggio; topographic and bathymetric data from the surface of the globe without water; and two works from Ahmed Mater's series *Mitochondria: Powerhouses* (first shown at Galleria Continua, San Gimignano, 2017).

Background: a test for the facsimile of Tutankhamun's tomb; a re-creation of Raphael's *Christ Falling on the Way to Calvary* (now in the Museo del Prado) painted for the church of Lo Spasimo, Palermo; and an altar made by Factum Arte from a print by Piranesi published in *Vasi, candelabri, cippi, sarcofagi, tripodi, lucerne, ed ornamenti antichi disegnati ed incisi dal Cav. Gio. Batt. Piranesi*, Rome, 1778. Foreground: the re-creation of the lost silver map by al-Idrisi, made for Roger II of Sicily but lost in a shipwreck in the 12th century.

Background, left to right: a CNC-carved relief panel from the north-west palace of Ashurnasirpal II, Nimrud; a facsimile of a pillar face from the tomb of Seti I in the Pergamon Museum, Berlin; and facsimiles of two facing door-frames from the tomb of Seti I, now in the Museum of Archaeology, Florence, and the Musée du Louvre, Paris. Middle distance: a facsimile of Seti I's sarcophagus from Sir John Soane's Museum in London. Foreground: tests for a print of a destroyed temple in Tibet by Thomas Laird; colour test for a new recording of the tomb of Tutankhamun made in 2019 (in order to carry out a direct comparison with the colour recording of 2009).

New technologies are seldom new. Photo-sculpture emerged in Paris in 1851 and electroforming played an important role in the formation of the Victoria and Albert museum after the Great Exhibition of 1851. 3D recording and 3D output methods do not feature in Benjamin's idea of mechanical reproduction where a photograph is an image that subjectively records the material world and in turn is imperfectly reproduced by different printing systems available at low cost and in high volume. He focused on the impact that this was having on shaping public opinion. The media was pushing the aesthetics of Fascism and the propaganda of Communism. Benjamin's essay was written in German in 1935 and published in French in 1936 when many could see the world was only heading one way. The manipulation of printed media was playing an important role and seeding conflict. Benjamin's understanding of technology predicts the fake news, data harvesting and ephemeral twitter feeds devoid of truth that fuel today's political debate. Benjamin, the cultural critic, understands the ways in which technology was being harnessed for political control. Valéry, the poet, is thinking about a system of stimuli and works of art available wherever we wish. In today's digital world, augmented- virtual- and mixed-realities exist alongside new recording and output technologies capable of highly faithful physical 're-productions'. In turn this is changing the way we think about preservation, display, dissemination, archiving and ownership.

This collection of essays and short texts does not attempt to be definitive, but it touches on many of the concerns facing preservation today. Most of the authors or projects have a direct connection to Factum, others less so. In each case, the words and images help to map out the rapidly changing territory. Charles-Germain de Saint Aubin titled his caricature of a satyr inspecting Boucher's portrait of Madame de Pompadour at the Salon of 1757 'La verité Surmonte l'Autorité'. Hopefully technology is helping us to look past our own prejudices and re-think why culture is essential for communication. Today would the same satyr inspecting the facsimile of Boucher's painting in the exhibition *Madame de Pompadour in the Frame* at Waddesdon Manor, feel that the aura has become unfaithful, inhabiting both the original object and the authentic copy.



CHAPTER 1

RE-THINKING THE FUNCTION OF FACSIMILES

SAVING THE BEST WINE FOR LAST

Richard Powers

This is the transcript of a presentation given by Richard Powers at an interdisciplinary discussion entitled 'Coping with the Past' that took place at the Giorgio Cini Foundation on the island of San Giorgio Maggiore, Venice in 2009.

Richard Powers is a novelist whose works explore themes from science, technology and nature. He was awarded a MacArthur Fellowship in 1989, the National Book Award in 2006 for his novel *The Echo Maker*, and a Pulitzer Prize in 2019 for *The Overstory*.

PREVIOUS PAGE

Crowds in front of the *Mona Lisa* in the Musée du Louvre, Paris, with Veronese's *Wedding at Cana* in the background.

OPPOSITE

Factum Arte's facsimile of the *Wedding at Cana* in Palladio's refectory on the island of San Giorgio Maggiore, Venice, the space for which the original was conceived and painted.

My goal in this session is for us to use the language of storytelling – character, setting, scene, focalization, plot, reversal, exposition, development, denouement, all the conventions of narrative expectation – to reveal the hidden stories that underwrite our different disciplines.

So let me start by looking for the similarity at the core of four related stories. In the oldest of the four, a young man attends an enormous party that is about to turn into a disaster of the first order. The host has misjudged his guests' needs and run out of libation. The whole social fabric of the gathering is about to unknit. Reluctantly, the young man undertakes an act of creative makeover, converting ordinary water into something that not only perfectly resembles wine but passes for wine of the finest quality. The guests marvel at the miraculous conversion, the gathering is refreshed, and earthly possibility is rewritten. And I am left with two slightly frivolous questions: first, why does this story become immortal? And second, why did the young man need to start with water in the first place? Why didn't he just make wine spring up from empty vessels?

In the second oldest story, a young man at the height of his power is commissioned by a prominent institution in a city nearing its zenith to recreate that first story. After a millennium and a half of countless representations, that narrative has become so familiar it is all but invisible. In an astonishing 15 months, the man transforms a mainsail's worth of canvas into a scene both ancient and current. He places the biblical story in a strange Greco-Roman-Renaissance assemblage and populates it with 130 contemporaries, including himself and two other masters of visual simulation. A fossilized story becomes, through *re*-presentation, something weirdly, unnervingly re-*presented* – old wine in new bottles. Viewers marvel at the miraculous translation, legacy is reaffirmed, and the past is re-inhabited.

In the third oldest story, an obscure 20th-century French poet, essayist, and translator from Nîmes sets out to recreate Don Quixote. He doesn't mean to copy or transcribe the canonical masterpiece, or even to write his own contemporary version of the story, which would be too cheap and easy. He does not want to create one of 'those parasitic books which situate Christ on a boulevard, Hamlet on La Canebière or Don Quixote on Wall Street'. Instead, 'His admirable intention [is] to produce' from out of the context of his own historical moment and his own personal experience 'a few pages which [will] coincide – word for word and line for line – with those of Miguel de Cervantes'. Over the course of three centuries, the comic epic has become lost inside its own aura. Once, the poet says, the Quixote was a profoundly transforming entertainment; 'now it is the occasion for patriotic toasts, grammatical insolence and obscene de luxe editions. Fame is a form of incomprehension, perhaps the worst'.

Over countless sleepless nights, tearing up and revising thousands of tortured manuscript pages in an archaic language that he hasn't even mastered, the young man arrives

– through the force of his own experience and creative impulse – at a handful of passages judged by an outside reader to be an astounding revelation. For the exact same words are now wiser, more surprising, and more achingly profound because of the three centuries of historical contingency that have added to the pain and comedy of the tale. To tilt at those windmills in the early 17th century is inspired satire. To do so in the age of trench warfare and aerial bombardment is the most divine madness. Pierre Menard, as his literary executor Borges says, 'has enriched, by means of a new technique, the halting and rudimentary art of reading: this new technique is that of the deliberate anachronism and the erroneous attribution'. Scholars of the restored passages marvel at the miraculous reconstruction, the canon is revivified, and the society of reading is re-inscribed.

In the youngest of the four stories, a vast network of artists, historians, scholars, scientists, engineers, programmers, designers, technicians, and countless others, few of them known to one another, aggregate for the startling task, not of transcribing a 67 sqm painting almost half a millennium old, but of recreating it, re-originating it, through many thousands of agonizing decisions, at dizzy degrees of fidelity. But fidelity not to some static original, but to a 'trajectory of transformations' set loose in the constantly changing run of social time. To fill a refectory wall at the height of the Renaissance with an ancient story of renewal is an act of mastery, faith, cohesion, exuberance, and conviction. To restore that same wall with that same painting of that same ancient episode – after Darwin, after Hiroshima, after the launch of interplanetary probes, after decolonisation, after the onset of global warming and mass extinction, after nanocomputing, after the discovery of the molecular basis of life – and to do so with technologies that have broken free of any individual's ability to understand, now becomes an act of near-perverse regeneration. Those who had lost the ability to see anything at all in the aura-laden original will look again. New gatherings will be refreshed. Future pasts will be reformed. The reproduction reawakens the original.

The thing that makes these four stories similar is one peculiar power of narrative. Narrative is, of course, the thing that keeps time from collapsing into just one damn thing after the other. It's the grouping of a series of events and interactions into a significant arc. Narrative accomplishes this conversion primarily by bringing about, in the willing mind, a strange reversal of the dominant direction of time.

The act of reading consists, in Peter Brook's memorable phrase, of 'the anticipation of retrospection'. In the quotidian experience of unreflective time, the past is fixed and gradually forecloses on the open future. In the reflexive experience of narrative time, the pre-existing future constantly changes the mutable past. You read page 10, already knowing it will mean something very different by page 300. And sure enough, by page 300, page 10 has changed utterly, although it remains word for word the same. Page 10 posts itself forward, waiting for page 300 to intercept and reinterpret it.

Every new event in a story alters the events that generated it. Veronese re-enchants what happened at Cana. Borges re-canonizes Cervantes. Lowe re-cognizes Veronese. In an age obsessed with innovation and individuality, it pays to remember Eliot's words in the essay 'Tradition and the Individual Talent': 'the most individual parts of [the poet's] work may be those in which the dead poets, his ancestors, assert their immortality most vigorously'. [Or better yet, his famous words from *Four Quartets*: 'We shall not cease from exploration, and the end of all our exploring will be to arrive where we started and know the place for the first time'.]

Yeki bood, yeki nabood. This is the traditional Persian fairy tale opener: it was like this, but it wasn't like this. The English gambit is *Once upon a time*. *C'era una volta*. *Il était une fois*. This is the seditious contract between the writer and reader of fiction: the following isn't real, but treat it as if it were. And the contract is offered up in a time that was in time once, but isn't anymore, except in the time recreated by narrative time. So the question immediately arises: why should something with no material basis in fact and lying outside actual time have any emotional power to move or rearrange us? The answer, I think, is that our brains have been shaped by natural selection to take the map for the place and use it as a shortcut into the *nunc stans*, the standing now.

Fiction sacrifices an ontological hostage in order to ransom an epistemological one. And it does so once, upon time itself. By inverting time, stories restore us *to* time. Stories aren't just *like* some world, they *are* the traces of mind, negotiating the world. Representations are real things: ask the writers of the code that controls the scanner that recorded Veronese and helped Adam (Lowe) bring a factual past back into the dynamic present. But representations are not slaves to a conventional realism; they *fashion* the conventions we use to sense ourselves in time. By releasing the present to once again resemble and re-assemble the past, representations can free the past to rejoin its vital new futures.

Good reading is the act of empathically becoming any number of desperate characters colliding with each other. But the collisions that fiction portrays must be as robust as the collisions of this world, in which every character fashions herself as a moral center. The impoverishing novel – or call it the fundamentalist novel – is dominated by a single, monolithic conviction. The story means less than it says. In enriching novels, the map gives way to a wider place. Good writing and good reading reproduce not fixed, autonomous positions, but interdependent assemblages of hopes, fears, dreams, legacies and testaments, woven into a shared text-tile by countless shareholders, a textile being constantly rehabilitated.

Over the last two days, I've been hearing this group move toward a provisional starting point for how we might begin to tell impoverishing stories from enriching ones: impoverishing narratives collapse reciprocal, dynamic processes into amnesiac packaged products. Enriching narratives release products into long-time processes. Bad stories are full of monolithic, privileged certainties that stop time and collapse focal perspective to a controlling view. Good stories move the reader freely across all three tenses, through a country full of voices. Bad stories get us to side with the hero. Good stories get us to keep changing sides, and even to change the sides themselves.

Here are some hidden narratives we've touched on that can impoverish our existence in time: the myth of cultural progress or, on the other hand, the myth of the golden age, the myth of the unique destiny or the myth of the invariant inheritance, the myth of the privileged present, the myth of the intact origin, the myth of the solitary maker, the myth of autonomous innovation.

What of the narratives that restore and renovate time? We have a little over one hour to find them. Stranger things have happened, *c'era una volta*.

In the Greek New Testament, the common word for miracle is *semeion*: 'sign'. And from this word – by what Bruno Latour calls devious etymology, using that wonderfully fictional reconstruction, Proto-Indo-European – I can get to the word facsimile. At impoverished parties, the good stuff comes out first and it's downhill from there. Enriching gatherings – those that spill backwards into the future past – make from the merely similar something miraculous, forever saving the best wine for last.

THE MIGRATION OF THE AURA, OR HOW TO EXPLORE THE ORIGINAL THROUGH ITS FACSIMILES

Bruno Latour and Adam Lowe

A chapter prepared by Bruno Latour and Adam Lowe for *Switching Codes: Thinking Through Digital Technology in the Humanities and in the Arts*, eds. Thomas Bartscherer and Roderick Coover (Chicago: University of Chicago Press, 2011)

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OPPOSITE

The statue of Idrimi (c. 1600–1500 BCE) was excavated in the 1930s in what is now the Hatay region of Turkey. The inscription states that Idrimi, originally from Aleppo, travelled across the Middle East to Emar and Canaan before becoming ruler of Alalakh (in Hatay). A facsimile was made for the charity Making Light. It will be part of an exhibition about migration and refugees from the conflict in Syria.

Something odd has happened to Holbein's *The Ambassadors* at the National Gallery in London. The visitor does not immediately know how to describe her malaise. The painting is completely flat; its colours bright but somewhat garish; the shape of every object is still there but slightly exaggerated; she wonders what has happened to this favourite painting of hers. 'That's it', she mutters, 'The painting has lost its depth; the fluid dynamics of the paint have gone. It is just a surface now'. But, what does this surface look like? The visitor looks around, puzzled, and, then, the answer dawns on her: it resembles almost exactly the poster she bought several years ago at the Gallery bookshop, and that still hangs in her study at home. Only the dimension differs.

Could it be true, she wonders. Could they have *replaced* the *Ambassadors* by a facsimile? Maybe it's on loan to some other museums, and, so as to not disappoint the visitors, they put up with this copy. Or maybe they did not want to trick us, and it is a projection. It is so flat and bright that it could almost be a slide projected on a screen… Fortunately, she composes herself enough to not ask the stern guard in the room whether this most famous painting is the original or not. What a shock it would have been. Unfortunately, she knows enough about the strange customs of restorers and curators to bow to the fact that this is, indeed, the original although only in name, that the real original has been irreversibly lost and that it has been substituted by what most people like in a copy: bright colours, shining surface, and above all a perfect *resemblance* with the slides sold at the bookshop that are shown in art classes all over the world by art teachers most often interested only in the shape and theme of a painting but not by any other marks registered in the thick surface of a work. She leaves the room suppressing a tear: the original has been turned into a *copy of itself looking like a cheap copy*, and no one seems to complain, or even to notice, the substitution. They seem happy to have visited in London the original poster of Holbein's *Ambassadors*!

Something even stranger happens to her, some time later, in the Salle de la Joconde in the Louvre. To finally get at this cult icon of *The DaVinci Code*, hundreds of thousands of visitors have to enter through two doors that are separated by a huge framed painting, Veronese's *Nozze di Cana* (*Wedding at Cana*), a rather dark giant of a piece that directly faces the tiny *Mona Lisa*, barely visible through her thick anti-fanatic glass. Now the visitor is really stunned. In the Hollywood machinery of the miraculous wedding, she no longer recognizes the facsimile that she had the good fortune of seeing at the end of 2007 when she was invited by the Cini Foundation to the island of San Giorgio, in Venice. There it was, she remembers vividly, a painting on canvas, so thick and deep that you could still see the brush marks of Veronese and feel the sharp cuts that Napoleon's orderlies had to make in order to tear the painting from the wall, strip by strip, before rolling it like a carpet and sending it as war booty to Paris in 1797 – a cultural rape very much in the

mind of all Venetians, up to this day. But there, in Palladio's refectory, the painting (yes, it was a painting even though it was produced through the intermediary of digital techniques) had an altogether different meaning: it was mounted at a different height, one that makes sense in a dining room; it was delicately lit by the natural light of huge east and west windows so that at about 5pm on a summer afternoon the light in the room exactly coincides with the light in the painting; it had, of course, no frame; and, more importantly, Palladio's architecture merged with admirable continuity with Veronese's painted architecture, giving this refectory of the Benedictine monks such a *trompe l'œil* depth of vision that you could not stop yourself from walking slowly back and forth and up and down the room to enter deeper and deeper into the mystery of the miracle.

But here, in the *Mona Lisa* room, even though every part of the painting looked just the same (as far as she could remember), the meaning of the painting she had seen in Venice seemed entirely lost. Why does it have such a huge gilt frame? Why are there doors on both sides? Why is it hanging so low, making a mockery of the Venetian balcony on which the guests were crowding? The bride and groom, squashed into the left hand corner, seemed peripheral here, while in Venice, they were of great importance, articulating a scene of sexual intrigue that felt like a still from a film. In Paris, the composition made less sense. Why this ugly zenithal light? Why this air-conditioned room with its dung brown polished plaster walls? In Venice, there was no air-conditioning; the painting was allowed to breathe by itself as if Veronese had just left it to dry. And, anyway, the visitors could not move around the painting to ponder those questions without bumping into others momentarily glued (queued) to the *Joconde* turning their backs to the Veronese.

A terrible cognitive dissonance. And yet there was no doubt that this one, in Paris, was the original; no substitution had occurred, no cheating of any sort – with all its restoration, Veronese would certainly be surprised to see the painting looking as it does, but that's different from cheating. She remembered perfectly well that in Venice it was clearly written: 'A facsimile'. And in San Giorgio there was even a small exhibition to explain in some detail the complex digital processes that Factum Arte, the workshop in Madrid, had used to de- then re-materialize the gigantic Parisian painting, carefully laser scanning it, A4 by A4, photographing it in similarly sized sections, white light scanning it to record the relief surface, and then somehow managing to stitch together the digital files before instructing a purpose-built printer to deposit pigments onto a canvas carefully coated with a gesso almost identical to that used by Veronese. Is it possible that the Venice version, although it clearly states that it is a facsimile, is actually *more original* than the Paris original, she wonders? She now remembers that on the phone with a French art historian friend, she had been castigated for spending so much time in San Giorgio with the copy of the *Nozze*: 'Why waste your time with a fake Veronese, when there are so many true ones in Venice?!' her friend had said, to which she had replied, without realizing what she was saying: 'But come here *to see it for yourself*, no description can replace seeing this original… oops, I mean, is this not the very definition of "aura"?…' Without question, for her, the aura of the original had *migrated* from the Louvre to San Giorgio: the best proof was that you had to come to the original and see it. What a dramatic contrast, she thought, between the Veronese and the *The Ambassadors*, which claims to be the original in order to hide the fact that it is an expensive copy of one of its cheap copies!

'But it's not the original, it's just a facsimile!' How often have we heard such a retort when confronted with an otherwise perfect reproduction of a painting? No question about it, the obsession of the age is for the original version. Only the original

LiDAR scan of the interior of the Cathedral of the Nativity of the Virgin at Ferapontov, Russia, painted by Dionisy and his assistants in 1502. The frescoes were recorded by the Peri Foundation and Factum Foundation in 2017.

possesses an aura, this mysterious and mystical quality that no second-hand version will ever get. But paradoxically, this obsession for pinpointing originality increases proportionally with the availability and accessibility of more and more copies of better and better quality. If so much energy is devoted to the search for the original – for archeological and marketing reasons – it is because the possibility of making copies has never been so open-ended. If no copies of the *Mona Lisa* existed, would we pursue it with such energy – and, would we devise so many conspiracy theories to decide whether or not the version held under glass and protected by sophisticated alarms is the original surface painted by Leonardo's hand or not?

So, in spite of the knee-jerk reaction – 'But this is just a facsimile' – we should refuse to decide too quickly when considering the value of either the original or its reproduction. Thus, the real phenomenon to be accounted for is not the punctual delineation of one version divorced from the rest of its copies, but the whole assemblage made up of one – or several – original(s) *together with* the retinue of its continually rewritten biography. It is not a case of 'either or' but of 'and, and'. Is it not because the Nile ends up in such a huge delta that the century-old search for its sources had been so thrilling? To pursue the metaphor, we want, in this paper, to behave like hydrographers intent in deploying the whole catchment area of a river, not only focusing on an original spring. A given work of art should be compared not to any isolated locus but to a river's catchment, complete with its estuaries, its many tributaries, its dramatic rapids, its many meandering turns and, of course, also, its several hidden sources.

To give a name to this catchment area, we will use the word *trajectory*. A work of art – no matter of which material it is made – has a trajectory or, to use another expression popularized by anthropologists, a career.[1] What we want to do in this paper is to specify the trajectory or career of a work of art and to move from one question that we find moot ('Is it an original or merely a copy?') to another one that we take to be decisive, especially at the time of digital reproduction: 'Is it *well* or *badly* reproduced?'. The reason why we find this second question so important is because the quality, conservation, continuation, sustenance and appropriation of the original depends entirely on the distinction between good and bad reproduction. We want to argue that a badly reproduced original risks disappearing while a well accounted for original may continue to enhance its originality *and* to trigger new copies. This is why we want to show that facsimiles, especially those relying on complex (digital) techniques, are the most fruitful way to explore the original and even to help re-define what originality actually is.

To shift the attention of the reader away from the detection of the original to that of the quality of its reproduction, let us remember that the word 'copy' does not need to be so derogatory, since it comes from the same etymology as 'copious', and thus designates a source of *abundance*. To the question: 'Is this isolated piece an original or a facsimile?', it might be more interesting to ask: 'Is this segment in the trajectory of the work of art barren or fertile?'.

To say that a work of art grows in originality thanks to the quality and abundance of its copies, is nothing odd: this is true of the trajectory of any set of interpretations. Abraham has become the father of a people 'as numerous as the grains of sand' only because he had a lineage. Before the birth of Isaac, Abraham was a despised, barren old man. That he became 'the Father of three religions' is a result of what happened to Isaac, and, subsequently, what happened to every one of his later sons and daughters. Such is the 'awesome responsibility' of the reader, as Charles Péguy so eloquently said, because this process is entirely reversible; 'if we stop interpreting, if we stop rehearsing, if we stop reproducing, the very existence of the original is at stake. It might stop having abundant copies and slowly disappear'.[2]

We have no difficulty raising questions about the quality of the entire trajectory when dealing with the *performing* arts, such as dance, music and theatre. Why is it so difficult when faced with the reproduction of a painting, a piece of furniture, a building or a sculpture? This is the first question we want to clarify.

No one will complain on hearing *King Lear*: 'But this is not the original, it is just a representation!'. Quite right. That's the whole idea of what it is to *play King Lear*: it is to *replay* it. In the case of a performance, everyone is ready to take into account the whole trajectory going from the first presentations through the long successions of its 'revivals' all the way to the present. The Platonic ideal of *King Lear* is something which no one has ever seen and no one will ever be able to circumscribe. In addition, it requires no great sophistication to be fully prepared for disappointment at not finding 'the' first, original presentation by Shakespeare 'himself', but several premieres and several dozen different versions of the written play with endless glosses and variations. We seem perfectly happy

1 Arjun Appadurai, *The Social Life of Things: Commodities in Cultural Perspective* (Cambridge: Cambridge University Press, 1986); Miguel Tamen, *Friends of Interpretable Objects* (Cambridge, MA: Harvard University Press, 2001).
2 See the commentaries of Péguy in Gilles Deleuze, *Difference and Repetition*, trans. Paul Patton (New York: Continuum International Publishing, 2005).

to be excited by the anticlimactic discovery of the source of a major river in a humble spring barely visible under the mossy grass. Third, and even more importantly, spectators have no qualm whatsoever at judging the new version under their eyes by applying the shibboleth: 'Is it well or badly (re)played?'. They can differ wildly in their opinions, some being scandalized by what they take as some revolting novelties ('Why does Lear disappear in a submarine?') or bored by the repetition of too many clichés, but they have no difficulty in considering that this moment in the whole career of all the successive *King Lears* – in the plural – should be judged *on its merit* and not by its mimetic comparison with the first (entirely inaccessible anyway) presentation of *King Lear* by the Shakespeare company in such and such a year.

So free are we from the comparison with any 'original', that it is perfectly acceptable to evaluate a replay by saying: 'I would never have anticipated this; it is totally *different* from the way it has been played before; it is utterly *distinct* from the way Shakespeare played it, *and yet* I now understand what the play has always been about!'. It is accepted that some revivals – the good ones – have the capacity to dig out of the original novel traits that might have been potentially in the source, but that have remained invisible until now. So, even though it is not evaluated by its mimetic resemblance to an ideal exemplar, yet it is clear, and everyone might agree, that, because of the action of one of its late successors, the genius of Shakespeare has gained a new level of originality because of the amazing feat of this *faithful* (but not mimetic) reproduction. The origin is there anew, even though it is so different from what it was. And the same phenomenon would occur for any piece of music or dance. The exclamation: 'It's so original' attributed to a new performance does not describe one section along the trajectory (and especially not the first *Ur*- version) but the *degree of fecundity of the whole cornucopia*. In performance art, the aura keeps migrating and might very well come back suddenly… or disappear altogether. When so many bad repetitions have so decreased the level of fecundity of the work that the original itself might be abandoned, it will stop being the starting point of any succession. Such a work of art dies out like a family line without any lineage.

Why is it so difficult to say the same thing and use the same type of judgment for a painting or a sculpture or a building? Why not say, for instance, that the facsimile of Veronese's *Nozze di Cana* has been *replayed*, rehearsed, revived thanks to a new *interpretation* in Venice in 2007 by Factum Arte? What seems so easy for performance art remains far-fetched for the visual arts. If we claim that the *Nozze di Cana* has been 'given again' in San Giorgio, someone will immediately say: 'But the original is in Paris! The one now in San Giorgio is *just* a facsimile!'. A sense of fakery, counterfeiting, or betrayal has been introduced into the discussion in a way that would seem absurd for a piece of performance art (even though it is perfectly possible to say of a very bad company that it made 'a sham' at playing Shakespeare). It seems almost impossible to say that the facsimile of Veronese's *Nozze di Cana* is not about falsification but it is a stage in the verification of Veronese's achievement, a part of its ongoing biography.

One reason for this unequal treatment obviously has to do with what could be called the *differential of resistance* among all segments of the trajectory. In his much too famous essay, through a deep fog of art historical mysticism, it is this gap in technology that Walter Benjamin pointed out under the name of 'mechanical reproduction'.[3] In the

3 Walter Benjamin, 'The Work of Art in the Age of Mechanical Reproduction', in *Illuminations* (New York: Schocken Books, 1968), 217–51.

case of performance art, each version is just as difficult to produce, and just as costly, as the former one (actually more and more expensive as time goes on and certainly more than in Shakespeare's time – just think of the wages for the security guards and all the health and safety standards!). Just because there have been zillions of representations of *King Lear* it does not mean that the one you are now going to give will be easier to fund. This is the technical reason why, in the case of performance art, we don't distinguish between an original and a copy, but rather between successive versions of the same play, each designated by the label 'version n', 'version n+1', 'version n+2', etc.

The situation appears to be entirely different when considering, for instance, a painting. Because it remains in the same frame, encoded in the same pigments, entrusted to the same institution, one cannot help having the impression that every reproduction will be so much *easier* to do and that there will be no possible comparison of quality between the various segments of the trajectory. This is why the aura seems definitely attached to one version only: the autograph one. And certainly this is superficially true: if you take a picture of the *Nozze di Cana* in Paris with your digital camera, no one in his right mind can render commensurable the pale rendering on the screen of your computer and the 67 sqm of canvas in the Louvre… If you claimed that your picture was 'just as good as the original', people would raise their shoulders in pity, and rightly so.

And yet, the distance between 'version n' called 'the original' and 'version n+1' called 'a mere copy' depends just as much on the differential of efforts, of costs, of techniques as on any substantial distinction between the successive versions of the same painting. While in performance art these are grossly homogeneous (each replay relying on the same gamut of techniques), the career of a painting or a sculpture relies on segments which are vastly heterogeneous and which vary greatly in the intensity of the efforts deployed along its path. It is this asymmetry, we wish to argue, that too often precludes one from saying that the *Nozze di Cana* in Paris has been 'reprinted' or 'given again' in Venice. And it is certainly this presupposition that so angered the French art historian who castigated her friend for wasting her time in San Giorgio instead of visiting the 'genuine Veroneses'. Hidden behind the commonsense distinction between original and mere copies lies a totally different process that has to do with the technical equipment, the amount of care, and the intensity of the search for the originality that goes from one version to the next.

It is also important to note that the difference between performance arts and the others is not as radical as it seems: a painting *has always to be reproduced*, that is, it is always a *re*-production of itself even when it appears to stay exactly the same in the same place. This requirement is well known by curators all over the world: a painting has to be reframed, dusted, sometimes restored, relit, and it has to be represented in different rooms with different accompanying pictures, on different walls, inserted in different narratives, with different catalogues, and with changes in its insurance value and price. So, even though a painting might never be loaned, surviving inside the same institutional setting without undergoing any heavy restoration, it has a career all the same; to subsist and be visible again, it needs to be taken care of. If you don't, it will soon be accumulating dust in a basement, be sold for nothing, or will be cut into pieces and irremediably lost.

If the necessity of reproduction is accepted, then we might be able to convince the reader that the really interesting question is not so much to differentiate the original from the facsimiles, but to be able to tell apart the good reproduction from the bad one. If *The Ambassadors* has been irreversibly erased, it is not out of negligence, but, on the contrary, because of an excessive zeal in 'reproducing' it. What the curators did was to confuse the obvious general feature of all works of art – to survive they have to be somehow reproduced – with the *narrow notion of reproduction provided by photographic posters while ignoring many other ways* for a painting to be reproduced. For instance, they could have had a perfect facsimile registering all its surface effects in 3D and restored the copy instead of the work itself. If they had done this, they could have invited several art historians with different views to suggest different ways of restoring the copy and produced an exhibition of the results. Their crime is not to have offered a reproduction of the Holbein *instead of* the Holbein itself to the visitors of the National Gallery – *The Ambassadors* remains behind all the successive restorations much like *King Lear* remains behind each of its replays, granting or withdrawing its auratic dimension at will depending on the merit of each instance – but to have so limited the range of reproduction techniques that they have chosen one of the most barren one: the photograph – as if a painting were not a thick material but some ethereal design that could be lifted out of its materiality and downloaded into any reproduction without any loss of substance. Actually, a terribly revealing documentary shows the culprits restoring the Holbein by using as *their* model *photographs* of the original and subjectively deciding what was original, what had decayed, what had been added, and imagining the painting as a series of discrete layers that can be added or removed at will – a process that resembles plastic surgery more than an open forensic investigation.

Thus, what is so extraordinary in comparing the fate of the *The Ambassadors* with that of the *Nozze* is not that they both rely on reproduction – this is a necessity of existence – but that the first relies on a notion of reproduction that makes the original disappear forever while the second *adds* originality to the original version by offering it new dimensions *without* jeopardizing the penultimate version – without ever touching it, thanks to the delicate processes used to record it.

But, one might ask, how could any originality be added? One obvious answer is: by bringing the new version to its original location. The cognitive dissonance undergone by the visitor in the *Mona Lisa* room comes in part from the fact that in Palladio's refectory every single detail of the *Nozze* has a meaning entirely lost and wasted in the awkward situation provided for the version n-1 in Paris. In other words, originality does not come to a work of art in bulk; it is rather made of different components, each of which can be inter-related to produce a complex whole. New processes of reproduction allow us to see these elements and their inter-relationship in new ways. To be at the place for which it had been conceived in each and every detail is certainly one aspect – one element – in what we mean by an original. Well, on that ground, there is no question that it is the facsimile of the *Nozze* that is now original and that it is the version in the Louvre that has *lost* at least this comparative advantage.

We should not however be too mystical about the notion of an 'original location' in the case of the Veronese since the very refectory in which the facsimile has been housed is itself a reconstruction. If you look at photographs taken in 1950, you will notice that the original floor was gone and another had been installed at the height of the windows. The top was a theatre and the basement a wood workshop – the whole space had been altered. It was rebuilt in the 1950s, but the plaster and floor were wrong and the *boiserie* that surrounded the room and added the finishing touches to the proportion of the room was missing. In its stripped-down state, it looked more like a high protestant space that almost seemed to laugh at the absence of Veronese's counter reformation flourish.

But now the effect of the facsimile is such that there are rumors that the return of the painting has triggered a plan for a new restoration that will retrospectively return the space to its former glory. A facsimile of a heavily restored original, now in a new location, was causing new elements to be added to an original in its original location that is in part a facsimile of itself. Originality once seemed so simple…

The same is certainly true of *availability*. What angered the visitor so much in the Louvre was that she could not actually scan visually the *Nozze* without bumping into *Mona Lisa* addicts. The Veronese is so full of incident and detail that it cannot be appreciated without time to contemplate its meaning, implications and the reasons for its continued importance. What does it mean to enshrine an original, if the contemplation of its auratic quality is impossible? This, too, is another element that can be prized away and distinguished from all the others. Actually, this component of originality does not need to go with the originality of the location: the best proof of this may lie in the facsimile of the burial chamber from the tomb of Thutmosis III in the Valley of the Kings.[4] It contains the first complete text of the Amduat to be used in a pharaonic tomb. The Amduat is a complex narrative mixing art, poetry, science and religion to provide a coherent account of life in the afterworld. The tomb was never made to be visited and the physical and climatic conditions inside are incompatible with mass tourism. As a result, the building is deteriorating rapidly and glass panels have had to be installed to protect the walls from accidental damage and wear and tear. However, the interventions in the tomb change its nature and inhibit both detailed study of the text and an appreciation of the specific character of the place. Exhibitions that present the facsimile and contextualize the text have now been visited by millions of people in North America and Europe. The delocalized facsimile has established the reasons for its continued importance, turned the visitors into a pro-active force in the conservation of the tomb, and could become part of a long-term policy that will keep the version n-1 safe but accessible to the small number of specialists who require access for continued study and monitoring. See? Each of the components that together comprise what we mean by a true original begin traveling at different speeds along the trajectory and begin to map out what we have called the catchment area of a work of art.

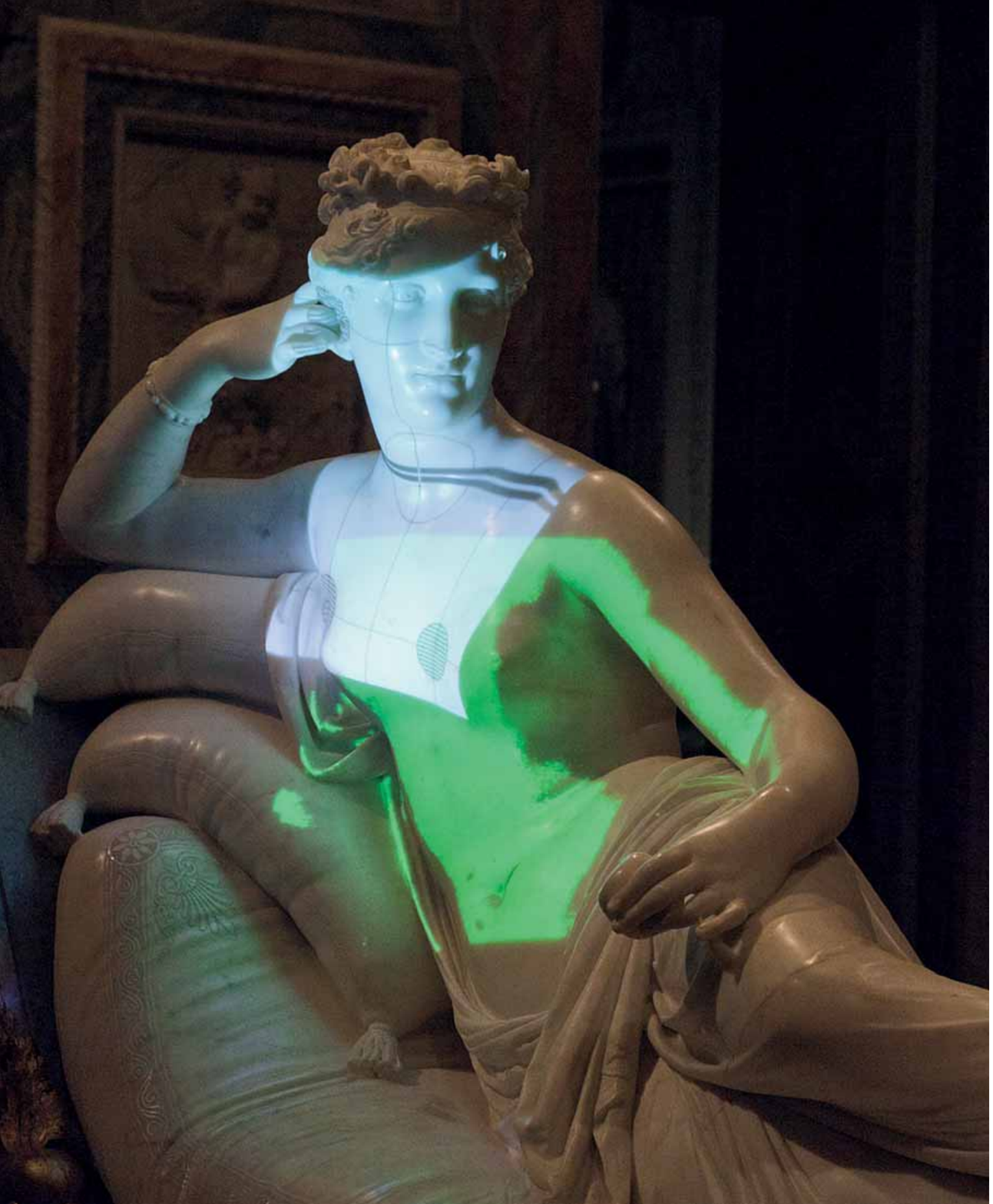
A third element of originality has to do with the *surface features* of a work. Too often, restorers make a mockery of the materiality of the original they claim to protect by limiting matter to shape only because they confuse 3D with 2D. Many Venetians, when they first heard of the *Nozze* facsimile, immediately conjured up in their mind a glossy flat surface much like that of a poster, and they were horrified at the idea of being given this in reparation for Napoleon's cultural rape of San Giorgio. Little could they anticipate that the facsimile was actually in pigment on a canvas coated with gesso, 'just like' Veronese had used. When it was unveiled, there was a moment of silence, then ecstatic applause and many tears. Large numbers of Venetians had to ask themselves a very difficult question: how is it possible to have an aesthetic and emotional response in front of a copy? This question is followed by another: how do we stop Venice from being flooded with bad copies without the criteria to distinguish between good and bad transformations?

4 The facsimile of the tomb (in its current condition but without the elements that turn the environment into a museum) has resulted in detailed publications by the Egyptologist Erik Hornung and the psychologist Theodor Abt in both film and book form. Erik Hornung and Theodor Abt, *The Dark Hours of the Sun – The Amduat in the Tomb of Thutmose III* (Madrid: Factum Arte, 2005), DVD; Erik Hornung et al., *Immortal Pharaoh – The Tomb of Thutmose III* (Madrid, Factum Arte, 2006).

No doubt, it is an uphill battle: facsimiles have a bad reputation – people assimilate them with a photographic rendering of the original – and digital is associated with an increase in virtuality. So, when we speak of 'digital facsimiles', we are certainly looking for trouble. And yet we claim that, contrary to common presuppositions, digital facsimiles are introducing many new twists into the centuries-old trajectories of works of art. There is nothing especially 'virtual' in digital techniques – and actually there is nothing entirely digital in digital computers either![5] The association of digitality with virtuality is entirely due to the bad habits given by only one of its possible outputs: the pretty poor screen of our computers. Things are entirely different when digital techniques are only one *moment* in the move from one material entity – Veronese's *Nozze* version n-1 in the Louvre – to another equally material entity – version n+1 in San Giorgio. During this time of mass tourism, increasingly vocal campaigns for the repatriation of spoils of wars or commerce, when so many restorations are akin to iconoclasm, when the sheer number of amateurs threaten to destroy even the sturdier pieces in the best institutions, it does not require excessive foresight to maintain that digital facsimiles offer a remarkable new handle to give to the notion of originality what is required by the new age. Since all originals have to be reproduced anyway, simply to survive, it is crucial to be able to discriminate between good and bad reproductions.

The authors thank the participants at the dialogue held at the Giorgio Cini Foundation in Venice on 'Inheriting the Past', and in particular the director of the Cini Foundation, Pasquale Gagliardi.

5 Adam Lowe and Simon Schaffer, *N01se*, 2000. An exhibition held simultaneously at Kettle's Yard, the Whipple Museum of the History of Science, Cambridge, the Museum of Archaeology and Anthropology, Cambridge and the Wellcome Institute, London (Cambridge: Kettle's Yard, 2000); Brian Cantwell Smith, 'Digital Abstraction and Concrete Reality', in *Impressiones* (Madrid: Calcografía Nacional, 2003).



OPPOSITE

Scanning Canova's statue of Paolina Borghese in the Galleria Borghese, Rome, a collaboration between Factum Arte and Giberto Arrivabene.

ReACH: A COLLECTIVE AND GLOBAL RE-THINK OF OUR APPROACH TO COPIES IN THE AGE OF DIGITAL REPRODUCTION

Anaïs Aguerre

Anaïs Aguerre is the founder and Managing Director of Culture Connect Ltd. Before setting up Culture Connect she was Head of International Initiatives at the V&A where she led the Museum's international strategy. Anaïs was the Project Director of ReACH, a global initiative on the Reproduction of Art and Cultural Heritage spearheaded by the V&A in collaboration with the Peri Charitable Foundation.

In 1867, Sir Henry Cole, founding director of the Victoria and Albert Museum (V&A), launched the *Convention for Promoting Universally Reproductions of Works of Art for the Benefit of Museums of All Countries*. Recognising the new opportunities that technological advances of the time (namely photography, electrotyping and new casting techniques) made possible, the 1867 *Convention* helped usher in a period in which museums actively engaged in the creation of reproductions of examples of great works of art and architecture produced from around the world 'for the benefit of museums of all countries'. As noted by Professor Mari Lending, author of *Plaster Monuments: Architecture and the Power of Reproduction*, 'Cole's convention marks a key moment in the translation of national monuments into portable global patrimony'.[1] The need to collectively preserve and share a common world heritage was clearly asserted.

150 years later, in response to increasing global threats (pollution, terrorism, conflicts or mass tourism) to our shared heritage, the V&A spearheaded, in collaboration with the Peri Foundation, the ReACH initiative on the Reproduction of Art and Cultural Heritage. One of the main objectives of ReACH was to establish what a 21st-century version of the Henry Cole *Convention* should be like. To this end, I had the privilege of coordinating and leading an unprecedented global consultation gathering experts from across the globe tasked with the mission to co-author this 21st-century version of the *Convention*.

Building on Cole's legacy, our ambition was to explore collectively what lies behind the immense promise that today's digital technologies offer to the field of historic preservation and more broadly, to the museum and heritage sector. Digital technologies are changing the cultural landscape, offering new ways to produce, store and share museum and heritage assets like never before. However, there was no clear methodology for how museums and heritage organisations should engage with these technologies. To complicate matters, legal protocols and procedures had not adapted to these new realities, and often acted as roadblocks to new practice. The ambition with the ReACH initiative was therefore to bring clarity – by highlighting best practices, debating pressing issues, and drafting a new declaration – and ultimately to offer our heritage and museum community a useful roadmap for dealing with reproductions in the future.

Officially launched in Paris at UNESCO's headquarters in May 2017, the ReACH initiative has brought the global museum and heritage community together and enabled a collective rethink of how our imperilled cultural heritage could be preserved, and to debate at a global scale the creative opportunities that copying these works offers a global audience. With the support of key research partners – Factum Arte, the Louvre Museum,

1 Mari Lending, 'Preserved in plaster', in *Copy Culture: Sharing in the Age of Digital Reproduction*, ed. Brendan Cormier (London: V&A Publishing, 2018).

the Smithsonian Institution, the State Hermitage Museum, the Vorderasiatisches Museum, the Warburg Institute and the Yale Institute for the Preservation of Cultural Heritage – the core research activity took place between May and December 2017. Through a series of five roundtable discussions – hosted in Washington with the Smithsonian Institution, in St Petersburg with the State Hermitage Museum, in Abu Dhabi with the Department of Culture and Tourism, in Beijing with the Palace Museum and in London at the V&A – we have drawn together more than 100 experts from across the world (individuals as well as institutions, start-ups as well as public organisations, scholars, lawyers, curators and digital experts) and conducted an unprecedented global consultation to broaden our collective knowledge and to share it with others.

This resulted in the production of the ReACH Declaration, launched at the V&A in December 2017 and reproduced here. Over twenty directors of world-class museums from across the globe put their names to this text as initial signatories. This 21st-century version of the Henry Cole *Convention* invites us to embrace with confidence advances in technology and connectivity to better study, share and preserve our cultural heritage.

Beyond the Declaration and the subsequent technical guidelines produced, ReACH has also outlined the benefit of activating our collective intelligence when tackling issues that no individual museum or country could address alone. Since December 2017, we have kept the #ReACHDialogue open. Maintaining this conversation on a global scale is critical to ensuring that the issues at stake don't fall hostage to nationalist discourses or become weaponised in other ways. Moreover, it is only by maintaining an open and global dialogue that we can truly embrace the unprecedented opportunity offered by new technologies for multiple heritage narratives to co-exist on a shared global stage and, as such, truly unlock the 360º view of our cultural heritage. Finally, as Brendon Cormier and I highlighted in the introduction to *Copy Culture: Sharing in the Age of Digital Reproduction* (ed. B. Cormier, London, 2018), 'the impulse to record should never outweigh asking the fundamental question of why and how'. In the face of the urgent imperative to develop more sustainable practices in the museum and heritage sector, the ecological impact of our work should also be taken into account. Our responsibility to the past is intimately connected to our responsibility to the future. Once again this requires a collective rethink and engagement.

THE ReACH DECLARATION, 2017

Promoting Universally the Reproduction, Storage and Sharing of Works of Art and Cultural Heritage through Digital Technologies

VISION

This declaration promotes the vision that works of art and cultural heritage should be preserved and shared as widely as possible throughout the world.

Through advances in technology and connectivity, we now have a revolutionary opportunity to enhance learning, creativity and innovation, and to reach new audiences worldwide, through the reproduction and sharing of works of art and cultural heritage ('Works'). Furthermore, digital technologies can enable us to record, document and, in some instances, recreate Works threatened by environmental hazards, conflicts, terrorism, rapid economic development, mass-tourism, theft and other natural and human-caused disasters ('Endangered Works'), or Works that have already been lost.

Three versions of Canova's Paolina Borghese, front to back: glass, wax, and stereolithographically printed resin, exhibited in *AWorld of Fragile Parts* at the 2017 Venice Biennale. The sculptures are now permanently installed in the new interpretation section of the V&A's cast gallery.

For cultural institutions that hold collections for the benefit of the public, the opportunity to provide open access now, or in the future, to Works in a digital format is an exciting new frontier in their mission to preserve and transmit knowledge, culture and history for present and future generations. Such opportunities and possibilities also present responsibilities. Digital Records need to be responsibly created and safeguarded for the long term, to ensure integrity as well as retrieval, and reuse by future generations. Furthermore, as the means and skills required to use and access digital technology are not distributed evenly around the world, it is incumbent on those with the capacity to do so to provide support and training.

This Declaration is intended to promote the production, sharing and preservation of digital records and reproductions ('Records') by both individuals and organisations. Owners and Stewards of Works and others involved in the process of generating these Records are encouraged to disseminate and use the ReACH Declaration as widely as possible.

The text herein is the result of an extensive global consultation on the occasion of the 150th anniversary of the 1867 Henry Cole Convention for Promoting Universally Reproductions of Works of Art for the Benefits of Museums of All Countries. The Convention, inspiring in its clarity, practicality and openness to the creation and sharing of reproductions, served as the basis for the establishment of this new Declaration. The ReACH Declaration for Promoting Universally the Reproduction, Storage and Sharing of Works of Art and Cultural Heritage Through Digital Technologies was adopted at the final ReACH roundtable held at the Victoria and Albert Museum in London on 8 December 2017.

REPRODUCTION

Article 1. Stewards of Works are encouraged, for the benefit of the public of today and future generations, to take advantage of technological advances to create Records of Works entrusted to their care, for purposes of documenting and preserving all Works, but in particular Endangered Works.

Article 2. Those involved in the process of documenting and producing digital Records are encouraged to work to then-current accepted standards that support academic study and the monitoring of the condition of the original object.
Article 3. The process of documenting and producing Records should be non-invasive for the Works involved. The preservation of the Work itself remains of paramount importance. Digital Records are a tool that can support preservation, but are not a substitute for preservation.
Article 4. The process used to produce Records, as well as the intended purpose for each specific Record, should be documented, to better enable usage and interpretation of such Records today, and by future generations.
Article 5. Before making and sharing Records, the historic context of and possible cultural and national sensitivities about the Works should be considered, as well as applicable legal and ethical constraints, and the rights of donors and third parties. Transparency, and participation by communities or cultural groups with ties to the Works, should be encouraged.

STORAGE
Article 6. Digital Records should be contemporaneously archived and maintained by the Steward of the Work. Works should be recorded in a manner that renders them likely to be retrievable and reproducible even if technology changes. Enabling data migration is of paramount importance.
Article 7. The Steward of the Work should own or, at a minimum, retain unrestricted and perpetual rights to use, reproduce and share the Records, unless applicable law or a contractual agreement requires otherwise.
Article 8. Digital Records should be linked to metadata that enriches the digital asset for research, education and preservation.
Article 9. Digital and Physical Records should be marked or otherwise identified as copies using methods that are sustainable and, to the extent feasible, do not rely on technologies at risk of obsolescence. Those involved in the process of making these Records are encouraged to develop an international system to identify copies.

SHARING
Article 10. Stewards of Works are encouraged to make Records freely available to the public for personal use and enjoyment and for non-commercial research, educational, scientific and scholarly uses.
Article 11. Stewards of Works and other parties involved in the process of documenting and producing Records are encouraged to share those Records of Works as widely as possible but, in particular, to reach new audiences, especially those with special needs. This includes, where possible, proactively addressing issues of equal access to digital technology on a global scale.
Article 12. Stewards of Works and other parties involved in the process of documenting and producing Records of Works are encouraged to use established and standardized licensing schemes and symbols that convey to the public the manner in which the Records of Works may be shared and reused, including open access content.
Article 13. When Records are shared and disseminated, Stewards of Works involved should provide attribution to the original author of the Works and, where practicable, provide credit to those involved in the process of documenting and producing Records of Works.

The exhibition *Words of Stone*, based on facsimiles of early Islamic tombstones from Kala Koreysh, Dagestan, at the State Hermitage Museum in St Petersburg (2017). The exhibition travelled to the V&A (2017–18) following the signing of the ReACH declaration. © Peri Foundation.

COLLABORATIONS
Article 14. Stewards of Works with resources, skills and access to digital technology are encouraged, as much as they possibly can, to provide support and training to develop the skills needed to document and produce high-quality Records to other cultural institutions in the world who lack such means.
Article 15. Stewards and other parties engaged in making Records should share digital technology, where feasible, and collaborate on strategies to make it more affordable.
Article 16. Stewards of Works and other parties engaged in making Records are encouraged to work collaboratively to develop compatible systems to enable the exchange of recorded data and metadata on a global scale. A set of specific technological standards and practical guidelines will be produced by a ReACH technical committee. These standards and guidelines will be revised as technology changes.
Article 17. In light of the major infrastructure requirements to ensure long-term preservation and transfer of digital Records, public-private partnerships should be encouraged as well as collaborations between countries.

DEFINITIONS
A. *ReACH* stands for Reproduction of Art and Cultural Heritage. B. *Work* means a work of art or other cultural item. The term Work is intended to be broadly construed and includes, but is not limited to, works of art in all media and from all eras, for example paintings, works on paper, sculpture, murals, antiquities, monuments, architecture and architectural elements, and archaeological sites. C. *Endangered Work* means Work threatened by environmental hazards, conflicts, terrorism, mass tourism and all other natural and human-made disasters. D. *Steward* means any governmental or private entity that owns or possesses Works held for the benefit of the public. The term Steward is intended to be broadly construed and includes, but is not limited to, museums, heritage sites, monuments, libraries, repositories, archives, places of worship, whether governmental, sovereign, or private. E. *Record* means a digital recording or reproduction of a Work and the data generated in the process of faithfully capturing images and data regarding the Work so as to create a high-quality digital or physical reproduction of the Work. F. *High quality* means a level of quality sufficient to constitute a representation of a Work as faithful as possible.

OPPOSITE

Digital render of a 3D scan of the bust of Nefertiti, recorded by TrigonArt for the Neues Museum, Berlin. Render by Cosmo Wenman.

3D DATA, PUBLIC ACCESS, FREEDOM OF INFORMATION LAWS

Cosmo Wenman

Cosmo Wenman is an artist and design consultant specialising in 3D design, 3D scanning, and 3D printing applications. He lives in Southern California.

If 3D scans are made freely available to the public, the world's cultural heritage can be copied and transformed in new, unpredictable ways, and the data will reverberate in the arts for thousands of years. The specific applications – robotically-milled replicas, architecture, video games, augmented reality, surgical modifications, and who knows what else – will reveal themselves in the work of countless artists to come. That as-yet-unseen art, and that open-ended process, are what I am working to realize with my access projects, which I pursue as my own works of art: I encourage reluctant cultural heritage institutions to see my broader view, and I try to demonstrate public interest in, and demand for access to, their 3D data.

In Berlin, the Egyptian Museum and Papyrus Collection has a high-quality, full-color 3D scan of the most iconic portrait sculpture ever produced, the 3,364-year-old *Bust of Nefertiti*. The artefact has been in their collection since 1920, and is one of the most copied works of ancient Egyptian art. For reasons the museum has difficulty explaining, it does not share its Nefertiti scan with the public.

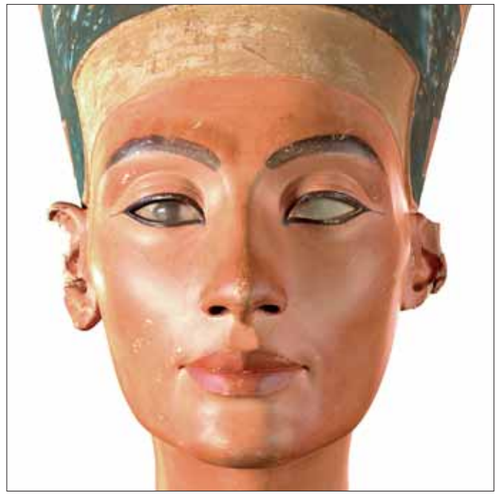
The museum is operated by the Prussian Cultural Heritage Foundation, known in German as the Stiftung Preußischer Kulturbesitz (SPK). SPK is one of the largest cultural organizations in the world, with a 390-million-euro annual budget. As a state-funded entity, SPK is subject to German freedom of information laws. I sent them a request for their Nefertiti 3D scan and cited those laws, which grant everyone an unconditional right to access state records.

SPK resisted. They acknowledged that the law required them to give me access to the scan, but claimed that directly giving me copies of the data would threaten their commercial interests. They use the 3D data to produce the expensive Nefertiti replicas they sell in their gift shop, and implied they needed to protect that revenue to finance ongoing digitization projects. In museum-world parlance, this argument against open access is known as 'the gift shop defense'.

Instead of simply giving me copies of the data, they offered to let me 'inspect' the scan in a controlled setting, either in their Berlin offices, or in the German consulate in Los Angeles.

They were treating their scan of Nefertiti like a state secret.

Curious to witness their concept of access in action, I accepted their offer. At the inspection in Los Angeles, the museum's attorneys provided a slow, underpowered laptop that was barely capable of displaying the large 3D files. I objected to this inadequate form of access and made a new freedom of information demand, this time for information about their purported gift shop revenue. I also called their bluff on their revenue excuses by asking them if they would accept a donation in exchange for making their Nefertiti data freely available to the public, and what their price was.



Digital renders of a 3D scan of the bust of Nefertiti, recorded by TrigonArt for the Neues Museum, Berlin. Render by Cosmo Wenman.

Their response was revealing.

SPK rejected the idea of accepting a donation in exchange for unrestricted public access to the scan. They confirmed they had earned less than 5,000 euro, *total*, from marketing the Nefertiti scan, and admitted that they did not direct even that small revenue towards digitization.

In the nearly 10 years since it had created the Nefertiti scan, SPK had completely failed to commercially exploit the valuable data idling on its hard drives.

All their reasons for not giving me the Nefertiti data fell apart. The gift shop defense had been a deception.

As if in recognition of this, there was something else in their response – something I did not expect. A flash drive containing the Nefertiti scan.

When I looked at the data for the first time, there was another surprise. To mark their territory, SPK had crudely carved a copyright claim directly into the underside of the digital model of Nefertiti, along with a Creative Commons license that prohibits using the data for commercial applications.

The Nefertiti artifact is undisputedly in the public domain. It is nonsensical and irresponsible to claim a copyright in a digital *copy* of a public domain work. This practice – known as *copyfraud* – is intended to have a chilling effect on the public's lawful use of public domain works. But the Creative Commons license SPK used to bar commercial applications also explicitly allows for the copying, redistribution, adaptation, and transformation of the data. That license also states that users 'do not have to comply with the license for elements of the material in the public domain'.

So with that, SPK almost completely buckled.

I say *almost* because, even three years after I made my first freedom of information demand, SPK still left it to me to actually put their Nefertiti scan online and make it available to a wider audience. When I put it online, thousands of people downloaded it just in the first week; proof of public interest in the data. SPK should be embarrassed.

I hope other museums will see the SPK's secretive policy as an example of what *not* to do with their 3D data. Unfortunately, their stalling tactics and bad-faith arguments are not unique. I'm facing similar resistance to my current effort to force the Musée Rodin in Paris to release its unpublished scans of Auguste Rodin's works, which are all in the public domain. (Victory in that case will make all French national museums' 3D scans accessible to the public.)

It's very difficult to find anyone who can articulate coherent reasons for keeping this kind of data away from the public. I've come to believe that policies like SPK's are driven by fear of loss of control, fear of the unknown, and, worse, a lack of imagination.

SPK cried poverty to protect a tiny amount of gift shop revenue that it falsely purported to spend on digitization efforts, and did the absolute minimum to comply with freedom of information laws. All to prevent me – and you – from looking too closely at a 3,364-year-old portrait of an Egyptian royal.

OPPOSITE

Recording the Borgherini Chapel using panoramic photography in the convent of San Pietro in Montorio, Rome, 2016.

A RENAISSANCE OF THE RENAISSANCE

Jonathan Jones

Jonathan Jones is the art critic for *The Guardian* and was on the jury for the 2009 Turner Prize. He is currently writing a history of the Renaissance for Thames & Hudson.

There's nothing like experiencing Italian art in the churches, convents, palaces and loggias that survive among modern Italy's mopeds and focaccerie, the espresso still buzzing inside you. I can't think of Raphael's frescoes in the Villa Farnese without also remembering a particular garage you pass on the way to see it, or the Doria palace in Genoa without the motorway flyover at the bottom of its garden. Not that it's always so gritty. It would be a lie to say I don't think of a negroni in a Sicilian square every time I picture Caravaggio's *Burial of St Lucy*.

For some, this unavoidable web of associations might seem to reduce the seriousness and importance of Italian art. Perhaps it was an underlying Victorian puritanism that made the creators of London's National Gallery, in assembling one of the world's finest collections of Italian Renaissance painting, strip it of almost anything that might tie it to the sordid streets of 19th-century Italy where – according to E. M. Forster in 1908 in *A Room with A View* – you were as likely to see a knife fight as a cicerone. Here, hexagonal trays made for serving sweetmeats to 15th-century Florentine women who'd just survived childbirth are hung on the wall as oddly shaped 'paintings' and Piero della Francesca's *Baptism of Christ* is shown in splendid isolation from the Catholic rites of Sansepolcro Cathedral – leaving its arched top, made for an exact physical setting, as a kind of ineffable mystery.

It was like a shot of properly made coffee (hard to find in London) to come across Factum Foundation's recreation of the Borgherini Chapel in San Pietro in Montorio, Rome, in this museum. Here was a big piece of Italy, perfectly reproduced. Instead of showing a photograph of Sebastiano del Piombo's painting of the *Flagellation of Christ* for its exhibition *Michelangelo & Sebastiano*, the National Gallery got Factum to make a facsimile of the semicircular chapel itself. It was like punching through the wall. Flatland became three-dimensional. The towering recess with its half-dome canopy receded in real space in a time-scarred curved expanse of colour. In that curving space, the bodies of Christ and his torturers that Sebastiano based on drawings by his great friend Michelangelo take on a solid, sculptural existence you could never guess at, or at least not feel, from a flattened image.

Factum's replica was so uncannily precise that it included a space made by some fool for electrical sockets among all the resonant traces of history. It seems to me to inaugurate a new era of reproduction. It is now possible to replicate not just images, but places. The complex emotions place brings with it radically change the experience a museum brings its visitors. Factum's Borgherini Chapel doesn't just have the 'aura' Walter Benjamin thought only an original work of art can possess. It practically has an aroma. You can smell the candle wax, incense, and dust as you are transported into that shady church on Rome's Janiculum Hill. Sigmund Freud wrote vividly of his pilgrimages to

THIS PAGE

Factum Arte's artisans putting the finishing touches to the semi-dome of the apse.

OPPOSITE

Constructing the facsimile of the Borgherini Chapel, 2017.

another Roman church on another hill, San Pietro in Vincoli, on the Esquiline, to behold Michelangelo's *Moses*:

> How often have I mounted the steep steps from the unlovely Corso Cavour to the lonely piazza where the deserted church stands, and have essayed to support the angry scorn of the hero's glance! Sometimes I have crept cautiously out of the half-gloom of the interior as though I myself belonged to the mob upon whom his eye is turned…

If you have ever explored Renaissance art in its intended locations you will surely recognise this intense quality of discovery and encounter. In fact it's the essence of Michelangelo, whose physicality Sebastiano echoes in the Borgherini Chapel. And perhaps the entire art history and popular understanding of the Renaissance has been muffled by an inability to reproduce its immediate, physical, multisensory impact – until now.

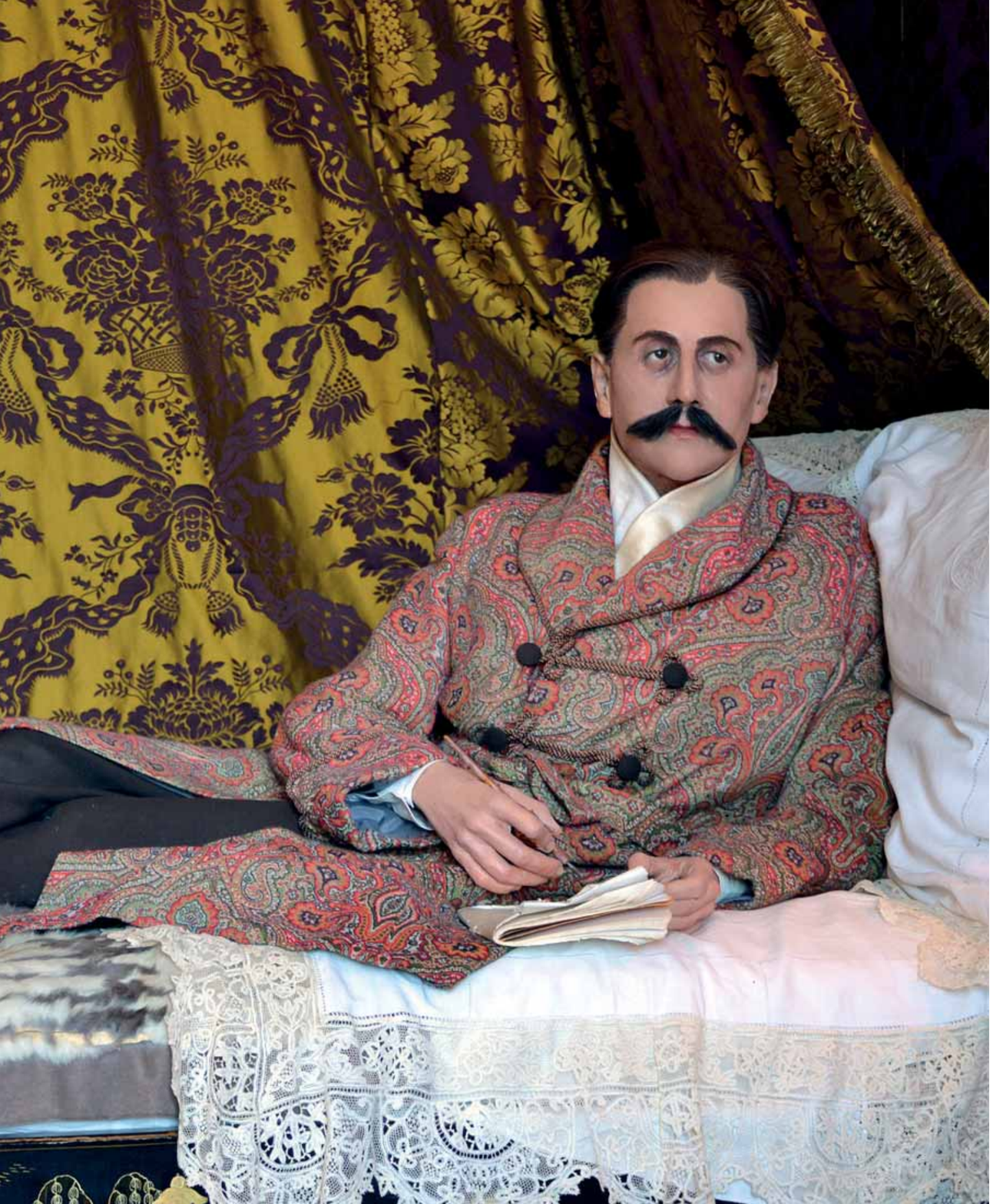
The National Gallery's extreme approach to the Renaissance, presenting it as a succession of perspective illusions on flat panels and canvases, isn't the only one museums have taken over the two centuries of their existence. The V&A assembled a fantastical collection of casts in the 19th century that try to do exactly what Factum has now achieved with the Borgherini Chapel: present the Renaissance in the round. But its casts of such icons as *David* and the *Gates of Paradise* can only be grey or at best gilded imitations of the real thing, enjoyed today with a glib post-modern irony that sees these idealistic teaching aids as equal to the original. Their true purpose is to make us taste the original, and so want more of it. But they can't capture its aura, any more than a photograph can.

Another option is to bring the original itself into the museum. I can't think of a better way to infect someone with the Renaissance than to show them the Studiolo from Gubbio that you can enter in New York's Metropolitan Museum. Among its perspective

panelling you can feel the spectacle and magic of actually being there – because you are there. But in an age when museums are criticised for their imperialist possessions and some Dubliners have even demanded the repatriation of James Joyce's bones, it doesn't seem likely any more big chunks of Italy are going to enter universal museums.

Enter Factum. For the miraculous transportation of a real, solid, yet also virtual chapel from the Janiculum to Trafalgar Square opens a radical new possibility. Now great art can be experienced in its place – in a distant place. The magic of great art can be translated elsewhere without dispossessing anyone. The Borgherini Chapel is quite a small piece of the fabric of Italian art. What about fascsimiles of the Brancacci Chapel in Florence, the Arena Chapel in Padua, the Sistine Ceiling…?

This is not a new age of fakery. It's a new era of knowledge. Imagine schoolkids experiencing the Sistine in London, the *Last Supper* in Chicago, *The Fall of the Giants* in Lagos. We might be on the verge of a Renaissance of the Renaissance, when we wake up and smell the coffee of great art.



RETURNING TO DISTORTED ORIGINS

Mari Lending

Mari Lending is a professor in Architectural Theory and History, and a founding member of OCCAS (the Oslo Centre for Critical Architectural Studies). Within the EU-funded HERA project she edited *Printing the Past: Architecture, Print Culture, and Uses of the Past in Modern Europe* (PriArc). She edited the book *Images of Egypt* (Oslo: Pax, 2018), with Eirik Bøhn and Tim Anstey, and curated an exhibition with the same name at the Museum of Cultural History in Oslo (20 September – 20 December 2018). She is the author of the monograph *Plaster Monuments. Architecture and the Power of Reproduction* (Princeton University Press, 2017).

OPPOSITE

This waxwork of Marcel Proust is located in the Château de Breteuil, where the author stayed while writing *À la recherche du temps perdu*. Factum also has a connection with the Château de Breteuil: from 2015–16, Factum Arte worked on a project with the Château to make a facsimile of the famous Teschen Table.

I

The last decade has witnessed a return to a very physically received past, which has made itself manifest in a wide range of exhibition-making that displays a sensitivity for the material archival object and its space.[1] The desire to rethink spaces and objects, and the return to objects spanning from documents to monuments, is clearly grounded in an intellectual climate different from the one that governed postmodernism's play with the past as a repository of form. Yet however meticulously such returns to lost contexts are based on empirical evidence and documentary residues, they align themselves neither with the 'wie es eigentlich gewesen ist' ('as it really was') of 19th-century positivism, nor the Enlightenment's fantasies of primordial states, which resurfaced in the modernist myth of the tabula rasa as yet another theory of origins. It is exactly a disinterest in the pristine and in origins that characterizes this new return to historical artifacts across media, while emphasizing both the history and historicity of objects.

'As the trend away from theory's abstraction has moved the tectonic plates of research more and more towards materiality, so has its manifestation in "things" attracted greater interest', Alina Payne observes while describing how works of art and architecture are collected and consumed, detached and detachable, discrete and unrooted.[2] If art and architectural culture has slowly recovered from a slight hangover caused by decades of theoretical excess, it is nonetheless a very specific theoretical backdrop that enables the current reassessment of things and spaces. The fundamental destabilization of the original/copy dichotomy inherited from philosophical deconstruction has somehow meandered from the realm of texts to a wide territory of objects. In lieu of nostalgia, ideas of permanence, origins, and authenticity, maybe also of chronology and genealogies, we are witnessing a preoccupation with how artefacts behave, change, move, work, and fluctuate, with how they circulate in time and space. Distorted temporalities and unexpected returns are parts of the unruly and sometimes traumatic lives of objects, as Factum Arte's exquisite facsimiles have repeatedly shown; most iconically with the reintroduction of Paolo Veronese's *Wedding at Cana* in its original setting in 2007. In critical ways, Factum Arte demonstrates the extent to which a reproduction's relation to a possible original work can hardly be explained as derivative. Remakes, replicas, reinventions, restitutions, restorations, and facsimiles are part of the lives of precious objects.

1 For instance: *When Attitudes Become Form. Bern 1969/Venice 2013*; *Environments and Counter-Environments* (New York, Basel, Stockholm, Chicago, 2010–13), and *Model as Ruin* (Oslo, 2013).
2 Alina Payne, *From Ornament to Object: Genealogies of Architectural Modernism* (New Haven: Yale University Press, 2012), 11.

II

A dazzling scene in Marcel Proust's *À la recherche du temps perdu* (1913–1927) may help us understand the complex relations of an assumed original work to its reproduction, and also to rethink concepts of originality, integrity, aura, authenticity, and authorship beyond modernist ideology and received ideas of monuments and permanence. The scene in question revolves around one of the first and most compelling objects of desire introduced in the novel. As a young boy, the main character, Marcel, visits the Trocadéro museum in Paris, particularly admiring a plaster portal from the medieval church in the fictitious Norman town Balbec. The museum is however everything but fictitious: it is the Musée de sculpture comparée, conceived by Eugène-Emmanuel Viollet-le-Duc, and opened to the public in the Palais de Trocadéro in 1882. Within the frame of a novel, the young Marcel recurrently visited this fashionable museum of reproductions during the 1890s and fell in love with the Balbec portal, sprinkled with alluring epithets such as 'singular', 'Persian', 'half Romanesque', 'Norman Gothic'.[3]

Marcel becomes increasingly impatient to experience the totality of the church firsthand. Yet finally in front of the church, in this long-awaited moment, he immediately realizes that the original does not measure up to the copy. Not only is the church trivialized by its surroundings, by prosaic elements such as a square, a café, a billiard saloon, a bank, a bus station, streetlights, and trams. Marcel is also discouraged to discover that it is located in Balbec-en-Terre and not, as he believed, in Balbec-Plage, 'soaked by the spindrift blown from the tumultuous deep', inseparable from the Norman topography and built of stone quarried from 'wave-washed cliffs'. Expecting 'the church itself, the statue in person, the real things!' to be more imposing than its plaster version in Paris, it turns out to be 'much less'. Most aggravating of all, the original is reduced to 'nothing but its own shape in stone'.[4]

The church has absolutely nothing of the aura that is normally ascribed to the unique, the particular, the original. While the plaster portal in Paris appeared universal and immortal, endowed 'with a general existence and an inaccessible beauty', the real building with its sculptured doorway appears as 'a little old woman in stone, whose height I could measure and whose wrinkles I could count'. Whereas the plaster cast is perfect and timeless, the actual stone version is the victim of time and reality, caught in what Proust sensationally termed 'the tyranny of the Particular'.[5] Proust's receptivity to the reproduction would certainly have pleased the founders, architects, restorers, artists, molders, directors, curators, archivists, and photographers involved in what became one of the most influential collections of plaster monuments, and in which exquisite reproductions of portals from French medieval churches formed the core. And when showing that the monument's irreducible particular does not reside in its material authenticity, Proust fundamentally challenged the notions of aura developed by his first German translator Walter Benjamin.

19th-century plaster casts and contemporary high- resolution recording, digital restoration and creative re-materialization of three-dimensional works of art and

3 Marcel Proust, *The Way by Swann's*, vol. 1 of *In Search of Lost Time*, trans. Lydia Davis (London: Penguin, 2002), 388.
4 Marcel Proust, *In the Shadow of Young Girls in Flower*, vol. 2 of *In Search of Lost Time*, trans. James Grieve (London: Penguin, 2005), 237–38.
5 Ibid., 239.

Young boy, Marcel's age, admiring a plaster portal at the Trocadéro, 2007. Photo Mari Lending.

architecture share a number of critical issues in regards of ideality, reality, historicity – and materiality. The *formatori*, architects, artists, archaeologists, and museum curators that created the exquisite plaster monuments, displayed an intense interest in materiality when recording fragile and often dispersed works of the past at full scale. The material expression of plaster displayed many different claims to truth, not least in regards of patina, polychromy, and surface treatment: plaster monuments were hailed as perfectly preserved replicas of weather-beaten originals or as ideal expressions of imaginary beginnings, spanning from Assyrian sculpture, Egyptian columns, and Greek friezes to medieval portals and Renaissance balconies, niches, and choir stalls. The apparently banal material of plaster became an important matter to display the history and historicity of weathered originals, as well as theories on the origins of works that had suffered the 'destructive hand of Time'.

From its conception, the Trocadéro promoted the benefits of plaster far beyond the commonsensical opinion that a good reproduction is more valuable than a poor original. The reproduction could reveal aspects of a work undetectable in the fragmented reality of the real world, and the mounting of architectural fragments aimed at a realism in the experience of details impossible in situ. The curators saw no reason to distinguish between the work itself and its reproduction: a cast has 'the complete scientific value of the original and thus deserves to be examined with the same interest'.[6] In fact, the museum boldly claimed that a perfect cast is not only 'plus exact que l'original', but in its plaster perfection closer to the monument's moment of origin, and as such in a sense closer to the original than the original itself.[7]

III

Proust was untouched by the enduring French tradition of museum critique, dating back at least to Quatremère de Quincy's attacks on the Louvre in the 1790s, to Paul Valéry's 'Le problème des musées' (1923), and beyond. 'Our age is plagued by the notion that objects should be shown only with things which accompany them in reality, thus depriving them of the essential, that act of mind which isolated them from reality in the first place', he stated, advocating the museum as a liberating, abstracted space that introduced a necessary distance between the object and its place of origin.[8] 'For Proust, the work of art

6 Louis Courajod and P. Frantz Marcou, *Musée de sculpture comparée (moulages). Palais de Trocadéro. Catalogue raisonné publié sous les auspices de la commission des Monuments historiques. XIVe et XVe siècles* (Paris: Imprimerie Nationale, 1892), III.
7 Camille Enlart, *Le Musée de sculpture comparée au Palais du Trocadéro* (Paris: Librairie Renouard, 1911), 3.
8 Proust, *In the Shadow of Young Girls in Flower*, 224 and 223.

Two views of the 12th-century gallery, Trocadéro. From Paul Frantz Julien Marcou, *Album du Musée de sculpture comparée*, vol. I (Paris, 1897).

is like a quotation that forgets its source and thereby demonstrates its own origin', Didier Maleuvre asserts, an observation that is even more intriguing given that a reproduction constitutes the center of Proust's museum philosophy.[9] The version first experienced – in this case, the replicated fragment in the museum – has become a new original, distanced from the model's historic source. Nowhere does Proust make this clearer than in a detour on bibliophilia in the novel's final volume. Like printed books, a plaster cast may come in editions, it can be multiplied. The aging narrator acknowledges that the book-lover's passion transcends the singular volume's inherent value, and is separable from the historical value rooted in the precious object's provenance.[10] This objective value is determined in 'a living sense' – that is, the life of the rare book as a collector's item, analogous to a singular work of art.

Here, however, the original has to be looked for elsewhere. A first edition is the 'edition in which I had read it for the first time', the narrator states, 'I would look for the original editions, by which I mean those from which I had received an original impression of the book. Because subsequent impressions are not original'. It is impossible not to think about Factum Arte's Egyptian works in light of Proust's reflection; the Tutankhamun tomb as installed by the entrance to the Valley of the Kings, and the tomb of Seti I, at the moment residing further from its source. These works evoke the historicity of both the old and the new, and let us understand that however exactly performed, reproductions carry an inherent productive and liberating distance from their sources.[11] Similarly, Proust effortlessly inverts the conventional hierarchy of copies and originals when the young pilgrim finds himself in front of 'the real thing'. This disappointment with the church in Balbec is not, however, a local phenomenon; rather, it is symptomatic of a fundamental aesthetic problem. While the awe-inspiring effect of art is guaranteed conventionally by the singular and irreproducible work, Proust hints at another way of thinking about the convoluted relationship among materiality, context, and significance.

9 Didier Maleuvre, *Museum Memories: History, Technology, Art* (Stanford, CA: Stanford University Press, 1999), 72.
10 Marcel Proust, *Finding Time Again*, vol. 6 of *In Search of Lost Time*, trans. Ian Patterson (London: Penguin, 2003), 195.
11 See Mari Lending, 'Reciting the Tomb of Tutankhamun', *Perspecta*, 49 (The MIT Press, 2016).

'In even the most perfect reproduction, one thing is lacking: the here and now of the work of art – its unique existence at a particular place', Walter Benjamin declared in the mid-1930s.[12] Compared to art forms such as sculpture and painting, architecture, one would assume, is especially site-specific: immovable, inexorably subjected to gravity, place, and its own materiality. 'The here and now of the original underlies the concept of authenticity', according to Benjamin, who let phenomena like authenticity, uniqueness, authority, and aura serve as floating signifiers.[13] Monuments are indeed imbued with ideas of a 'unique existence in a particular place'. Architecture is brutally subjected to history, both with regard to reception, and physically, through deterioration, restoration, and environmental change. In the case of the singular half-Romanesque, Norman Gothic, Persian church in Balbec, Benjamin would have conferred the irreproducible 'here and now' quality on the medieval building facing the busy square in Balbec-en-Terre. Proust concludes differently. Marcel realizes that the 'here and now' reality is incapable of guaranteeing anything of importance, not to say of permanence. Just like Eurydice disappears from the ambit of Orpheus's gaze, the 'real' building disintegrates into history and the everyday before Marcel's eyes. The plaster portal in Paris had allowed him to imagine a totality unobtainable in real life.

In Proust, authenticity springs from the first impression, not from the first version in regard to origins or provenance. This first edition, the fragment in Paris, generated something 'more and different'. 'When I recognised the Apostles, whose statues I had seen as mouldings in the Trocadéro Museum and who now stood to the left and right of the Virgin, waiting by the deep recess of the porch as though to pay me homage, I tried to close my mind to everything but the eternal significance of the sculptures.'[14] This eternal significance is not embodied in the stone carved from the Norman cliffs and patinated through the course of history. It originates in the first encounter with the unalterable reproduction. In this tension Proust grasped an aspect of Benjamin's theory of the decline of aura that Benjamin himself overlooked. It is, writes Samuel Weber, 'the very real possibility that aura will be reproduced in and by the very media responsible for its "decline"': what 'has become increasingly evident ever since, is that aura thrives in its decline and that the reproductive media are particularly conducive to this thriving'.[15] This possible blooming of aura – transplanted from the original to the reproduction, and from one medium to another – is exactly what Proust identified in the 19th-century mass medium of the architectural plaster cast.

In contrast to the persistent analogy linking museums to tombs, graveyards, and epitaphs, Proust sees reality as lethal for art. Face-to-face, the carved-in-stone Virgin of the Porch appears lifeless and accidental, drowning in context and the banality of everyday life. The reproduction, on the other hand, was 'protecting her forever from any vicissitudes which might jeopardize them, letting her stand unscathed amid their annihilation, ideal, full of her universal value'.[16] In reality and across history, the original work is perpetually corrupted.

12 Walter Benjamin, 'The Work of Art in the Age of Its Technological Reproducibility', 2nd version, in Benjamin, *Selected Writings*, vol. 3, 1935–1938, trans. Edmund Jephcott et al. (Cambridge, MA: The Belknap Press of Harvard University Press, 2002), 103.
13 Ibid., 103.
14 Proust, *In the Shadow of Young Girls in Flower*, 238.
15 Samuel Weber, 'Mass Mediauras, or: Art, Aura and Media in the Work of Walter Benjamin', in *Mass Mediauras: Form, Technics, Media* (Stanford, CA: Stanford University Press, 1996), 101.
16 Proust, *In the Shadow of Young Girls in Flower*, 238.

Postcard by the Neurdein brothers showing director Camille Enlart, curator Jules Roussel, and chief moulder Charles Édouard Pouzadoux in the 13th-century gallery, Musée de sculpture comparée, c. 1900. Musée des monuments français / Cité de l'architecture et du patrimoine.

The authorial voice of *In Search of Lost Time* famously compares Marcel's future novel to a medieval cathedral. More specifically, and less commented on, is the fact that its model of remembrance is taken from Viollet-le-Duc's dream of restoring 'the whole edifice to the state in which it must have been in the 12th century'. Paraphrasing Viollet-le-Duc, Proust also, anachronistically, evokes the working methods – and the vocabulary – of Factum Arte, when the future novelist claims that he has more 'precise data' to 'reinstate' and 'restore' the past than 'restorers generally have'. Yet Marcel's reproductions spring from 'mental imprints' not forensic investigations; impressions that he compares to forever-lost originals such as Leonardo's *Last Supper* and the portal of St Mark's Basilica, as painted by Gentile Bellini.[17]

Proust's attentiveness to details detached from their architectural body by means of zooming anticipated Walter Benjamin's promotion of the *advantages* of mechanical technologies in the experience of art. Photography 'can bring out aspects of the original that are accessible only to the lens (which is adjustable and can easily change viewpoint) but not to the human eye'. Further, it can 'use certain processes, such as enlargement or slow motion, to record images which escape natural optics altogether'.[18] As such, Benjamin's discussion of the decay of aura as a result of mechanical reproduction was not primarily a melancholic musing on decay and loss, but a hint at the aura's possible manifestations in new media. When defining an original, he underscored that its physical alterations over time 'can be traced only from the standpoint of the original in its present location', and that changes 'can be detected only by chemical or physical analyses (which cannot be performed on a reproduction)'. Nonetheless, the following reads as a perfect description of the effects of both Proust's plaster portal and Factum Arte's facsimiles: 'technological reproduction can place the copy of the original in situations which the original itself cannot attain'.[19]

17 Proust, *The Way by Swann's*, 166–67.
18 Benjamin, 'The Work of Art in the Age of Its Technological Reproducibility', 103.
19 Ibid.

Today, new media and new technologies are challenging orthodox modernist conceptions of material authenticity and the ontology of originals. The 19th-century plaster monument was already part of this destabilization of originals and copies. The idea of the precious original, the tenacious cult of authenticity, the obsession with indigenous materiality, the modernist ideology of honesty, and essentialist conceptions of site-specificity are all challenged by the historical patina of high-end reproductions. In Proust, the Balbec portal is not a referent pointing to a lost original. It is a thing in its own right. Fragmented, decontextualized, and translated – in time, place, discourse, and materiality – Proust's plaster portal and Factum Arte's productions testify to aspects of art works that the original itself, in a chaotic reality beyond curated control, could never present.

REVIVING WALPOLE'S NARRATIVES AT STRAWBERRY HILL HOUSE

Silvia Davoli

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Horace Walpole, renowned for publishing the first ever Gothic novel, *The Castle of Otranto*, in 1764, was a multi-faceted writer, the first English art-historian (*Anecdotes of Painting in England*, 176–80), author of an immense number of letters, inventor of the neo-gothic style, an antiquarian and a great art collector.

Son of the first Prime Minister, Robert Walpole (1676–1745), in 1739 Horace – like so many of his peers – went on the Grand Tour, accompanied by the poet Thomas Gray. On his return, he bought a small strip of land close to the Thames, in a pastoral area described by Walpole as 'my little Brenta' and where other nobles and men of letters possessed elegant houses. In order to build the house in an authentic neo-Gothic style Walpole formed the 'Strawberry committee', whose goal was to reproduce a neo-Gothic style based on features of original medieval architecture.

Walpole was aware of the novelty of his work; writing to his friend Horace Mann in Florence he declared: 'I shall speak much more gently to you, my dear child, though you don't like Gothic Architecture. The Grecian is only proper for magnificent and public

THIS PAGE

Facsimile of a double portrait of Robert Walpole and Catherine Shorter, painted by George Eckardt (c. 1754) and now at Houghton Hall, in a frame attributed by Horace Walpole to Grinling Gibbons.

OPPOSITE

Silver bell, known by Horace Walpole as the 'Cellini Bell', made by Wenzel Jamnitzer around 1550 and now part of the Rothschild Bequest to the British Museum.

A detail from the facsimile of Joshua Reynolds' portrait of the Ladies Waldegrave, Horace Walpole's nieces, in the roles of the three Fates. Commissioned by Horace Walpole in 1780.

buildings. Columns and all their beautiful ornaments look ridiculous when crowded into a closet or in a cheesecake house. The variety is little, and admits no charming irregularities' (letter to Mann, 25 February 1750).

Strawberry Hill is a complex and original place. To fully understand it, it is necessary to completely immerse oneself in 18th-century English culture animated by philosophical empiricism, by Edmund Burke's theories of Beauty and the Sublime, and by the first learned societies of antiquarians, who instead of looking at Roman and Greek classicism, looked to the national past. There are various characteristics of Strawberry Hill that recur in Walpole's letters – its small size, asymmetrical structure, use of fragments – and frequent reference to the artificiality of the composition, emphasized by the abundant use of *trompe l'œil*, such as the wallpaper imitating Gothic architectural details made of stone. Walpole constantly uses an ironic lens to describe Strawberry Hill, calling it in different instances a Trifle, a Toy House or even a faux ancestral castle – his family, of mercantile origin, did not have a real one. This irony serves to create a sense of distance from reality, thereby inviting meta-reflection on the house itself, on the collection and on their profound integration.

Walpole dedicated half of his life to building Strawberry House and its collection, and the other half to thoroughly describing it. He feared its eventual dispersal and to avoid this danger he used the only means he had at his disposal, the written word. He published two descriptions of the house and its contents (*A description of the Villa of Horace Walpole*, 1774 and 1784) complemented by some beautiful views of the main rooms. Walpole's fear was not completely unfounded: in 1842 the collection, more than six thousand objects (not including the prints, drawings and coins!), was dispersed in a memorable auction that lasted more than ten days.

FOLLOWING PAGES

The petroglyphs in the sacred cave of Kamukuwaká, located in the Xingu region in the Brazilian Amazon, were vandalised in 2018. Following the digital restoration of the damaged surfaces in collaboration with the Wauja people, Factum Arte recreated the cave, whose return to the Xingu region is currently being planned.

Bakor monoliths in Cross-River State, Nigeria, 2016. The monoliths are under increasing threat from deforestation and the burning of yam stubble. Factum Foundation has been working with the Trust for African Rock Art and the University of Calabar for the last four years to digitise and preserve these important monoliths. © David Coulson.

The installation of a facsimile of one of the lamassu from Ashurnasirpal's palace at Nimrud, now in the British Museum, into the entrance of the student hall at the University of Mosul in 2019.

Walpole was an insatiable collector of historical curiosities, such as the famous Magic Mirror of Doctor Dee (British Museum) or Cardinal Wolsey's Hair (Christ Church, Oxford), objects which he collected not because of their uniqueness, as in the case of the Renaissance Wunderkammer and its mixture of *naturalia* and *mirabilia*, but because of the power they had to create connections to the past. Walpole, like many of his contemporaries, was interested in History, in the reconstruction of historical narratives. Even portraiture, omnipresent in Strawberry Hill, develops this theme: through their characters, the portraits represent history, helping the spectator to connect with a particular past.

After years of semi-neglect, the house was restored and reopened to the public in 2010, but it was like an almost empty shell. The new museum's mission is to acquire, where possible, the works of art that were once part of the original collection, but for obvious reasons this is a slow, expensive and complex process. Another priority is to allow the public to enjoy Strawberry Hill in its entirety – that is, to experience the original complementarity between architectural design and some of the key works of the collection. To this end, the Trust has decided to reproduce several works of high artistic value which were once exhibited in Strawberry Hill but are now held in museums or private collections.

This is how the collaboration with Factum Arte was born. Factum Arte allowed us to faithfully reproduce complex works such as the double portrait of Robert Walpole and Catherine Shorter by John Giles Eccardt and its elaborate Rococo frame (Lewis Walpole Library), the extraordinary portrait of the three Ladies Waldegrave by Sir Joshua Reynolds (National Gallery of Scotland), the historic painting depicting the family of Henry VII and *St George and the Dragon* now part of the Royal Collections, the portrait by Allan Ramsey of Walpole's nieces (Museum of Fine Arts in Boston) and the extraordinary silver bell made by Wenzel Jamnitzer (British Museum), one of the objects most admired by Walpole. These highly significant works today accompany visitors on their discovery of Strawberry Hill and help to restore some of the narratives which Walpole had created for the house.

Moreover, the presence of copies does not seem to be completely contrary to Walpole's philosophy. Precisely because the historical narrative prevailed over the concept of uniqueness, when Walpole could not obtain original portraits of his heroes and heroines – such as the portrait of Lord Falkland painted by Mark Geeraerts, at the centre of one of the most famous episodes of the Castle of Otranto – he did not hesitate to commission a copy. In fact, one of the most famous rooms in Strawberry Hill, the Holbein Chamber, was entirely built around copies of a series of drawings originally by Hans Holbein, rediscovered in 1727 by Queen Caroline at Kensington Palace, executed by his friend the antique dealer George Vertue. Vertue's drawings are now preserved at Sudeley Castle, but thanks to the reproduction of facsimiles faithful in every respect to the originals, they can now be admired in the room that was built to hold them at Strawberry House. Without the reproduction of these splendid portraits from the court of Henry VIII it would not have been possible to transmit to the public the historical, artistic, and cultural significance of this room.

In 2018, an exhibition was held which brought together the house and its collection for the first time in more than 150 years. It was a never-to-be-repeated occasion, in which original works of art were united with copies to allow visitors an authentic visual experience, viewing Strawberry Hill House through the eyes of Horace Walpole.

CHAPTER 2

PRESERVING, SHARING AND RESPONSIBILITY

COLLECTIONS ENTAIL RESPONSIBILITIES. NOTES ON A GLOBAL INSTITUTION

Hartwig Fischer

This essay was originally published in Peter Mosimann and Beat Schönenberger, *Kunst und Recht*, vol. XI (Bern: Stampfli Publishers Ltd., 2019).

Hartwig Fischer took up the post of Director of the British Museum in Spring 2016. He gained his PhD in Art History at the University of Bonn in 1993 after studying in Berlin, Rome and Paris. Hartwig began his career in museums as a Research Assistant and then Curator of 19th-Century and Modern Art at the Kunstmuseum Basel, Switzerland before becoming Director of the Folkwang Museum, Essen in 2006. In 2012 he was appointed Director General of the Staatliche Kunstsammlungen (State Art Collections), Dresden, with responsibility for 14 museums and associated libraries, archives and research centres.

PREVIOUS PAGE

The re-creation of Raphael's *Christ Falling on the Way to Calvary*, often known as *Lo Spasimo* (*The Agony*). Originally painted on wooden panels in 1514, it was transferred onto canvas in Paris in the early 19th century. Factum has remade the work as a panel painting to be installed in the recently restored original marble frame in the Church of Santa Maria dello Spasimo, Palermo.

OPPOSITE

Fig. 1: Stele of Ashurbanipal, 668–655 BC. © Trustees of the British Museum.

1. CULTURAL RESOURCES

In his essay 'There is no cultural identity', published in 2016,[1] the French philosopher and sinologist François Jullien re-examines the concept of the universal – as developed and advanced by the West. Jullien considers the challenges the concept increasingly faces as new centres of power and thinking emerge, Western controls mutate or wane, globalisation diversifies or fractures, nationalisms thrive, and reclamations abound. Without reducing universalism to a mere tool of domination – its roots and development over 2,500 years are diverse and complex – Jullien states that any claims to a (totalising) universal, on the part of the West, are no longer sustainable. In its place he advocates a 'rebellious universal' which, as an unattainable horizon, an unachievable ideal, keeps us searching, keeps peoples from retreating into their 'cultural differences', from indulging in their 'essence'; instead it pushes them to continue facing and reaching out towards each other, and to continue developing and transforming, an attitude which alone keeps them alive.

Opposing the concept of difference defining identity through exclusion, Jullien strengthens the notion of *écart*, a distance or in-between that connects. He insists that cultures are interrelated through an in-between that keeps them *en regard*, in sight of each other, each remaining dependent on the other, challenged by the other. Through the in-between that keeps them linked, each culture activates the other as a resource, pushing each beyond the boundaries of its 'identity' and opening them up to the impact of the other. We should conceive of culture here as a set of thought systems, beliefs, and interactions growing out of history, a people's or group's practice, knowledge and conceptions that develop over time, through the accumulation of individual and collective actions and interactions.

What bridges the distance between cultures and enables us to use them as a resource is dialogue, a dialogue that respects the otherness of the other and enables us to comprehend ourselves, and the other, in our interconnectedness.

Jullien's 'dialogue' combines *dia*, meaning distance as well as moving across the distance, and *logos*, meaning the possibility of understanding, the shared common ground of intelligibility.

Jullien fears that the West has put its ability to dialogue at risk. With the overpowering strength of its 'global' values it has tried to impose its universalism on other peoples, colonising their cultural practices through triumphant rationality, which in turn is now provoking identity claims whose virulence mirrors the uniformity formerly imposed by the West.

1 François Jullien, *Il n'y a pas d'identité culturelle* (Paris: L'Herne, 2016).

A true dialogue can only take place in the language of both cultures, Jullien claims, between languages: translation is the basic, practical implementation of dialogue, it reveals the discomfort, the permanent disquiet, the nondefinitive nature of any authentic dialogue, moving forward through never-ending reiterations. It also reveals its strength: moving between cultures and bridging the *écart* generates energy and engagement, leading to mutual understanding.

Jullien's thinking addresses important aspects of what the British Museum as one of the great comprehensive institutions of human cultural achievements aspires to: a self-critical but confident universalism constantly engaged in dialogue to activate its collection as a beneficial cultural resource for millions of people. This resource should be available physically both in London and abroad, and digitally across the world, working with specialists and communities from all continents to bring out the many stories the objects in its care encapsulate, rendering them meaningful and accessible for a most diverse global public. The Museum itself has the capability to constitute a 'shared common ground of intelligibility' – each object in its collection has the potential to generate dialogue.

All human societies create material circumstances within which people live and attempt to thrive. Such material circumstances are embodied in the artefacts in the British Museum, which are concrete instances of the logics, emotions, aesthetics, successes and failures of all human ways of life. Living in a multicultural world involves bringing one's own logic into contact with other logics and exploring areas of congruence and disjuncture. The Museum is the very place of hospitality to allow this to happen, to acknowledge areas of similarity, and also of radical difference in engaging with the cultures of the world.

But isn't the Museum's claim to universal relevance being challenged by movements in many parts of the world that reject cosmopolitan approaches in favour of nationalist and populist ideologies, denounce universalism as self-interested subterfuge and endorse the renationalisation of cultural politics? What is the Museum's position in the current debate 'about possession of objects and sites, about who is entitled to produce knowledge and narratives about them, about the contexts in which they are most appropriately understood and accessed, and about who is responsible for their conservation and preservation [?]', to borrow Professor Sunil Khilnani's succinct formulation during a recent conversation.

2. A COLLECTION BELONGING TO THE WORLD

The British Museum is a unique place of translation, placing cultures *in sight* of each other, bridging the *écart* and making them freely accessible. It is no coincidence that the most visited object of the Museum is the Rosetta Stone, the one object that, discovered and transferred from Egypt in a context of imperial competition, allowed Champollion and his contemporaries to decipher the hieroglyphs and thus rediscover and open up the history and culture of ancient Egypt.

The British Museum was founded in 1753 when Britain was already a significant power with colonial possessions across the world. This context is obviously important to the history and character of the collection of the British Museum. But the Museum was not established as an arm of the state to celebrate British imperial power. It was founded at the height of the European Enlightenment by the British Parliament as an independent charitable trust. Its collection had to represent the world; it had to be kept together forever, for the benefit of present and future generations; it had to be openly accessible for everybody, for people from all nations, not only the British; the collection had to be explored through innovative research bringing together different disciplines to compare cultures across the millennia and to understand our common humanity; and the knowledge thus generated had to be widely shared to benefit the public. In other words, the Museum was meant to be not only about objects and the knowledge and stories they preserve but just as much about relationships and exchange between human beings.

In order to deliver these objectives, Parliament vested responsibility for the institution in the Trustees. The Trustees have fiduciary ownership of the collection, but they are owners only inasmuch as they act on behalf of the entirety of its beneficiaries, and these beneficiaries, or owners, are the citizens of this world, and future generations.

This is a unique setup: it has created an exceptional tool to study and explore the history of humankind through significant objects, from first beginnings until today.[2]

3. COLONIALISM, IMPERIALISM

The term 'colonialism' refers to nations or powers or elites extending their authority over territories and peoples, primarily for the purposes of expanding trade and accessing and using resources, mostly to the benefit of some parts of the population, and to the disadvantage of others. There are evidently great differences between the basic types of colonialism that variegate into a great range of forms impacting on the identities of all involved, whatever their role and position within these constellations.

There are vast differences, also, between the loose network of Greek or Phoenician cities across the Mediterranean and centralised, industrialised states that carved up an entire continent, Africa, into different areas of rule and exploitation, or between the empires of the Aztecs and the empire of Han China.

Broadly speaking, however, we might say that colonialism and its specific form of government – empire – have marked the last 5,000 years of history, and have for a great number of people provided the basic political and social framework of their lives: 'An empire is thought to exist where there is some overarching political control over subject colonies. Imperialism is a special case of colonialism where there are colonies tied together into one political structure, which has a series of ideological, economic and cultural implications', Chris Gosden writes in *Archaeology and Colonialism*.[3]

Empires and colonialism themselves are part of the global history of power, inequality, and exploitation, the history of amassing resources for major innovations and developments that have shaped the world, its societies, and individuals and their notions of both society and identity profoundly. The emergence of the modern world and of globalisation as a world system are marked by colonialism. 'Colonialism is the major cultural and historical fact of the last 500 years and to some extent the last 5,000 years', Gosden writes.[4]

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2 See Jonathan Williams, 'Parliaments, Museums, Trustees, and the Provision of Public Benefit in the Eighteenth-Century British Atlantic World', *Huntington Library Quarterly*, 76, no. 2 (2013): 195–214. The British Museum Act of 1753 was replaced by the British Museum Act of 1963 and enhanced by subsequent legislation, notably the Museums and Galleries Act of 1992, the Human Tissue Act of 2004 regulating the return of human remains, and the Holocaust (Return of Cultural Objects) Act of 2009, which do not change the basic legal structure of the institution.

3 Chris Gosden, *Archaeology and Colonialism* (Cambridge: Cambridge University Press, 2004), 5.

4 Ibid., 4.

'Colonialism is a process by which things shape people, rather than the reverse. Colonialism exists where material culture moves people, both culturally and physically, leading them to expand geographically, to accept new material forms and to set up power structures around a desire for material culture.'[5] We understand the experience of people living under the conditions of colonialism through the items they made, exchanged, used, had to give up or left behind. A considerable number of objects in the collection of the Museum are themselves documents of forms of imperial rule and colonisation dating back over 5,000 years, through many different forms of Empire across the world. They allow us to situate colonialism within the long history of empires as a political and cultural phenomenon and their crucial role in the diffusion and displacement of people, ideas, cultural practices and things on the one hand, of exploitation, oppression and destruction on the other, with slavery as its most horrendous and pernicious practice.

However, the imperialism and colonialism that the current debate on restitution focuses on is the more recent form of this type of rule. It is still close to us, it marks the lives of people up to the present, and it is part of our own past even though we were not directly involved in it or not even born when it ended. It is a shared difficult past. Acts of violence were perpetrated during the period of imperial conquest and during colonial rule with effects that echo into the present. Institutions like the British Museum have a responsibility to address and respond to these challenges.

4. RESTITUTION

The report on the return of objects to Africa commissioned by President Macron, written by Felwine Sarr and Benedicte Savoy and published in November 2018, advances two areas of action: restitution, and collaboration, following the President's earlier statements on colonialism as crime against humanity (in February 2017 while campaigning in Algiers) and on the temporary or permanent return of African objects in French public collections (in a speech in Ouagadougou, Burkina Faso, in November 2017).[6]

In assessing how objects have entered collections in France, the authors make the basic assumption – following Macron's assertion – that colonialism constitutes a crime against humanity and that therefore any transfer of objects under the conditions of colonialism was inherently illegal, unless the present owner can prove that an object was acquired with the full and documented consent of the previous owner, and that an adequate price was paid. They suggest that the major part of African holdings in France (and by implication in Europe) should be returned, or rather that they are still the property of nations, communities, institutions or individuals in Africa, and that it is France's duty to acknowledge this fact, and the African states' only task is to decide at which moment over the next decades they wish to take back the objects, or whether leave them as loans in European museums. Nations, communities, institutions or individuals are here being subsumed by and represented through the state, and not acting on their own behalf — a legal and political assumption with far-reaching implications. The authors of the report consider other forms of collaboration as inadequate and basically unacceptable unless the objects have been returned at least in principle. The return alone corroborates the acknowledgement of past wrongs and the intention to engage in a process that would heal the wounds inflicted by European colonialism.

Sarr and Savoy argue that return is an indispensable prerequisite of more beneficial, more equitable relations between Africa and Europe, in a crucial moment of economic and intellectual transformation that will lead African nations to decide for themselves what kind of society they want to build, what kind of economy they want to develop, how to interpret and come to terms with their own complex past, and how to engage with the rest of the world.[7]

5. ENGAGING WITH THE WORLD

While convinced that the foundational value of the British Museum's collection – and its global significance – resides in its breadth, depth, complexity and unity, the Museum has been working with communities and institutions across the globe, entering into difficult conversations about the past and charting together a course that provides access to objects, tells their stories, makes different voices audible and uses them to reconnect with the past and derive from that connection new energies to shape the future.

The research conducted by the British Museum in partnership with others frequently reveals how layered, differentiated, entangled a historical situation can be when it comes to agency in trade and transfer under the conditions of colonialism in the British Empire, but equally across continents and millennia. This too needs to be acknowledged, and so indeed should the role of power, inequality and exploitation on all continents throughout history. There is no obvious reason for limiting this debate to any specific region, and the British Museum never has. Nor is there a reason to limit it to the late 19th and early 20th century or solely to European empires. The same arguments can apply to all countries formerly under colonial rule or simply under the rule of someone else. Colonialism and imperial expansion have been practised on all continents, and long before European states rose to global power.

When does a region (or community) cease to be independent and turn into an integral part of a bigger whole, and inversely, when does it gain independence and turn into an entity in its own right? Obviously, identities are multiple at all moments, and they are constantly in flux. Objects do not necessarily have a national identity inscribed into them and aligned with present-day nations and territories. In what sense can modern nation states lay claim to historical objects that predate contemporary national delineations and sentiment? Objects frequently carry intricate legacies of transfer and acquisition, involving violence, conflict and inequality, long before they enter a museum.[8]

In addressing these questions and in trying to chart an answer the British Museum must be aware of the persistence or recalibration of colonial structures today and their political, economic, social, and cultural dimensions in regional, national and transnational contexts. The shifting centres of power and of power constellations reshape the way we negotiate the specific relationship between the individual and local on the one hand, and the pervasive nature of global connections on the other. There are few places that allow us to engage in these processes like the British Museum, within the reference frame of two million years of human development in its diversity, complexity and unity. 'To understand

5 Ibid., 159.
6 Felwine Sarr and Bénédicte Savoy, *The Restitution of African Cultural Heritage. Toward a new relational ethics* (Paris: Philippe Rey, 2018).
7 These ideas are developed more comprehensively in Felwine Sarr, *Afrotopia* (Paris: Philippe Rey, 2016).
8 I am grateful to Sunil Khilnani for discussing these points in a recent conversation.

the present in its unique form, and its historical lineages, we need to understand the past shapes that colonialism and power have taken through material culture. The past histories of colonialism are no infallible guides to grasping the present, but they can open up our minds to the range of possible shapes power takes, which will provide inspiration in understanding our present situation and for seeking a more human dimension to global structures.'[9]

The British Museum has made great efforts in seeking to contribute to 'a more human dimension to global structures' by making the collection ever more accessible as a means of learning and knowledge. Its curators work with communities from around the world every day and conduct research on the history of its collection and the provenance of its objects. Together they organise exhibitions addressing many of the complex issues of world history and the many ways objects were acquired and have entered the collection; they also encourage curators in other countries to present their narratives of the objects from the British Museum. They welcome museum colleagues and heritage specialists from across the globe for training and skill sharing that enables all sides to learn from each other; they partner with institutions on all continents to build up cultural infrastructure; preserve cultural heritage; assist in the return of stolen or illicitly exported objects; and enhance experience and expertise, building up a global network of professionals.

The Museum is one of the most significant lenders of objects across the world and keeps circulating them through exhibitions and long-term loans. It has built up a comprehensive, publicly accessible database of the objects in the collection, and has accelerated the use of digital technologies to enable and facilitate exploration of the collection from anywhere in the world. Its inventories and archives are freely accessible, inviting independent research on the objects, the collections, and the history of the institution.[10] With continued investment in digitisation, information will progressively become available online to those who cannot physically visit the Museum and its archives.

There are myriad ways of working together, exploring the collections, researching their history and provenance, or of using them to open up a new understanding of a region's culture. Exhibitions are among those tools. One example of how this can be done was *India and the World*, presented in 2017–18 at the CSMVS Museum in Mumbai and the National Museum in Delhi. Preceded by ten years of collaboration, training, smaller shows and research projects, this major exhibition was developed by a team of curators and scholars from Mumbai, Delhi and London to showcase 5,500 years of Indian history in a global context, with all works pertaining to South Asia coming from Indian collections, and all works highlighting the global connections of South Asia coming from the British Museum. The show attracted far more than 200,000 visitors in Mumbai alone, and involved hundreds of schools who seized the opportunity to have their pupils engage with a much wider perspective on Indian and global history than their institutions would normally offer, stressing among other aspects the grand multicultural, multi-faith traditions of India. It also offered digital introductions and presentations for those who could not attend or desired to deepen their experience following their visit. The exhibition has created a template, both as a method of collaboration and as a means to show the interconnectedness of a country and its various cultures.[11]

9 Gosden, *Archaeology and Colonialism*, 259.
10 See for instance Delbourgo's critical appraisal of Hans Sloane, whose collection formed the basis of the British Museum. James Delbourgo, *Collecting the World: Hans Sloane and the Origins of the British Museum* (London: Allen Lane, 2017).
11 www.indiaandtheworld.org/.

Fig 2: Relief with Assyrian soldiers demolishing and looting the city of Hamanu, 645–640 BC. © Trustees of the British Museum.

6. OBJECT JOURNEYS

The paths which objects have taken through time and space before entering the collection of the British Museum are numerous. The following pages give an impression of just how varied these journeys have been and hint at the many complex stories of these objects. The final example, though not of one specific object, demonstrates the additional dimensions digital innovations offer for people from across the world to access the collection, engage with it and use it creatively.

a. Stele of Ashurbanipal (Fig. 1)

This monument, dated to 668–655 BC, was excavated in Babylon and has been part of the Museum's collection since 1881. It shows Ashurbanipal, king of the Neo-Assyrian Empire that had been controlling formerly independent Babylon for centuries, lifting a large basket of earth for the ritual moulding of the first brick of the Temple of Marduk. The cuneiform inscription records Ashurbanipal's restoration of a shrine in Babylon as an example of his kingly might, the divine favour he was enjoying, and his many good acts as imperial overlord.

Under Ashurbanipal's rule, from 669–631 BC, the Assyrian Empire reached its maximum expansion through conquest and annexation, stretching from today's Western Iran to the Eastern Mediterranean, from Turkey to the Persian Gulf and to Egypt. At its administrative and political centre, the royal city of Nineveh (present-day Mosul, Iraq), a literary and visual court culture developed, based on the influx of riches from all over the empire, which produced highly sophisticated architecture and works of art, and the greatest library of the ancient world.

Assyria, however, soon fell victim to destruction by previously oppressed peoples, especially the Medes and Babylonians, and after 612 BC it sank into oblivion. Excavations by Paul-Émile Botta, and especially by Austen Henry Layard and Hormuzd Rassam from 1845–47 around Mosul, then part of the Ottoman Empire, brought to light the extraordinary reliefs that had adorned the walls of the royal palaces, extolling the prowess and success of the ruler (Fig. 2). On their second expedition from 1849–51, they uncovered the library of Ashurbanipal, which allowed cuneiform script to be deciphered by Henry Rawlinson, and which in turn opened up the entire literary heritage of ancient Mesopotamia (Fig. 3). Typically for those times, Rawlinson was a British East India Company army officer, a politician and a leading Orientalist, called by some the Father of Assyriology.

With the permission of the Ottoman government, many of the finds were transferred to London and Paris, and triggered research into the ancient Middle East on an unprecedented scale, allowing for the rediscovery of the first states and empires in the region and their associated political, religious and administrative structures. After the fall of the Ottoman Empire, France and Great Britain carved up the Middle East along the lines of the Sykes-Picot agreement in order to secure access to a newly relevant natural resource, oil. The creation of the Kingdom of Iraq under the Hashemite dynasty was one of the consequences of these developments, and has influenced the development of the region up to the present day.

British writer, political officer, administrator and archaeologist Gertrude Bell, who played an important role in these developments, would also become instrumental in founding the National Library of Iraq, and in 1926 the Iraq Museum in Baghdad, which quickly grew into a major institution for the preservation and showcasing of Iraq's cultural

heritage, receiving the major finds from all over the country. Bell was also key in introducing legislation on the protection of cultural heritage in Iraq in 1926–27.

Despite this promising start, a nearly unbroken series of conflicts driven by far-reaching power struggles, colonial demarcations, the scramble for raw materials and denominational and religious enmities has led to entire communities being attacked, killed or forced into exile. In the process, some of the most important historical sites, museums and objects have been destroyed by war, subsequent looting and vandalism and, most recently by a short-lived radical regime, Daesh (the so-called 'Islamic State'). In response to this systematic destruction of cultural heritage, some of the great museums and research institutes of the world, with the financial support of foundations and governments of numerous countries, have started, in collaboration with Iraqi colleagues, to help protect and preserve cultural heritage sites, monuments and museums in Iraq for present and future generations.

In 2015 the British Museum developed a scheme which, in the face of destruction, could offer something positive and constructive. The 'Iraq Emergency Heritage Management Training Scheme', or simply 'Iraq Scheme', which is supported by the UK government, is building capacity in the Iraq State Board of Antiquities and Heritage by training fifty of its staff in a wide variety of advanced techniques of retrieval and rescue archaeology. The programme, undertaken first in the UK and then on two specially selected archaeological sites in safe areas of Iraq, delivers state of the art training in all aspects of archaeological fieldwork, from

Fig. 3: The Flood Tablet or The Gilgamesh Tablet, Library of Ashurbanipal, 7th century BC. © Trustees of the British Museum.

Fig. 4: Installation of lamassu facsimiles, University of Mosul, 2019.

geophysical and geomatic surveying and documentation to complex excavation methodology. The training provides the participants with the expertise and skills they need to face the challenges of documenting and stabilising severely disrupted and damaged heritage sites in preparation for potential reconstruction. These two fieldwork projects are not 'training excavations' as such, but rather fully developed scientific excavations at which participants are offered instruction in the detailed techniques of field archaeology. Both excavation projects provide a wealth of experience for the participants.

On 24 October 2019, Factum Arte and the British Museum set up, in collaboration with colleagues in Iraq, high-resolution 3D copies of two lamassu in the British Museum's collection produced by Factum Arte (lamassu are winged bulls, or, as in this instance, winged lions with crowned human heads, that flanked the entrances to Assyrian royal palaces). They were placed in front of the newly rebuilt Student Centre (Fig. 4), near the library building of Mosul University, one of the most important libraries of the Middle East that was destroyed by Islamic State. It is a statement about sharing, and about the importance of culture, at a time when digital can have an extraordinary impact in both the virtual and physical worlds. The event was celebrated by students and inhabitants of Mosul as an important step in the recovery of their cultural heritage.

b. The Cyrus Cylinder (Fig. 5)

Territorial expansion, consolidation and assimilation of language, religion and culture have a long history as a political and social phenomenon. Numerous objects now in the British Museum show that the movement of people, ideas and things, both voluntarily and by force, has roots in deep human history and in the ancient world. The Cyrus Cylinder is one such example.

Named for its shape, the Cyrus Cylinder is an account written in the Babylonian language that documents the conquest of the great city of Babylon by Cyrus the Great, in 539 BC, which resulted in the assimilation of the Babylonian Empire into the growing Persian Empire. The Cylinder was deposited in the city walls of Babylon around that date. Found at the site during a British Museum sponsored dig in 1879, it has been displayed more or less continually ever since.

The text, probably written on the orders of Cyrus, records the awfulness of Nabonidus, last King of Babylon, who is claimed to have perverted the cults of gods including Marduk, the presiding deity of Babylon. Marduk, we are told, selected Cyrus as his champion to restore the old ways and made him King of the World. Cyrus then marched on Babylon where the Babylonians welcomed him as their new king and delivered Nabonidus to him. Cyrus presents himself as a worshipper of Marduk who strives for peace, abolishes a labour service imposed on the city's free citizens, and restores temples, religious cults, and previously deported gods and people. The Cylinder also appears to support biblical evidence in the Book of Ezra, which tells us that Cyrus liberated the Jews and allowed them to return home. This has led to the assumption that Cyrus was a champion of humanitarian values, but although it is often described as a 'first bill of human rights', the surviving text on the Cylinder contains no guarantee of human rights. In any case, such a concept would not have existed in Cyrus' time. This is rather an official text justifying the annexation of Babylon by Persia and depicting an act of conquest as an act of salvation and restoration.

Adopted as an official emblem during the 2,500th-anniversary celebrations held by the last Shah for the founding of the Persian Empire, the Cylinder was loaned to Iran in 1971 where it formed part of the festivities. Having acquired special reverence among

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Fig. 5: The Cyrus Cylinder, 539 BC.
© Trustees of the British Museum.

OPPOSITE

Fig. 6: The Meroë Head, 27–25 BC.
© Trustees of the British Museum.

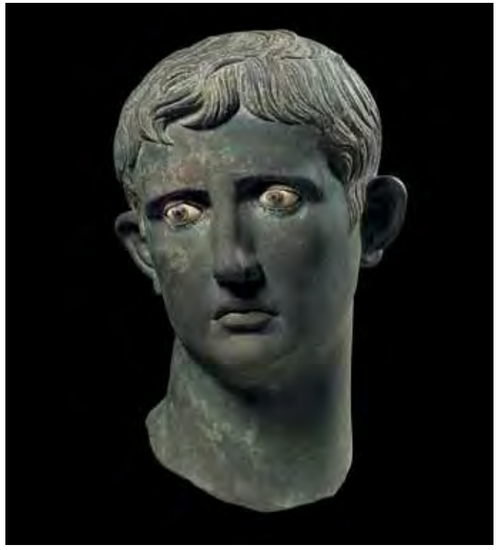
Fig. 7: The Rosetta Stone, 196 BC.
© Trustees of the British Museum.

Iranians, it was loaned again in 2010–11 to the National Museum in Tehran to figure in an exhibition curated by the museum's staff. At a time of tense political relations this second loan of the cylinder was a moment of great significance both within Iran itself and also for British-Iranian relations, demonstrating how objects can act as agents of cultural dialogue. Today copies of the Cylinder are omnipresent across Iran, speaking of the country's grand history, beneficial impact, and the clemency of a ruler who grants rights and allows peoples to return to their ancient lands.

c. The Meroë Head (Fig. 6)

Empires result in the movement of people, ideas and things. Not only do objects acquire new meanings through their diffusion, but their survival may sometimes even be dependent on their having been removed from their original context. The Meroë Head, which is an over-life-sized bronze portrait bust of the first Roman emperor, Augustus (27 BC – AD 14), is an example of this, and a rare survival of a bronze statue from antiquity. It is believed to have been part of a statue erected early in the reign of Augustus in a Roman garrison town in Egypt, newly annexed by the Roman Empire. Intended to project the power and omnipotence of the emperor, it served such a purpose for only a short period. Within a couple of years, it had been torn down by an invading enemy, the neighbouring Kushite Kingdom to the south of Egypt. They raided the Roman garrisons and looted the statues, transporting them hundreds of miles south to the Kushite capital at Meroë in present-day Sudan.

Most of the statues were returned following negotiations between the Meroitic Queen Amanirenas and the Roman general Petronius. However, this bust remained at Meroë where it was buried under the threshold of a temple dedicated to Victory. It appears to have been deliberately placed so that the Meroïtes could trample over it. This act of humiliation ultimately ensured its survival. It was discovered in 1910 by archaeologists led by John Garstang, having spent most of its history below ground and, therefore, out of sight. We do not know the name of the local workers who found the statue that day (as is so often the case). Garstang's project, on behalf of the Institute of Archaeology at the University of Liverpool, was carried out under the recently established (1905) Antiquities Ordinance, created by the British administrators of the Anglo-Egyptian Condominium of Sudan (1899–1956). While this banned illicit export of antiquities from Sudan, it did



allow for a *partage* system. This ensured that sponsoring institutions in the UK and beyond could receive a share of the finds; through this route, the Augustus head arrived at the British Museum. The phenomenon of *partage* sits alongside other methods of acquisitions of the time, including diplomatic gifts from governments, acquisition of older collections, and purchases by individuals subsequently donated to the Museum.

d. The Rosetta Stone (Fig. 7)

The Rosetta Stone, one of the most famous objects in the British Museum collection, is inscribed with three versions of a decree issued at Memphis in 196 BC on behalf of King Ptolemy V Epiphanes, roughly 140 years after Alexander of Macedon had conquered Egypt. The Greek dynasty of the Ptolemies was installed after his death and ruled the country until it was conquered and incorporated into the Roman Empire.

The top and middle texts are in Ancient Egyptian hieroglyphic and demotic scripts, while the bottom is in Ancient Greek. It is believed to have originally been displayed within a temple, possibly at Sais, and was probably moved in late antiquity or during the Mamluk period (1250–1517), when it was finally used as building material for the foundation of Fort Qaitbey near the town of Rashid (Rosetta) in the Nile Delta.

The Stone was discovered by a French soldier during Napoleon's attempt to conquer Egypt from the Ottoman Empire which aimed to weaken British access to India. Transferred to the Institut d'Egypte in Cairo, copies were made for French scholars to work on. With the defeat of Napoleon's armies by Britain, the Treaty of Alexandria set the terms of capitulation in 1801. This included 13 antiquities, which despite French protests, were deemed state property, not the holdings of individual French soldiers or scholars. King George III subsequently donated the Rosetta Stone along with the other 12 objects to the British Museum in 1802, and it has been on public display at the British Museum almost continuously ever since.

The Museum pioneered new printing and reproduction techniques and distributed copies and casts in the UK, France, Germany and the US immediately after the Rosetta Stone entered the collection.[12] This helped with the decipherment of hieroglyphs, finally cracked by Jean-François Champollion in 1822. Three more fragmentary copies of the same decree were discovered later, and a number of similar Egyptian bilingual or trilingual inscriptions are known today. The Rosetta Stone, though no longer unique, was the essential key to our modern understanding of ancient Egyptian literature and civilisation. Today, the term Rosetta Stone is used metaphorically to refer to the essential clue to a new field of knowledge.

The British Museum currently collaborates closely with Egyptian colleagues on research, skill-sharing and documentation projects. Fieldwork at Naukratis in the Nile Delta explores the cosmopolitan port city with its Greek sanctuaries and harbour facilities, while at Shutb near southern Egypt, there is work with the local community to explore continuities with the past. The 'Circulating Artefacts' project tracks and researches the movement of pharaonic antiquities beyond Egypt, helping combat illicit trade. A major project funded by the EU brings together the Museum and four other major European institutions to provide technical assistance towards the redevelopment of the Egyptian Museum in Cairo.

e. The costume of the Chief Mourner, Tahiti (Fig. 8)

Museums cannot ignore difficult colonial legacies; objects collected by European explorers often present complex narratives regarding conquest, trade and ownership. However, there is often agency on both sides, which the British Museum seeks to explore through the research, conservation and display of objects. One such example, a Chief Mourner's costume from a time preceding the colonisation of Tahiti, was one of the star objects in the recent *Reimagining Captain Cook: Pacific Perspectives* exhibition, which familiarised visitors with the appraisal of Cook's voyages and their aftermath by today's descendants of the people that inhabited the regions he explored, some of which would ultimately be incorporated into the British Empire.

In traditional Tahitian society the death of an important chief or high-ranking individual was followed by a period of mourning. It was a fraught and uncertain time, and to manage the transition of power to a new chief or leader, a series of ceremonies were held known as Heva Tupapa'u, or 'mourning for the corpse'. The Chief Mourner's costume was carefully designed and painstakingly constructed from beaten bark cloth and plaited coconut fibre decorated with feathers, coconut shells and hundreds of pearl shells which shimmer when it is worn. It would strike awe into those who encountered it, including the crew who arrived with James Cook's first voyage to the Pacific in 1769. The voyage botanist, Joseph Banks, described seeing a man wearing a 'dress so extraordinary that I question whether words can give a tolerable idea of it'.

Cook and Banks attempted to procure a costume, but they were rebuffed, having been unable to offer the Tahitians anything they would consider worth exchanging. Instead, they made drawings. Cook's disappointment at not being able to acquire a costume stayed with him and when he returned to Tahiti on his second voyage in 1774, he arrived prepared. This time, he brought red feathers from small parrots and

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Fig. 8: The costume of the Chief Mourner, Tahiti, 18th century. © Trustees of the British Museum.

OPPOSITE

Fig. 9: Benin plaque depicting the Oba flanked by two assistants, with Portuguese figures in the background, 16th–17th century. © Trustees of the British Museum.

12 A number of casts and copies were also presented to Egyptian institutions over the last 150 years.

lorikeets he had obtained on the islands of Tonga, having learned how much Tahitians valued them. Of the exchange, Cook wrote that during a visit from 'the Royal Family', Tu's father 'made me a present of a complete Mourning dress, curiosities we most valued, in return I gave him whatever he desired and distributed red feathers to all the others'. Cook purchased a number of complete mourner's costumes, perhaps as many as ten, which he brought back to Britain aboard the HMS *Resolution*.

Cook's interest in the costumes and persistence in acquiring them was, it transpires, crucial to their preservation. Another consequence of the arrival of early Europeans such as missionaries and the introduction of firearms was the disruption of traditional ceremonies, and the Heva Tupapa'u was soon abandoned. Other existing mourner's costumes did not survive on the islands, and some were traded out to Europeans in various circumstances. Today, six complete examples survive in various institutions around the world.

Close interaction between the Museum's curatorial, conservation and science teams, working with Tahitian specialists in preparation for the 2018 exhibition, revealed much new information about the costume, including the source of its feathers, as well as the emergence of two garments rolled into it, which had been previously thought to be padding. These collaborative discoveries have deepened understanding of this object, its role in traditional Tahitian culture, and of European contact with the people of Tahiti in the 18th century.

f. Benin Bronzes (Fig. 9)

The Kingdom of Benin was one of the most important precolonial states of West Africa and is known around the world for its sophisticated bronzes, many of which display narratives from the early life of the kingdom. Known to the Portuguese from the 15th century, since the earliest European voyages to West Africa, the kingdom became a major trading partner with Europeans. At this moment of European 'contact' Benin was already an important political formation and major trading state, situated within a regional network that connected it to trans-Saharan trade routes supplying gold, ivory and other products to the North African Islamic world and beyond. Benin's place within history is equally known for its conquest by British forces in the late 19th century, an expedition which led to the sacking and looting of its capital and the scattering of the majority of Benin's iconic bronzes around the world.

Today, Benin and its bronzes are the focus of international debates regarding cultural property and restitution. It is against this background that the Benin Dialogue Group has developed, a partnership of Nigerian and European museums and heritage institutions focused on realising the vision of a world-class permanent display of Benin Kingdom objects in Benin City, composed both of bronzes and other objects currently in Nigeria, and of international loans. The new Benin Royal Museum planned to house these objects, to be built by the commissioned architect Sir David Adjaye, will probably be one of the most significant African museum statements of the coming decade.

In the course of visits to Benin City by British Museum staff in both 2018 and 2019, the architect and a

range of people across the city communicated the desire for new ways of thinking and learning about Benin's past, and archaeology is seen as a central means of undertaking this new exploration. The British Museum intends to partner on such projects, working together with Nigerian colleagues to explore Benin's early history and in so doing to engage in new dialogues concerning the African and global past.

The archaeology of West Africa promises to shed new light on the histories of its precolonial empires and states and their global links via trans-Saharan trade routes from the medieval period. As demonstrated through the recent *Caravans of Gold* exhibition in North America, archaeology not only has the potential to dramatically improve understanding of these lesser-known aspects of Africa's history, but also to help bring these to life and communicate them to a wide range of audiences within Nigeria and across the world.

g. Exploring the Maya World[13] (Fig. 10)

A founding principle of the British Museum was, and remains, that the collection and the information contained within it must be shared to the greatest possible extent. In collaboration with Google Arts and Culture, the British Museum has harnessed the power of new technology to capture and communicate stories of the collection, bringing them to a global audience through the *Exploring the Maya World* project.

Exploring the Maya World has digitised a remarkable collection testifying to the achievements of ancient Maya art and architecture gathered by Alfred Maudslay in the late 19th century. Maudslay used the latest technology of his time to capture and record the stories of ancient Maya cities in Mexico, Guatemala and Honduras: he created the first dry glass plate photographs of iconic sites like Palenque, Chichén Itzá and Tikal, spending years living and working throughout the region. He also created more than 400 large plaster cast replicas of building façades and monuments, which have been stored in the British Museum for more than a century.

This collection also contains some of the best-preserved records of ancient Maya writing. By working closely with colleagues in Mexico and Guatemala, the entire collection has been made available online for anyone to explore and research. The extraordinary stories that have emerged during this project have also been put online for people to enjoy in Spanish, Portuguese and English anywhere in the world.

13 https://artsandculture.google.com/project/exploringthemayaworld.

Fig. 10: Exploring the Maya World Project, 2018–19. Palenque then and now, incorporating an original photograph by Alfred Maudslay from 1890–91. © Trustees of the British Museum.

The power of this project has been in its exceptionally collaborative approach: it has brought together curators, indigenous communities, scholars and technology specialists from across Mexico, Guatemala, the UK, Denmark, France and the US. Everyone has been united by a common mission to communicate the true value of conserving shared cultural heritage. *Exploring the Maya World* brings to life the energy and dynamism of culture in a way that can be hard to generate within a physical environment, and the voices in this project are vibrant and full of colour: they tell their own stories and the stories of those that have lived before.

The British Museum has the potential to reach many more people beyond those visiting the collection in London by bringing the Museum to the world virtually. Only a few years ago it would have seemed unrealistic to create a catalogue of 3D objects viewable from anywhere in the world, let alone walk around ancient Maya cities while sitting in your living room. These journeys of discovery are critical to engaging the most varied communities with the value of cultural heritage. Only by taking risks and by pushing the boundaries of what is possible can we begin to expand the reach and role of the 21st-century global museum.

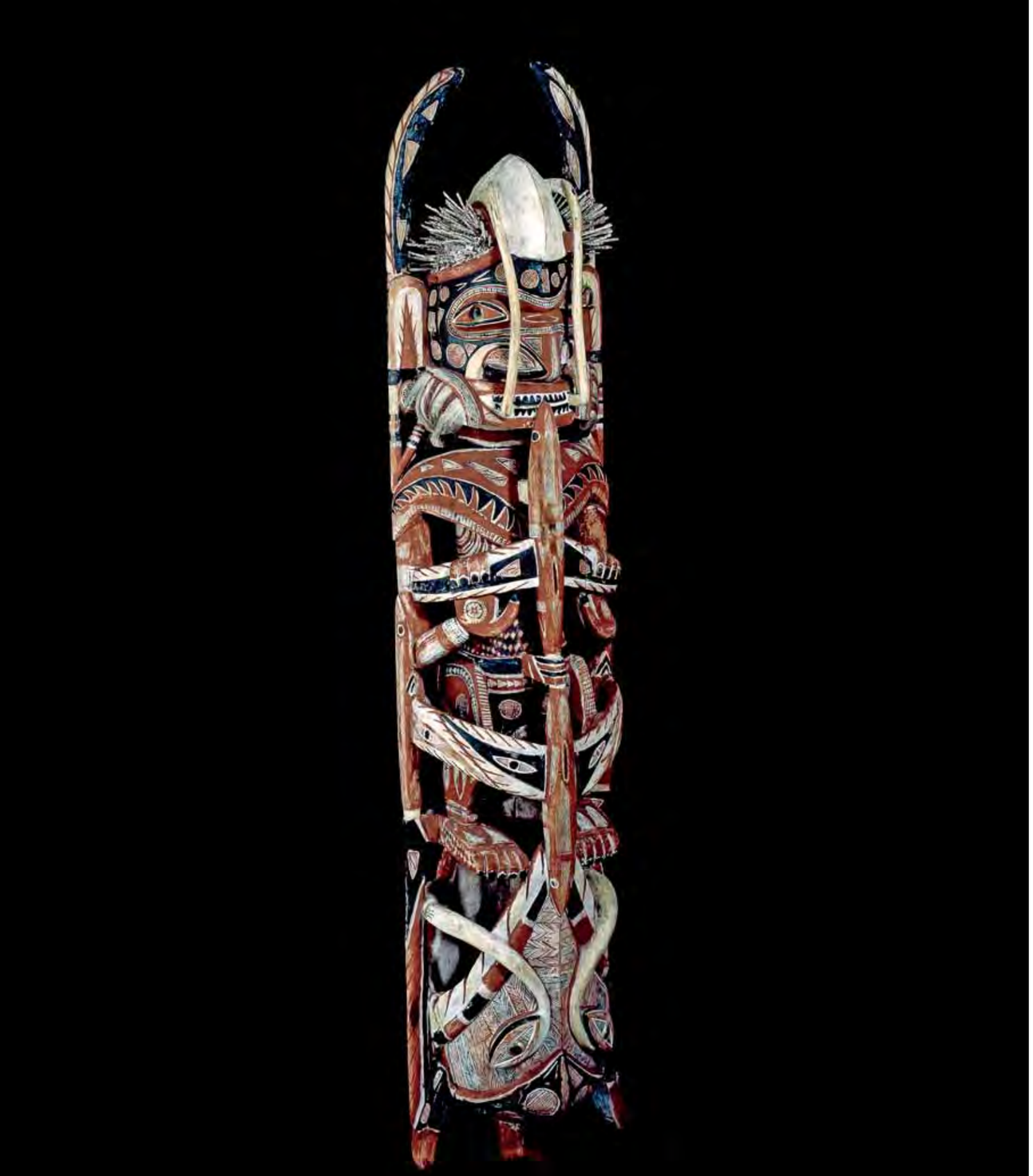
7. FUTURE

How can we address the past to forge a better future? We can only do this together, through dialogue and collaboration, by constantly working to establish, in Jullien's words, a 'shared common ground of intelligibility', with relentless disquiet and empathy. The collections of the British Museum come from many different cultural backgrounds, as do its visitors, 75 per cent of whom originate from outside the UK. The Museum is committed to working with people from all communities to unlock the stories and meanings that resonate with them and their cultural concerns.

The Museum has embarked on a major campaign to renovate its building and to transform the presentation of the collection: the Rosetta Project. It will set a high priority on showcasing the interconnectedness of cultures in the future display in London. The Museum seeks to show the achievements of humankind and its many communities, and in order to do so it reaches out and invites different cultures to join the staff in planning the new Museum. In working with their representatives, the Museum will reflect their views and convictions and make other systems of knowledge and expertise accessible. Through its many partnerships across the globe, the Museum has created a strong basis on which to build. Together with colleagues and communities from across the world, the Museum's curators have over the years developed relationships and established trust and openness, prerequisites to move on to ever more comprehensive, more sustainable and more equitable relations. The Museum has the responsibility and the desire to listen and learn, and to engage in difficult conversations in order to rewrite our shared, complicated history together.

Another important task is strengthening existing institutions and collaborating in building up new infrastructure that allows people in all parts of the world to engage with cultural heritage, both their own and that of others. Together we can, and must, create a network of institutions that allows for the circulation of objects, and of the stories, ideas and debates they can trigger. The British Museum will be a passionate partner in making this happen.

One thing seems absolutely clear: the British Museum is a unique global resource for exploring the world in its ever-changing constellations, allowing the development of new perspectives on humanity's shared pasts and investigating fresh responses to the shifting challenges of the present, as we find our way together, towards a better future.



OPPOSITE

Malangan figure (detail), 1882–83, h 122 cm, wood, vegetable fibre, pigment and shell (*Turbo petholatus opercula*), north coast of New Ireland, Papua New Guinea. © Trustees of the British Museum.

GET BACK. ARTIFICES OF RETURN AND REPLICATION

Simon Schaffer

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The work of Factum Foundation is distinguished by impressive endeavours to produce exact facsimiles of objects of cultural and historic significance to the individuals and societies that have made and shared their lives with them. Think what is at stake when such a facsimile is installed at the site once occupied by the original, now departed, dispersed or destroyed. In the process, copy and compensation are often connected. An evident feature of this work is its painstaking diligence, attention to the observable features of an object and to the mechanisms through which those features can then be used in the complex labour of recovery. In the fraught work of return and repatriation, such projects join specific cultures' practices of maintenance and devotion. The significant terms used in accounts of material restitution are in some salient cases formally sanctioned by UNESCO conventions and in national legislation. Idioms and principles are debated in museum policy documents and conservation codes.[1] They are vividly contested in dramatically iconoclastic acts of destruction. Most importantly, they join active and vital campaigns for indigenous rights. Common idioms used in such campaigns often betray major ambiguities in understanding how activities of replication and restitution are supposed to work together.

In many different ways, the production of a copy, the conservation of an object through various stages of its replication, must go far beyond mere imitation. In conflicts about repatriation of the holdings of cabinets and storerooms, galleries and museums, what is at stake is often not simply the fate of a mute object but rather what must be treated as the career of a person, an active agent whose life and destiny are matters of contested concern. Current conventions around collection practice often seek to bring out the urgent need to take care of the significance and function of what is in store or on display, not solely forms of material realisation. For this reason among others, return is part of a concern with the viable practice and continuing conduct of a culture. These agents speak out, as diplomats, partners or prisoners. They testify in many different ways to the potency of the worlds from which they come and to which they refer.

Long histories of theft, loot, appropriation and violence meted out to and resisted by indigenous communities give the issues of replication and return much of their ethical and political charge. The question is frequently one of power, control not only over objects but over people, spaces and cultures, the very right to live and engage with them and to establish and determine their significance. The sense of apparently self-evident activities such as conservation or copying therefore frequently shifts and changes as part of restitution. This is what happens in many projects where Factum Foundation's collaborative production of facsimiles is negotiated and implicated. The Kamukuwaká cave, sacred to the Wauja people of the Xingu in the southern Amazon basin, was violently

1 Martin Skrydstrup, 'Theorizing repatriation', *Ethnologia Europaea*, no. 39, II (2010): 54–66.

defaced and its powerful inscriptions in large part deliberately destroyed. Assyrian deities, lamassu in the form of protective winged lions and bulls with human heads, were systematically demolished during the occupation of Mosul in northern Iraq. The *Griffoni Polyptych*, originally made for a chapel in the Basilica of San Petronio in Bologna, was profitably sold off by an eminent 18th-century cardinal and its components dispersed. In each of these cases, the work of replication and return might perhaps seem straightforward, in little need of further reflexion or justification. Yet different cultures, often those most exploited or excluded, sustain very different practices and attitudes around decay and destruction, maintenance and materiality. It becomes vital to recognise, respect and respond to the range of senses proper to such restorations.

The *Griffoni Polyptych*, the Kamukawaká cave inscriptions and the Mosul lamassu have all been described as sacred, a term used somehow to make sense of agents that are taken to command great powers far beyond the mundane realm. Replication and preservation are always peculiarly sensitive when such sacred potencies are at work, even and perhaps especially when the agent's original culture has a complex lineage into the present. In the balance of this discussion, cases from the Americas and Oceania help bring out key features of these dilemmas. In 2006 an exhibition was staged at the then Hawaiian Academy of Arts of objects taken from the Pacific in James Cook's voyages and held at Göttingen University in northern Germany. Pride of place was given a wickerwork head covered in multicoloured birds' feathers, an embodiment of the great Hawaiian god Kū. Visitors to the Honolulu exhibition left offerings in front of this deity. But one Hawaiian commentator expressed disquiet, since the specific embodiment of the god on show might have been carefully restricted to specific communicants, not a public figure to be venerated by all.[2] The facile assumption that knowledge and display are best unrestricted often accompanies the faith that restoration through replication is an unambiguous virtue. The example of the Roman Catholic eucharist, a ritual whose correct repetition is to be understood as bringing the divine body to presence for each communicant, offers a clear case of a fundamental relation between religious power and publicly repetitive action. The familiar argument that such rituals of repetition and veneration are peculiarly subject to subversion and especially in need of care applies in force when shifted or mimicked. Care is required in stipulating exactly what is at stake in making a copy and aiding conservation. The powers cultures recognise in these agents can depend, precisely, on their fate in deliberate destruction.

Celebrated cases of complex relations between preservation and acquisition include those of the malangan sculptures made by specialist carvers in New Ireland in the Bismarck Archipelago of north-eastern New Guinea, and the Ahayu:da, wooden images of protective twin gods cared for by Bow Priests of the Zuni people of western New Mexico. Within their original cultures, both of these extraordinary forms of sculptural work embody fundamental powers. On their travels, they also exerted remarkable roles in the aesthetics of European modernism through the 20th century. Malangan are prepared from cut wood left to dry in the same enclosures that hold the dead before burial. The carvings enclose the threateningly potent force that accumulates as bodies fall apart. After a completed sculpture is unveiled it is left to decay in the forest so the vital powers captured in the carving can escape. The people of New Ireland have taken to treating these carvings' cash sale to collectors as appropriate

2 Margaret Jolly, 'Moving objects: reflections on Oceanic collections', in *Tides of Innovation in Oceania*, eds. Elisabetta Gnecchi-Ruscone and Anna Paini (Canberra: Australian National University, 2017), 87; Philipp Schorch, Conal McCarthy and Arapata Hakiwai, 'Globalizing Maori museology', *Museum Anthropology*, no. 39 (2016): 48–50.

Akari Waurá (right) and his son dancing on the occasion of the unveiling of the digital and physical restoration of the sacred cave of Kamukuwaká in Factum's Madrid workshops in 2019.

substitute for malangan abandonment to rot – revival and contamination are associated both with smell and with money.[3] Contrast the fate of the Ahayu:da. Once installed in their sandstone shrine, the twin gods replace long sequences of prior carvings which themselves are set nearby. Ahayu:da's powers are exerted through these processes of weathering and decay. They must therefore neither be removed nor must any attempt be made to conserve them. The Pueblo of Zuni reckons that the appropriation, theft, display and conservation of hosts of these carvings have disturbed the world order – for over two decades Zuni have campaigned effectively for the Ahayu:da to return from private and public collections worldwide.[4] In such cases, power is exercised and unleashed through deliberately organised decay. But there is a graphic and telling distinction between how different cultures deal with what passes away.

The fates of Ahayu:da and of malangan within their own cultures largely depend on the fact that their powers are exercised through their deliberately curated decay. In contrasting cases of concern, the Mosul lamassu or the Kamukawaká caves, the rationale of iconoclasm lay instead in destroyers' view that the object they would obliterate was somehow granted potency by the culture being attacked. Iconoclasts claim their targets are mere matter; but the targets are chosen because they matter to the iconoclasts' victims. Relations between the deliberation of sacred objects left to fall apart and the pointed violence of defacement are complex. During the Polynesian iconoclasm of the early 19th century, island peoples in south-eastern Oceania ceremonially transferred god images to British missionaries for destruction. The evangelical missionaries reckoned these images powerfully embodied indigenous belief systems, and that their surrender and annihilation marked islanders' repudiation of heathenism. The Tahitian high chief explicitly stated that these objects should either be burnt or sent to the missionaries' collections for display, as though these were equivalent. Across the Society Islands and the

3 Susanne Küchler, 'Malangan: objects, sacrifice and the production of memory', *American Ethnologist* 15 (1988): 625–37.
4 Edmund J. Ladd, 'A Zuni perspective on repatriation', in *The Future of the Past: Archaeologists, Native Americans and Repatriation*, ed. Tamara L. Bray (New York: Garland, 2001), 107–15.

Cook Islands, god houses were set on fire. In some cases a god image was unwrapped, cut up like an animal before a feast, burnt, and bananas cooked in the ashes and eaten. These practices of deliberate surrender and destruction might be understood as forms of sacrifice, part of an ingenious indigenous ritual to help strengthen central authority for the high chief's regime in eastern Polynesia.[5]

In comparable passages in the late 19th-century northeast Pacific, members of the Heiltsuk nation of the central coast region of British Columbia, though undoubtedly subject to confinement and coercion, in encounters with Wesleyan missionaries effectively transformed Protestant principles and practices into forms proper to indigenous custom and institutions. Elaborate cedar masks, agents that could mediate between spirit worlds, were traditionally burnt at their owners' deaths. The custom was adapted during evangelical conversion in ceremonial fires of many masks and other powerful objects.[6] Destruction by fire and sale to outsiders were sometimes aligned. Just as the people of New Ireland could treat the sale of malangan as equivalent to deliberate decay, so for the Heiltsuk and some other northeast Pacific coastal peoples disposal of their objects to collectors could disperse otherwise threatening and vengeful agents. Apparent iconoclasm and commercialisation could in some cases thus be part of adaptation and innovation within rich cultural tradition.

Arguments around repatriation therefore risk overhasty generalisation and the effacement of highly specific forms of cultural practice and interaction. This especially applies where debates hinge on the conditions of property and of originality, where notions of ownership and of the character of a copy are in question. The enterprise of repatriation is a critical component both of the definition of the intimacies of a specific culture group and of relations that extend world-wide along lines of political and economic power and expropriation. Against demands for restitution, appeals are made to the seeming virtues of universal synthetic accumulations in museums and galleries, to the needs of scientific access and study, to the mistaken essentialism that it is alleged lurks in definitions of a homogeneous culture's rights. It is argued that indigenous peoples often made their own collections and deliberately set out to take part in commercial exchange of goods and artefacts. A range of considerations have thus militated against and made trouble for claims for restoration and return. In several cases in debates about the proper hosting of cultural heritage in Aotearoa / New Zealand, Maori elders have judged that repatriation demands can sometimes undermine projects for more worthwhile forms of partnership.[7] Such artefacts may on occasion be understood by their home culture as eloquent representatives, and can thus exert considerable effective diplomatic power when lodged securely far from their origin. In 2015, a very fine feather dress made among the Kanindé of north-east Brazil was donated to the Museu do Índio in Rio de Janeiro by a Kanindé spokesman since the collection lacked any such material and, as the speaker put it, the Kanindé would thus come to exist as a people in the Museum.[8] Similar sentiments were expressed by successive paramount chiefs of Rewa, a powerful province in Fiji, with respect to the possible repatriation of highly sensitive human remains held at the

5 Nicholas Thomas, *Entangled Objects: Exchange, Material Culture and Colonialism in the Pacific* (Cambridge, MA: Harvard University Press, 1991), 151–61; Jeffrey Sissons, 'The Polynesian Iconoclasm', *Oceania*, no. 81 (2011): 302–15.
6 Michael E. Harkin, 'Object lessons: the question of cultural property in the age of repatriation', *Journal de la Société des Américanistes*, no. 91 (2005): 18.
7 Paul Tapsell, 'Partnership in museums: a tribal Maori response to repatriation', in *The Dead and Their Possessions: Repatriation in Principle, Policy and Practice*, eds. Cressida Fforde, Jane Hubert and Paul Turnbull (London: Routledge, 2002), 284–92.
8 Renato Athias, 'Museums, ethnographic collections, and virtual repatriation: new issues for an old debate', https://www.academia.edu/37105863.

Working on the scagliola surface of one of the lamassu facsimiles in preparation for their exhibition at the Rijksmuseum van Oudheden in Leiden, prior to shipping to Mosul.

Smithsonian Institution in Washington. The then paramount chief argued in 2009 that it was perfectly proper for a noble ancestor's remains to be cared for in a foreign country, and that this would reinforce the ancestor's central place in Fijian history.[9] Powerful objects can become delegates who act on behalf of their culture elsewhere.

A complementary form of indigenous resistance to repatriation stems from concerns that these objects' powers can be malevolent or subversive, and that return may therefore raise real risks. Along the Pacific coast of British Columbia and Alaska, such artefacts were sometimes traded away or disposed of by their owners in the past precisely because of such threats. Among the Tlingit of south-eastern Alaska, some elders hold that their community's religious welfare might be challenged by the return of these potent objects from museum collections. The challenge is rendered more pressing for several Pacific coast peoples and in some groups among Native Americans on the Great Plains by indigenous elders' concern that current members have only rarely mastered the practices, some of them highly secretive and restricted, required to control and direct the errant powers of such agents.[10] Such questions of control are also directly implicated in highly variable models of property relations. Much recent legislation around repatriation has taken it as read that cultural heritage is a communally owned good. One implication is that an object on return is thus the shared property of the entire community. Yet often it is precisely the most ceremonially and ritually significant objects that are treated as the absolute property of an individual and their lineage.[11] Rights to ownership of the artefacts and the knowledge they embodied are understood as exclusive, thus legitimately capable of exchange and transmission. As example, while the Zuni Tribal Council will not

9 Vasiti Ritova, 'Ro Veidovi's grave found', *Fiji Sun* (22 November 2009); Adrienne Kaeppler, 'Two Polynesian repatriation enigmas at the Smithsonian Institution', *Journal of Museum Ethnography*, no. 17 (2005): 152–62, on pp. 160–61.
10 Harkin, 'Object lessons', 14.
11 Sarah Harding, 'Cultural property and the limitations of preservation', *Law and Policy*, no. 25 (2003): 17–36.

Brass reproduction of a Maori cleaver, cast for Joseph Banks by Eleanor Gyles of London, Pitt Rivers Museum, inv. no. JC 29 7 2005. © Pitt Rivers Museum, University.

support transfer of such individually-owned ritual objects outwith the tribe, it equally refuses to support repatriation of items subject to individual property rights, preferring they be subject instead to appropriate curatorship rather than return to the Pueblo.[12]

The issue of return becomes especially complex in cases where copies are at issue, precisely the situation in several of the projects launched by Factum Foundation where a facsimile is returned to its original home. Zuni people have been especially concerned with the status of replicas. This is not least because in the late 19th century the Pueblo hosted the Smithsonian ethnologist Frank Hamilton Cushing, whose practice was experimentally to learn how to reproduce his hosts' carving techniques. One such reproduction of an Ahayu:da was the subject of a repatriation request by the Zuni in 1993. It was gifted by Cushing to an eminent Oxford anthropologist and subsequently housed from 1911 at the Pitt-Rivers Museum. Zuni claims argue that either the Cushing carving is inaccurate, in which case the Museum should not use it and it should better go back; or it is, in which case it should be returned. For the Zuni, a range of arguments challenges the notion that such copies are in some sense less potent or authentic than the original god figures. In a museum setting, it is urged, such copies embody powerful information, disrupt traditional forms of instruction, and can mislead or offend.[13] The act of replication is understood as a fundamental aspect of Zuni cultural life: and the principle is certainly not restricted to the Ahayu:da. In the 1770s the eminent Spanish mapmaker and santero Bernado de Miera y Pacheco carved a remarkable sculpture of a saint deposited at the Pueblo. It was taken for the Smithsonian Institution in 1879 and later destroyed by fire. In 1991 the Zuni successfully arranged the repatriation of a replica of the carving to the Pueblo.[14] Management of property relations, of cultural heritage, and of the very notion of the copy or the facsimile are all in question in such processes of requisition and return.

It is therefore possible to reflect, finally, on what the eminent anthropologist and curator Adrienne Kaeppler calls repatriation enigmas, episodes which throw a peculiarly clear light on the fundamental issues of agency and identity in the worlds of cultural property and rights. A celebrated case is that of the brass clubs, versions of Maori patu, made for the naturalist and traveller Joseph Banks in London in 1772. Banks had obtained an original basalt patu from Maori interlocutors during James Cook's first Pacific voyage, then commissioned metal copies to be made and engraved with his coat of arms to use as

12 T. J. Ferguson, Roger Anyon and Edmund J. Ladd, 'Repatriation at the Pueblo of Zuni: diverse solutions to complex problems', *American Indian Quarterly*, no. 20 (1996): 251–73, on p. 262.
13 Gwyneira Isaac, 'Whose idea was this? Museums, replicas and the reproduction of knowledge', *Current Anthropology*, no. 52 (2011): 211–33, on pp. 218–20.
14 Ferguson, Anyon and Ladd, 'Repatriation', 266.

trade goods on a subsequent expedition. Some of the brass patus were taken on Cook's third voyage to the northeast Pacific coast in 1778. One brass patu was eventually recovered at Umatilla near the Columbia River in inland Oregon. A local lawyer, keen to back up his theory of ancient American indigenous metal working, claimed in 1895 that the bronze club had been found in an old grave so must be pre-contact in date. It reached the Smithsonian Institution in 1897. In 2001 representatives of the Umatilla Indian Reservation made a repatriation claim with a view to the club's reburial. In her analysis of this dilemma, Kaeppler notes that this is a metal object based on a Maori design, made in a London foundry, marked with the arms of a Lincolnshire landowner, traded between British, Nuu-chah-nulth and other peoples along the Pacific coast before reaching inland Oregon.[15] The act of making copies and the life-stories of such objects can in this manner escape attempts at tight and easy definitions of their provenance and their properties.

Similarly, complex reflexions are prompted by the extraordinary career embodied in the pair of lamassu now installed at the University of Mosul using recordings made in 2004 by Factum Arte of the Assyrian statues from Nimrud held at the British Museum. As is well known, the statues were shipped to London under the orders of Austen Henry Layard, based in the Ottoman Empire as a British political agent during the 1840s. Layard's view was that by convincing the inhabitants of the region around the Nimrud site that his interest in the great statues was antiquarian not commercial, the principles of what he described as civilised justice and benevolence would be disseminated in the region. Meanwhile, admiring London reviewers of his account of the excavations boasted that Victorian civilisation was more worthy and more likely to be recalled in the future than that of idolatrous Assyria. Layard's colleagues in the diplomatic service encouraged him somewhat more cynically to ensure that his finds were publicised as confirming biblical truths, since this would aid sales and get funds for further expeditions.[16] In sum, the political and cultural charge of the mid-19th-century unearthing, shipment and display of the lamassu was unambiguous and explicit. It is a mark of ingenuity to turn that politics around. Nor, of course, is this the first time replicas have been made of Layard's Nimrud finds. On the long sea journey from Basra to London in 1848 they were landed at Bombay, where casts were made of a series of carved slabs and a great black obelisk, to be displayed to the public in Bombay's Central Museum. All this was part of a somewhat tetchy exchange between the authorities in Britain and in India about possible damage to the carvings and relics during shipment.[17] The burden of the copy, and the security of the specimen, form fundamental aspects of these long and winding histories of restitution and restoration. It is all the more welcome, therefore, that in delivering these exact facsimiles to their homeland, the commitment has been made by Factum Foundation to ensure that the techniques and the practical skills demanded by this work are also made available in Mosul for the future. This is certainly not adequate compensation for the deeds and sufferings of the people and their cultures, but it is an important part of the hard work of getting back to what really matters.

15 Kaeppler, 'Two Polynesian repatriation enigmas', 152–57.
16 Shawn Malley, 'Shipping the bull: staging Assyria in the British Museum', *Nineteenth-century contexts*, no. 26 (2004): 1–27, on pp. 5, 10–11; Malley, 'Austen Henry Layard and the periodical press', *Victorian Review*, no. 22 (1996): 152–70, on p. 161; Mirjam Brusius, 'Misfit objects: Layard's excavations in ancient Mesopotamia and the Biblical imagination in mid-nineteenth century Britain', *Journal of Literature and Science*, no. 5 (2012): 38–52.
17 Sudeshna Guha, *Artefacts of History: Archaeology, Historiography and Indian Pasts* (New Delhi: Sage Publications India, 2015), 75–85.

OPPOSITE

A monolith known as ‘Ebi Abu’, which was documented by Philip Allison in 1961–62 at the site Eting Nta (Nta clan) and was sold by Pierre Dartevelle to the Musée du Quai Branly in Paris. Photo Ferdinand Saumarez Smith.

THEFTS, FAKES AND FACSIMILES: PRESERVING THE BAKOR MONOLITHS OF EASTERN NIGERIA

Ferdinand Saumarez Smith

Ferdinand Saumarez Smith is leading Factum Foundation’s work in Nigeria, building on previous projects relating to rock art in the Amazon, the Sahara and the Levant.

Over the past three years Factum Foundation has collaborated with the Trust for African Rock Art (TARA) and the University of Calabar (UNICAL) on a project aimed at documenting, preserving and raising awareness about the Bakor monoliths, also known as the ‘Cross-River’ or ‘Ikom’ monoliths, and locally referred to as ‘akwanshi’ or ‘atal’. The Bakor monoliths take their name from a group of linguistically and ethnically related communities (‘clans’) in an area of approximately 350 square miles in the Middle Cross River region in which they are exclusively found. The word ‘Bakor’ means ‘come and take’, a name that was chosen as a collective title because the phrase is identical in the languages of each of the original eight clans that make up the Bakor people. Referring to them as the ‘Bakor’ monoliths, rather than the ‘Cross-River’ (the state) or ‘Ikom’ (the nearest large town) monoliths as was formerly customary, respects the unique ownership of the monoliths by this people. Furthermore, the meaning of the word perhaps has some ironic value, since one of the main problems that has beset their preservation has been theft.

The material of the monoliths is primarily basalt or limestone that has been naturally shaped in nearby riverbeds and they generally range from about 40 cm up to 2 m in size, with a few exceptional cases reaching up to 3 m. The natural form of the rock is embellished by carvings of facial features, beards, protruding navels and decorative symbols, which distinguish each as a specific ancestral clan leader. These symbols and patterns serve as visual proof of the connection to the Bakor people: photographic evidence from the early 1960s demonstrates that the same motifs of concentric circles which are found on the monoliths were tattooed, using scarification techniques (Fig. 1), on the faces of local inhabitants. The age of the monoliths remains the subject of speculation, particularly in the absence of proper archaeological investigation, although a 2020 dig supervised by UNICAL and Ahmadu Bello University, Zaria, will hopefully shed further light on the question. It seems probable that, since each monolith represents one clan leader, the tradition developed over a number of centuries, gradually falling out of practice over the period of British colonial influence. This must, however, have occurred at some time before direct colonial engagement in the area as the earliest account, Charles Partridge’s *Cross River Natives* (1905), demonstrates that the inhabitants had already lost the custom of producing them. The situation of cultural disconnect today has been exacerbated by the strong influence of Pentecostal Christianity in Nigeria, which associates the monoliths with ‘juju’, or black magic. Nevertheless, some communities still retain practices and rituals associated with the monoliths, particularly at the time of the yam festival in September.

The monolith sites can be roughly divided into three categories: those enclosed by a perimeter wall (Alok and Emangebe); those which have been subsumed by farmland (e.g. Manden, Nkunkundah); and those which remain in forested areas (Nkrigom,

Egunonkwor). Although the first category has helped combat the problem of theft, concrete walls destroy the atmosphere that can be experienced in the original forest context. Furthermore, it has not stopped the practice of burning to remove vegetation, although this is less damaging as the grass is not allowed to grow as much as in the farmland. Slash and burn farming has caused enormous damage to many of the monolith sites, with the extreme heat followed by rapid cooling leading to cracks in the monoliths, which in turn has faciliated theft, particularly of the carved faces (Fig. 2). The monolith sites in the forest are generally the best preserved and have suffered the least from theft, although in sites such as Nkrigom falling trees have also caused damage.

Fig. 1: The now defunct practice of facial scarification in the Bakor region employed similar patterns to those carved into the monoliths. Bodleian Library, University of Oxford, MS. Afr.s.2535/9.

Fig. 2: A monolith damaged as a result of slash and burn agricultural practices. Photo Ferdinand Saumarez Smith.

Fig. 3: The bottom half of the monolith at Ntitogo, whose top half is now in the Metropolitan Museum of Art, New York. Photo Ferdinand Saumarez Smith.

In the course of four trips to the Bakor region (supported initially by the Prince Claus Fund and later by Jim and Paula Crown, the US Ambassador's Fund for Cultural Preservation, and the Carène Foundation), the team visited almost all sites recorded during fieldwork conducted by Philip Allison in 1961–62. With the particular help of Chief Sylvanus 'Orlando' Akong, a number of others not yet documented were also identified. These include Egunonkwor (Allison documented only part of a site by that name of which we were unable to recognise any monoliths), Ekeleboghor, Ekpara, Lowya, Manden (Allison's 'Manden' site is actually Mkpananfa) and Nkunkundah. Compared to the near 300 monoliths identified by Allison, our project has recorded approximately 215 – thus up to one third of the total have been removed since the late 1960s.[1] Allison's survey was commissioned by John Picton (Professor Emeritus at SOAS), then of the Nigerian Department of Antiquities (now the National Commission for Museums and Monuments, or NCMM), who donated the archive to the Bodleian Library in 2017. With access to the entirety of Allison's material, as well as the local knowledge gathered on

1 This figure is approximate because the borders between obvious fully carved monoliths, broken fragments, lightly carved monoliths and uncarved stones can be difficult to clarify. Furthermore, these figures should be taken only as broadly indicative on account of the new sites and not having visited all the sites recorded by Allison.

Fig. 4: Presentation of a scaled-down reunited facsimile of the Ntitogo monolith to the Paramount Ruler of the Bakor People, Ntol Emang. Photo Ferdinand Saumarez Smith.

Fig. 5: Philip Allison's 1961–62 photograph of the complete Ntitogo monolith alongside a photograph of its upper half, which is now in the Metropolitan Museum of Art. Left: Bodleian Library, University of Oxford, MS.Afr.s.2535/9. Right: The Metropolitan Museum of Art, New York.

Fig. 6: A monolith known as 'Ebi Abu', which was documented by Philip Allison in 1961–62 at the site Eting Nta (Nta clan) and was sold by Pierre Dartevelle to the Musée du Quai Branly in Paris. Left: Bodleian Library. Right: Musée du Quai Branly.

repeated visits, it was possible to gradually piece together a picture of the theft and international trade of the monoliths. The Bakor region is located on the border of Cameroon and was part of the attempted breakaway state of Biafra. Today the region has been subject to further instability on account of another attempted breakaway state, Ambazonia, which comprises the Anglophone districts of western Cameroon and has caused an influx of refugees into eastern Nigeria. From the civil war of the late 1960s onwards, a large number of monoliths were removed from the sites (likely using the heavy logging machinery with which the region's forests were cut down) and taken over the border, from where they entered the international antiquities market. According to Professor Picton, theft was not a problem before the civil war.

Allison's documentation led to the discovery of several monoliths in prominent international collections. In October 2016, Factum recorded the base half of a monolith (Fig. 3) using photogrammetry at a site called Ntitogo (Nnam clan, referred to by Allison as 'Ntetakor'), the top half of which was identified by Dr. Abu Solomon Edet and Dr. Ivor

Miller of UNICAL in the Metropolitan Museum of Art, New York (Fig. 5). After securing permission to record the top fragment in 2018, Factum produced a scaled-down reunited facsimile that was presented to a conference on the monoliths at UNICAL in the same year; this was afterwards gifted to the Paramount Ruler of the Bakor People, Ntol Emang (Fig. 4). Factum also recorded a monolith identifiable from the site Eting Nta (Nta clan) at the Musée Quai Branly, Paris, which had been purchased from the Brussels-based dealer Pierre Dartevelle in 1998 (Fig. 6). According to older members of Eting Nta village, this monolith was stolen in the 1970s and is known to the community by the name 'Ebi Abu'. During a visit to Eting Nta in September 2019, an assembled group of elders broke into an impromptu rendition of the phrase 'bring back Ebi Abu to us' to the tune of the song 'My bonnie lies over the ocean.' The name connects the stone to the secret society 'Ekpe', which uses uncarved monoliths in its contemporary rituals and is involved in the transmission of ancestral knowledge (Fig. 7). Ekpe also uses a symbolic language called 'Nsibidi' which some practitioners identify with the patterns found on the Bakor monoliths. Dartevelle, who in the course of his collecting travelled widely in 'Cameroon, the Congo and West Africa', also has another monolith from Eting Nta (in Allison's reference system 'E10') listed on his gallery's website (Fig. 8).

Research online also led to the discovery of a monolith not documented by Allison belonging to the Brussels-based dealer Didier Claes. Upon receiving permission to record this example, Factum travelled to a warehouse in the outskirts of Brussels to record it in 2018. The warehouse manager brought out two examples wrapped in blankets, neither of which proved to be the monolith expected from the picture online. One was identifiable from Allison's archive as originating from the site Oyengi (Nta clan, 'OY2', Figs. 9–10), while the other, which was exhibited in the sculpture garden at Frieze Masters in 2015 and has abrasive marks down one side, appeared similar to those found at a site not recorded by

Fig. 11: A monolith not recorded by Allison in the warehouse of the Brussels-based dealer Didier Claes. Photo Ferdinand Saumarez Smith.

Fig. 12: A monolith recorded in situ at Oyengi by Allison. Bodleian Library, University of Oxford, MS.Afr.s.2535/8.

Fig. 13: The same monument from Oyengi in the collection of Pierre Dartevelle. Galerie Dartevelle.

Fig. 14: The chief and clan elders of Oyengi with the last of their remaining carved monoliths. Photo Ferdinand Saumarez Smith.

Allison called Bonima (Abanyom clan, Fig. 11). In the early 1960s, Oyengi had four carved monoliths and one uncarved. Today, only one carved and one uncarved remain; of the other three phallic-style examples, aside from the one in the Claes collection, one is missing and the other is owned by Dartevelle (Figs. 12–13). The chief of Oyengi entreated us to help return it and the other monoliths to his community (Fig. 14). Another online search led to the discovery of a limestone example identifiable from a site called Akumabal (Abanyom clan, 'AK1') held in the collection of Jerome and Ellen Stern in East Hampton, USA. This monolith was donated in 2018 to the Israel Museum in Jerusalem, where Factum recorded it in December 2019 (Fig. 15). Akumabal is the site of the Bakor meeting house, but the original location of the stones is unknown. These case studies are just a selection and many other monoliths registered on the websites of auction houses could be cited.

OPPOSITE

Fig. 7: The secret society 'Ekpe', which is involved in the transmission of ancestral knowledge, uses uncarved monoliths in its contemporary rituals. Photo Ivor Miller.

Fig. 8: Monolith from Eting Nta documented by Allison in situ and pictured for sale on the gallery website of the Brussels-based dealer Pierre Dartevelle. Left: Bodleian Library, University of Oxford, MS.Afr.s.2535/8. Right: Galerie Dartevelle.

Fig. 9: Monolith originating from the site Oyengi (Nta clan, 'OY2'), scanned using photogrammetry in the warehouse of Didier Claes in 2018. Photo Ferdinand Saumarez Smith.

Fig. 10: The same monolith (Oyengi, Nta clan, 'OY2') recorded in situ by Allison in 1961–62. Bodleian Library, University of Oxford, MS.Afr.s.2535/8.

A parallel aspect to the theft, removal and trade in the Bakor monoliths since the Biafran civil war has been the circulation of monoliths that our project believes to be inauthentic on grounds of style, scale and material. One possible example held in the collection of the British Museum was verified by Philip Allison, but the stone it is carved from appears to be granite rather than basalt or limestone (Fig. 16). In terms of style, it is almost identical to one held by the Israel Museum and another acquired in 2019 by the New Orleans Museum of Art; it therefore seems likely that they were produced by the same workshop. Dr. Edet believes that there was a workshop which produced 'fakes' across the border in Cameroon. In the Bakor region, there are two carvers active that our project is aware of, Philip Nsuko of Njemetop village (Nselle clan) and Ekon Nsakpe of Emeakpen village (also Nselle), both of whom are convinced that the British Museum example is not authentic.

Fig. 15: Monolith donated to the Israel Museum in Jerusalem and recorded by Factum Foundation in 2019. Photo Ferdinand Saumarez Smith.

Fig. 16: Monolith in the collections of the British Museum, with debated authenticity. Photo Ferdinand Saumarez Smith.

The British Museum's monolith will be the departure point for an exhibition on the subject of the Bakor monoliths that will open at the museum on 1 October 2020, Nigerian Independence Day. The exhibition will then run through November and another relevant date: the 50th anniversary of the 1970 UNESCO Convention on the Means of Prohibiting and Preventing the Illicit Import, Export and Transfer of Ownership of Cultural Property. The exhibition will draw on the research project, asking questions about the role of digital technology in documentation, preservation and restitution. Following its conclusion, we hope that contents from the exhibition, including 1:1 high-resolution facsimiles, will be shipped back to Nigeria and displayed first in an exhibition at the Calabar National Museum, then as a permanent exhibition installation at the Alok Open Air Museum. Other facsimiles will be returned to their original sites as one aspect of the ongoing community engagement activities aimed at supporting the local preservation of the monoliths.

The Bakor monoliths project demonstrates that blanket solutions to the question of how to respond to Europe's colonial legacy with regard to Africa's material heritage are ineffective. Although the Bakor communities have a legitimate claim to the restitution of objects of the highest spiritual and cultural value to them, at this stage it is unrealistic to simply return the monoliths to sites which for the most part are still farm lands and throughout which damaged monolith fragments are scattered. Through the project and the exhibition, Factum Foundation hopes to present an effective model for addressing preservation and the problem of restitution, involving the development of long-term relationships both with national heritage bodies such as the NCMM and local communities. The first stage in the relationship is documentation. In the present context, Philip Allison's survey is ample proof of the necessity of comprehensive recording with the most up-to-date tools available: in the 1960s a black and white film camera, today high-resolution 3D scanning. Perhaps more than anything else, this documentation is a powerful deterrent to theft. The second stage is community engagement. On Factum's first visit to the region, a frequent complaint was that university researchers had come to study the monoliths, received considerable help from the communities, and then failed to share any of the results with them. Our repeated visits to communities have gradually built up the trust lost by academics and we have tried to ensure that all the various clan groups are given equal time and attention. A key element of this stage in the project will be the permanent exhibition at the Alok Open Air Museum, generously supported by the Carène Foundation, and the activities planned to engage young community members from across all clans. Without the pride of the local community in the monoliths and the conviction that the sites can be effectively managed, all external attempts at preservation will ultimately be futile. Finally, as to the question of restitution, Factum believes that returning exact facsimiles can serve a valuable role as a stepping-stone towards the eventual return of originals, with the provision that the context they are returning to is entirely safe. It is hoped that bringing back even a facsimile of 'Ebi Abu' will inspire the Bakor communities to preserve their precious heritage.

With thanks to the Paramount Ruler of the Bakor people, Ntol Emang and Chief Sylvanus 'Orlando' Akong, and all the clan and village leaders who have helped facilitate our work in the region. Thanks also to the Nigerian rock art team: Dr. Abu Solomon Edet, Dr. Frank Enor, Dr. Ivor Miller, David Coulson, Terry Little, Dr. Abubakar Sule, Edith Ekunke, Dr. Clement Bakinde, Dr. Asmau Ahmed Giade, Dr. Mohammed Sanni, Aliyu Abdu, Salisu Aminu, Mohammed Adam, Uzoma Nwosu, Sam Ntino, Dr. Ekwutosi Offiong, Evelyn Osuwagu, Dr. Joy Ejikeme, Dr. Angela Ajimase. And to Jim and Paula Crown, the Prince Claus Fund, the US Ambassador's Fund for Cultural Preservation and the Carène Foundation for their generous support.

THE RESURRECTION OF THE SACRED CAVE OF KAMUKUWAKÁ

Akari Waurá, Shirley Djukurnã Krenak, Nathaniel Mann, Irene Gaumé, Mafalda Ramos, and Patricia Rodrigues

Akari Waurá is a musician, storyteller and a leadership representative of the Wauja community. He lives at Piyulaga, the main Wauja village in the Xingu Indigenous Territory, and participates in teaching activities and projects of Indigenous cultural conservancy across the Territory. Since 2018, he has worked with Factum Foundation on the documentation and conservation of the Kamukuwaká Cave.

Shirley Djukurnã Krenak, a graduate in social communication, has made it her life's work to fight for the rights of the Indigenous peoples of Brazil and preserve their heritage. Her aim is to safeguard the language, culture and traditions of her tribe, the Krenak, a people once declared extinct, but who have reappeared to demonstrate the strength, sophistication and wealth of tradition of the Brazilian Indigenous community.

Nathaniel Mann is an award-winning composer, sound artist, and broadcaster. He has collaborated closely with Akari Waurá to produce the BBC Radio 4 Feature Documentary 'Orchestra of the Rainforest', and to record and produce a CD of traditional Wauja music, 'Wauja Songs from Upper Xingu', available on Antigen Records. Nathaniel is a 2018 Arts Foundation Fellow and 2019 Paul Hamlyn Award winner.

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OPPOSITE

Shirley Djukurnã Krenak at the unveiling of the re-creation of the sacred cave in Madrid.

INTRODUCTION by Akari Waurá

My name is Akari Waurá. I am a singer, a historian, a leader, and I am here to represent the Wauja people. I live at the Piyulaga village, the Wauja capital village of the Xingu Indigenous Territory (Mato Grosso, Brazil).

I am here to speak about my people and Kamukuwaká. The Kamukuwaká cave is a sacred place of great significance for all the Wauja and the people of the Upper Xingu. In that cave, the teachings of our ancestors, the Kamukuwaká people, are engraved on the rockface. That rock is our history book. It is in the cave that we teach the history of our people, our culture, and our cosmogony to the young. In the past, the elders and historians would take the young to Kamukuwaká to tell the story. Today, since the cave is outside the demarcated area, we are no longer able to do that.

It was in the Kamukuwaká cave and along the Batovi/Tamitatoala river that our ear piercing, our painting, our music, the rituals, and even the rules of our society originated. Kamukuwaká is our history, our culture, and that is why it is so important for the Wauja people.

With the demarcation of the Xingu Indigenous Territory in 1961, the Kamukuwaká cave and part of our sacred river were left behind. At the time, the elders didn't really understand what that demarcation meant, or that it meant we could no longer move around our traditional territory. Then, as our generation grew up and recognized the Territory and its borders, we realized the cave had been left out of the demarcated area, in private farmland. We couldn't visit our historical sites anymore. How could we learn and teach the new generations?

Since the demarcation, we have been fighting for the right to our traditional and cosmogonic territory. Even after the government acknowledged our cave as an important cultural heritage site, protected by IPHAN (the Brazilian government agency in charge of cultural heritage affairs), we keep fighting for the right to our history, our cave, and our river.

Every year, we visit the Kamukuwaká cave. Every year, we see the garbage on the riverbanks, the sand building up in the cave and covering the engravings, the fish dwindling. This year, when we visited the cave with the Factum Foundation team, what we feared the most had taken place. The engravings in the cave had been vandalised. The fragments were lying on the ground. What can we do about it? That destruction made us very sad. It represents an attempt to destroy the Wauja identity, our memory, our resistance.

THE SACRED CAVE OF KAMUKUWAKÁ

The petroglyphs in the sacred cave of Kamukuwaká tell the creation myths of the Indigenous communities of the Xingu, in the Mato Grosso region of the Amazon. But

when a Factum Foundation team travelled there in 2018, they found the cave vandalised and most of the petroglyphs destroyed. The team recorded the cave despite this vandalism and the data has now been used to recreate damaged areas and produce a 'facsimile' of the cave as it once was.

The experience of recording and recreating Kamukuwaká has forever changed our understanding of the complexity of conservation and the importance of technology for preservation. This project has helped to close the distance between two cultures that are separated by more than 8,000 kilometres of land and ocean, reminding us in the process of what it is that makes us human.

THE XINGU AND KAMUKUWAKÁ

The Xingu Indigenous Territory was formed in 1961 and comprises a protected area of some 2,642,003 hectares – almost the size of Belgium – in the heart of Brazil, in the state of Mato Grosso. It represents the first official demarcation of Indigenous territory in Brazil and is intended to serve as home to the area's autochthonous inhabitants, as well as other Indigenous groups displaced from their former territories across the Central-West Region of Brazil by the advance of colonial agriculture. The area is now home to 16 Indigenous ethnic groups, who despite speaking distinct languages, share many cultural traits.

The Kamukuwaká cave lies just beyond the territory's south-western border, a 6 x 4 m rock face adorned with dozens of ancient petroglyphs, leading into a double chambered cave. It is a sacred place of great significance for all the peoples of the Upper Xingu, and the Wauja community are considered to be the cave's caretakers and guardians. The Wauja make an annual pilgrimage to visit the site, travelling several days by boat and at considerable expense in order to impart Kamukuwaká's history to the younger generations.

During these visits, time is spent looking at the petroglyphs, which in turn activates the retelling of vivid legends from the Wauja's oral traditions. Many of these tales are told exclusively at the site – including the story of the culture-hero Yakuwixeku visiting the sky-village of the birds to learn the origins of the Wauja's male ear-piercing rituals. Kamukuwaká's engraved patterns and motifs not only trigger stories, but they also directly inform the geometric patterns used by the Wauja when adorning their bodies with paint or decorating ceramics. Our understanding is that the Kamukuwaká petroglyphs have performed the same function for many generations, and although an ancient site, it is very much part of a living tradition.

THE XINGU COSMOVISION AND CULTURAL HERITAGE

The Wauja people's worldview is a cosmovision commonly known as Amazonian animism. From an animistic perspective, one can say that all things are part of a living world, and therefore embody part of its vital energy. In the Xingu, Apapaatai spirits epitomize the forest's vital energies. They are the 'owners', 'keepers', or, more accurately, the 'growers' of ecological resources. They are the true essence of all living things, and the animal species in the forest are merely existential extensions, the inauthentic/corporeal avatars of these owner-spirits. The Apapaatai are connected both to the generative principles of nature and life and the pathogenic principles of death and disease. These

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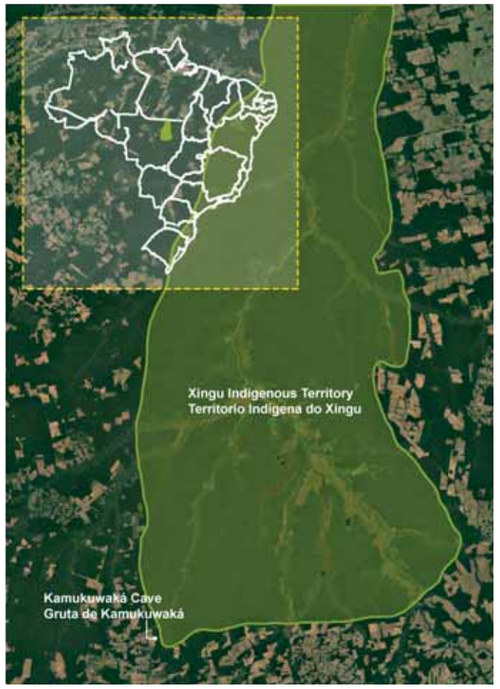
Irene Gaumé works at Factum Arte as a digital artist focusing on the translation of ideas into objects. Trained at the Koninklijke Academie voor Schone Kunsten in Antwerp in traditional sculpture, she is continuously developing the art of 3D organic modelling. Irene performed the digital restoration of the cave.

Mafalda Ramos is an archaeologist and scientific coordinator of heritage management projects, specialising in the Pantanal and Upper Xingu regions. Since 2018, she has collaborated with the Wauja and Factum Foundation as an ethnoarchaeologist and mediator in the documentation and reconstitution of the Kamukuwaká Cave.

Patricia Rodrigues worked from 2015–17 as a scientific coordinator of archaeological heritage and Indigenous cultural conservancy projects for a local NGO in the state of Mato Grosso. During this period, she consulted for Wauja community associations as a pro-bono expert on a project for the preservation of endangered Indigenous archaeological sites (including the Kamukuwaká cave) located outside the official limits of the Xingu Indigenous Territory. She is currently studying for a PhD in Anthropology at the University of Notre Dame in the USA.



Bird's-eye view of the protected Xingu Indigenous Territory, state of Mato Grosso, shown within a map of Brazil. This largely green area, with a total size of around 2,642,003 hectares (comparable to the size of Belgium), is encroached upon by yellow patches which reveal the dominance of industrial agriculture in the surrounding area. The Xingu river runs through the centre of the protected territory, but all of its sources lie beyond it, with the result that agro-chemical wash off is continually travelling downriver to the Xingu communities.

beings correspond to what is named in the anthropological literature as 'more-than-human entities', that is, entities that transcend humanity, sharing our main attributes such as the capacity for agency and culture but existing in a different ontological realm. Bilingual Wauja people often translate Apapaatai as 'spirits' because they are invisible and can only be seen in dreams or through trance by visionary shamans or dying people. The Wauja know that humans are not the true, original owners of earth's resources, so their own relationship with the forest and use of ecological resources are indissociable from their relationship with, and respect for, the Apapaatai.

For many of the Wauja, the world of Apapaatai intersects seamlessly with the worlds of Western technology – of smartphones, flatscreen TVs, motorbikes and social media, all of which are now ubiquitous throughout the Xingu region. However, the worldviews of much of the younger generation are becoming increasingly outward-looking, their eyes and thoughts drawn towards the cities. This is a cause for concern for the elders, who fear a shift away from the traditional worldviews and ways of life. The protection of cultural heritage is also becoming a source of anxiety.

Indeed, Akari Waurá, now the principal traditional singer of the Wauja community in the village of Piyulaga, Xingu, shared a similar disinterest in the traditional ways when he was a young man. It wasn't until he was 27 that he felt his calling to learn the Wauja's traditional songs, and it was in part thanks to a technological intervention by a North American anthropologist, who had recorded his father's singing in the 1980s, that Akari was able to recuperate these traditions.

In 2018 Akari wrote: 'My father was a singer and he died when I was only 14. He took his songs with him. When I grew up, I decided to rescue the songs that my father sang and that were recorded on a CD (by anthropologist Emi Ireland). I learned from the CD. I now thought to myself – I'll do as my father did. I've been looking for support to record a CD for a while. That was my dream. My father left his recordings for us to listen to. That's why it is important for us to record our music on a CD.'

KAMUKUWAKÁ UNDER THREAT

The Wauja community has been struggling to protect Kamukuwaká from the threat of road and railway builders for almost thirty years; most recently the site and the sacred Batovi river which runs beside it have been put at fresh risk by a planning application from mining prospectors. It was in recognition of these very real threats to the future of the site that Factum Foundation, in a gesture of solidarity with the communities of the Xingu, extended an offer to scan the cave for posterity so that, should the worst happen, at least the communities would have an accurate record of their heritage which could be used by future generations.

Upon the team's arrival at the site, however, it was found that the worst had indeed happened. An unknown assailant had deliberately and systematically hacked off all of Kamukuwaká's petroglyphs. For the Indigenous communities of the Xingu the brutal destruction of their most sacred site represents yet another violent assault upon their territory, culture, and way of life. It also comes at a time of severely increased political and environmental pressure. Every one of the sources of the Xingu River lies on private land beyond the limits of the protected territory. This principal lifeline to all of Xingu's communities is beyond their control or protection. Pesticides, industrial waste, and chemical wash-off are polluting the river and tributaries, something which is having a devastating impact upon fish numbers – a key source of food for the communities. Meanwhile, President Bolsonaro is deregulating the destruction of the rain forests at an unprecedented rate and is rapidly normalizing anti-Indigenous rhetoric and policy. On 10 June 2016 on a video published by *Correio do Estado*, Bolsonaro stated that 'This unilateral policy of demarcating Indigenous land by the Executive will cease to exist. Any reserve that I can reduce in size, I will do so. It will be a very big fight that we're going to have with the UN'.

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Akari Waurá discovering the vandalised cave of Kamukuwaká. The yellow patches on the surface are where petroglyphs have been hacked off by the cave's attackers.

A DIGITAL RESTORATION

In spite of the vandalism of the petroglyphs, it was decided that the cave site should be recorded in full using LiDAR laser scanning and photogrammetry technologies. Following this recording, an ambitious plan was formed to attempt to digitally restore the petroglyphs based on extant photographs of the site. Members of the Wauja community helped to contact dozens of anthropologists and archaeologists who had visited the site over the last few decades, and a database was compiled of images of Kamukuwaká's petroglyph motifs prior to destruction.

A unique methodology was developed for the digital restoration. Factum Foundation's digital artist Irene Gaumé spent many months analysing the database of images and matching them to the vandalised areas on the 3D model. The photographs which showed the petroglyphs intact were projected onto the model and turned into 'height-maps' – they were converted from two-dimensional to three-dimensional form. Using the 3D modelling software ZBrush, each of the damaged areas was identified, examined, volumised and adjusted before being merged into the 3D model. This new approach to digital restoration offered the freedom to play with the original and test different theories on the computer model.

However, understanding the forms of petroglyphs was sometimes a difficult process. Often the mark-making was so subtle that it was difficult to tell natural rock forms from deliberate engravings, and only someone who knew the original engravings intimately could differentiate them. Factum Foundation therefore sent images of the in-process restoration back to the Wauja community, allowing them to work as epigraphers to collectively revise and correct the restoration work. This input from the Wauja allowed for a fresh perspective on the data, and their clarifications, adjustments, additions, and corrections were assimilated into the 3D model.

OPPOSITE, CLOCKWISE FROM TOP LEFT

Render of the cave and its entrance, produced using the data from LiDAR and photogrammetry recordings.

Colour render of an area after the attack; black and white render of the digital restoration.

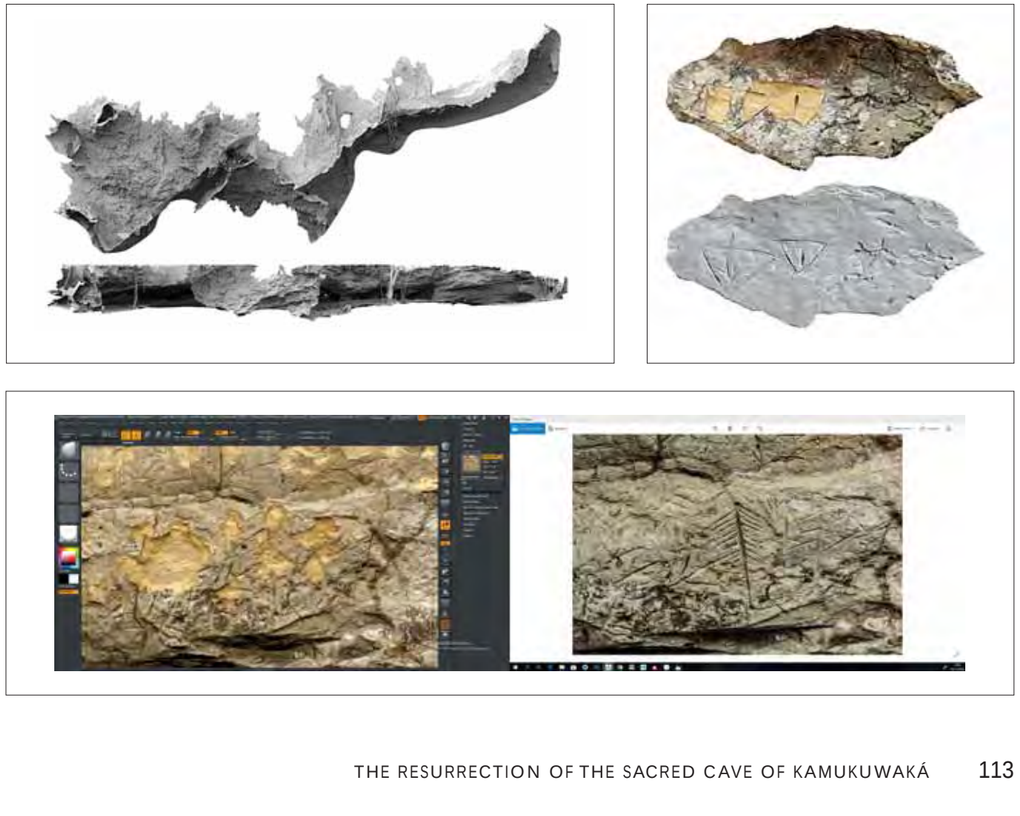
Detail of the vandalised surface of the cave; the same area, shown in a photo taken before the attack.

A DIGITAL AND PHYSICAL RE-CREATION

Over a period of four months, the Factum team worked to make an exact physical reconstruction of the Kamakuwaká cave from the digitally restored data recorded at the cave and corrected by the Wauja community. Once the 3D data had been milled into medium-density polyurethane at a scale of 1:1 and the different segments assembled into the form of the cave, the surface was textured to match the original rock surface without losing any detail of the milled petroglyphs. The final task was to paint the surface, exactly replicating the variations of colour found within the rock at the original cave site.

AN EMERGENCY FORUM ON INDIGENOUS CULTURAL HERITAGE IN BRAZIL

In October 2019, to mark the completion of the facsimile, a forum was held in Factum Arte's Madrid workshops, with the support of People's Palace Projects (Queen Mary University, London). Representatives from Xingu, including Akari Waurá, Yanam ak Akuma Waurá, and Takumã Kuikuro attended to lead discussions about the facsimile and its future. They were joined by Indigenous activist Shirley Djukurnã Krenak of the



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The digitally restored images of all vandalised areas were sent to the Wauja community as A3 renders. The community added their knowledge onto acetate overlays to ensure a correct digital restoration. © Mafalda Ramos.

OPPOSITE

The Wauja community at Piyulewene looking at the A3 renders of the digital restoration and drawing on top of acetate sheets. Every decision is collectively negotiated. © Mafalda Ramos.

Krenak community, as well as academics, activists, fundraisers and producers from some of the world's most prominent institutions and organisations drawn from related fields, who engaged in passionate discussion and debate.

When Akari Waurá saw the rematerialized cave of Kamukuwaká in Madrid, he found he could easily read the engravings from the facsimile. It works as a memory theatre: rather like looking at an album of photographs, very specific memories flood the mind. Standing in Madrid before the restored petroglyphs, Akari began to narrate the creation myths of the Xingu. As they are remembered, they come back to life – they can remain dormant but, like a seed or a pre-programmed sequence of DNA, they revive when nurtured.

When asked if the facsimile of the cave possessed the same 'sacred' qualities as the original, Akari Waurá explained that for him the facsimile is already sacred: 'it's sacred in a different way. It's sacred because it represents support and recognition of our culture from beyond Brazil. It represents the investment of time, care and solidarity of those who created it.'

For the duration of the event Akari was in continual contact with the rest of the Wauja community via Facebook messenger. Through him the community relayed its desire to eventually possess the reconstructed cave, so that future generations could continue its use as a site and trigger for their culture, stories and heritage. But first, it was decided, if the opportunity arises, it should travel the world, as a platform from which the communities of the Xingu can amplify their voices, speak of their struggle, enhance their agency on an international stage and help to share their culture.

The resurrection of the cave represents to the Wauja, and indeed to all Xingu's communities, their rights to territory and self-determination. As Akari explains, 'the reconstruction of the Kamukuwaká cave and the engravings is a symbol of our endurance despite everything they do to undermine us.'

AN EMOTIONAL RESPONSE FOR EVERYONE

Many of Factum's facsimiles are of objects from ancient cultures or which now exist at a far remove from their original contexts of use. The experience of working with a 'living' object, which remains the focus of intense and regular activity, was in many respects a new one and had a profound impact on the approach taken. While it is often the objects themselves – the original and the facsimile – that take centre-stage in such a process, here the most important thing was to respect the perspectives of the communities involved, designing processes which allowed their voices to be heard and seeking to understand the cultural significance of the cave within the worldview of the peoples of the Xingu. It was a transformative and humbling experience for the Factum team to be allowed to collaborate with the Wauja people on an endeavour of such significance to their lives and identities.

SHIRLEY DJUKURNÃ KRENAK ON THE ARTIFICIAL NATURE OF A FACSIMILE

The ability of the digital restoration of Kamukuwaká to build a bridge between two cultures was superbly summarized by Indigenous activist Shirley Djukurnã Krenak during her address to the Social Anthropology Amerindian Research Group at St Andrew's University, in response to questions about the 'artificial nature' of the facsimile of Kamukuwaká:

I want to talk to you about artificiality. My people (Krenak) live in Minas Gerais (southeastern Brazil), where we also have a sacred cave whose paintings have been completely destroyed. The artificial white men came and destroyed everything. Like the communities from the Xingu, we plan to do whatever we can do to return the paintings to our sacred cave.

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Securing sections of the re-created cave into place.

OPPOSITE

Akari Waurá recounting Wauja myths beneath the re-created cave.

These actions of restoration are not artificial. What is artificial are destructive actions. As Indigenous people, we already have to live artificially twenty-four hours a day: what is artificial is having to fight against deforestation, against weapons of war, against agro-toxics, against bad people. That's what is artificial to us, and it comes from the cultures that assault us.

What's happened with the restoration of Kamukuwaká is real, it is not artificial. It is sacred because it helps us and carries our culture forward.

As Indigenous people, we are continually readapting our ways of living, and we are heavily criticised by researchers and anthropologists precisely because we are adapting ourselves. For example, today under President Bolsonaro, we are threatened relentlessly, and one of the weapons we can use to respond to these continual attacks is communication. So, we try to bring our culture into the new modes of communication and make use of them in a way that is positive for us. To what extent is it fair that we should be criticised for that? We are not forcing these things upon ourselves. We are receiving and adapting to these new forms of communication.

There are lots of people who are concerned about us adjusting ourselves to this contemporary life. Now that we too are going to university, we too are becoming anthropologists, sociologists, teachers, doctors, lawyers. Eventually, we will no longer need the white researchers to do our research anymore. Eventually, we will be together doing our research, hand in hand with non-Indigenous researchers, and bring our own vision and our own culture to this research.

If these attacks and this artificial destruction continue, we may find ourselves in the future with no sacred mountains and no sacred caves. Yet we can still have our artificial mountains and artificial caves, along with our spirits. Because the spirituality of Kamukuwaká, or of any sacred cave, is carried by the people that live there, and these are living cultures.

THE FUTURE OF KAMUKUWAKÁ by Akari Waurá

How can we protect the river and our territory? Our wish is that the government would protect the sacred landscape where the Kamukuwaká cave is located. We continue to fight. I will fight, and I know my children will carry on with my struggle. We will fight for the protection of our culture, and our culture is the river, the land, the Kamukuwaká cave. We must take care of them, as they take care of us. They cannot be abandoned, or destroyed.

The reconstruction of the Kamukuwaká cave and the engravings is a symbol of our endurance despite everything they do to undermine us.

Being able to show it in Madrid is very important to the Wauja. People will learn about us, about who we are, where we come from, and how we live. They will learn about our history and our struggle, and perhaps they will be able to join us in the fight to protect the cave, the river, and our culture.

OPPOSITE

Render of a section of the 900-year-old 'Signing Oak' recorded in Windsor Great Park.

DEATH AND ENTANGLEMENT. SOME THOUGHTS ABOUT LIFE, LOVE AND THE AIMS OF ART CONSERVATION

Alva Noë

Prepared for the workshop 'Conserving active matter: degradation as an aesthetic value', Bard, New York City, 7–8 November 2019.

Alva Noë is a writer and philosopher living in Berkeley and New York. He writes about art, mind and human experience. His books include *Strange Tools* (2015), *Varieties of Presence* (2012), *Out of Our Heads* (2009), and *Action in Perception* (2004). He has been a recipient of a Guggenheim Fellowship and of the Judd/Hume Prize in Advanced Visual Studies. Noë is a professor of Philosophy at the University of California, Berkeley, where he is also a member of the Center for New Media, the Institute for Cognitive and Brain Sciences, and the Program in Critical Theory.

Back in the early 1980s, when the California Condor was on the verge of extinction, the pioneer environmentalist and conservationist David Brower, who was one of the founders of the Sierra Club, opposed efforts to save the species by breeding it in captivity for later release in the wild. His objection was principled. A condor is at most 5 per cent blood, brain, bones and feathers. The rest, he argued, is environment. A condor bred in captivity, in isolation from its environment, is no condor. Perhaps, he bitterly suggested, it is a flying pig.

Brower appreciated that an organism, in this case a bird, is no mere body. It is a locus of activity and this activity is world-involving. The animal, to borrow Susan Hurley's phrase, is a dynamic singularity.[1] Where do we find it? In its nexus with the wider world.

In my talk today I want to explore Brower's insight about living beings but in relation to questions of art and conservation. But to do so I would like, first, to warn against a way of misunderstanding the basic phenomenon he appreciated.

To bring this, the misunderstanding, into focus, let us consider Patricia Westerford, the fictional botanist in Richard Powers' novel *The Overstory*.[2] At a crucial juncture in the story, Westerford 'describes how a rotting log is home to orders of magnitude more living tissue than the living tree … She tells … about the ambrosia beetle. The alcohol of the rotting tree summons it. It moves into the log and excavates. Through its tunnel system, it plants bits of fungus that it brought in with it, on a special formation on its head. The fungus eats the wood; the beetle eats of the fungus … She tells … everything depends on everything else. There's a kind of vole that needs old forest. It eats mushrooms that grow on rotting logs and excretes spores somewhere else. No rotting logs, no mushrooms; no mushrooms, no vole; no vole, no spreading of fungus; no spreading of fungus, no new trees' [282].

On the basis of reflections such as these, she finds herself entertaining the hypothesis that 'a tree's real task on Earth is … to bulk itself up in preparation to lying dead on the forest floor for a long time' [282]. Life, she considers, is for death.

Westerford conceives of the living old-growth forest as 'reciprocal nations tied together in life' [282], but her conception has everything to do with death. Earlier in the book Westerford discovers this. Here is the crucial passage:

> She presses on fissures of bark and her fingers sink in knuckle-deep. A bit of bushwhacking reveals the extent of the prodigious rot. Crumbling, creature ridden boles, decaying for centuries. Snags gothic and twisted, silvery as inverted

1 Susan L. Hurley, *Consciousness in Action* (Cambrige, MA: Harvard University Press, 1998).
2 Richard Powers, *The Overstory* (New York: W. W. Norton, 2018).

> icicles. She has never inhaled such fecund putrefaction. The sheer mass of ever-dying life packed into each single cubic foot, woven together with fungal filaments and dewbetrayed spiderweb leaves her woozy. Mushrooms ladder up the sides of trunks in terraced ledges. Dead salmon feed the trees. Soaked by fog all winter long, spongy green stuff she can't name covers every wooden pillar in thick baize reaching higher than her head. Death is everywhere, oppressive and beautiful.

Powers here gives effective voice to ideas that are growing in popularity – think of Peter Wohlleben's bestseller *The Secret Life of Trees*[3] and Michael Pollan's article[4] a few years back in *The New Yorker* about the new plant 'neurobiology.' I teach about plant intelligence, so called, in my introductory classes, precisely in order to get students to think in fresh ways about what is required for an organism to have a mind, about what mind is or might be. The case for plant minds is all the more exciting when we notice that 'plant neurobiology' is a misnomer, for plants have no brains and no nervous system. Maybe these are not required for consciousness or thought?

But this is all an aside. What I'd like us to pay attention to here now is this idea of 'ever-dying life' that Westerford, Powers' character, encounters in the old-growth forest. Life and death, the idea seems to be, are joined symmetrically in a kind of processual, circular unity. Death is the source of life which is itself thought of as a condition of steady dying.

From this point of view, life and death are an unending process of metamorphosis and transformation in relation to which, very importantly, trees and other large-scale biological individuals – you, me, the California Condor – are but moments or phases; we are living bridges from one state of death or dying to another.

Authentic death is a kind of eternal life, a beautiful oneness with the biomass from which we come and to which we will return.

This impersonal, and perhaps consoling, picture of living death or dying life, of an authentic death, oppressive and beautiful, is implicitly contrasted with something else, a different kind of end-event, something much more frightening and total and absolute than the fertile death of the death life circle, namely, the very cessation of the death life circle itself. This cessation – brought about by the devastation of biodiversity and the destruction of eco-systems, by human interventions such as clearcutting – is something new and terrible and *wicked*. From the standpoint of the ecological naturalism I have been describing, this mega-death, this sterilization and undoing of four billion years of organic evolution, is uniquely human and very much the aftermath of *sin*: short-sightedness, greed, rapaciousness, ignorance, indifference.

But the essential piece in all this, for my present purposes at least, is not the politics, not the very genuine threat, not the moral challenge, but the focus-shift, implied here, from the individual, as a unit of significance, to the biomass collective. Ecological naturalism, here articulated by the fictional scientist Patricia Westerford, posits life and death as mutually enabling processes and, crucially, it views living agencies – trees, voles, people – as, in a way, mere epiphenomena: we come and go as the active microbial and fungal matter, which is our real ground, blooms and decays.

3 Peter Wohlleben, *The Secret Life of Trees* (Vancouver: Greystone Books, 2016). Published in German in 2015 by Ludwig Buchverlag.
4 Michael Pollan, 'The intelligent plant', *The NewYorker*, 15 December 2013.

Now the mistake comes into view. Yes, we are dynamic singularities. We are spread out and world involving; this is something I have been arguing for the last 15 years.[5] We are 95 per cent environment. Brower was right about that. But we are not epiphenomena, and our relation to death, and life, is not at all like what the ecological naturalist would have us believe.

We do not just come into life, and then depart, preserving a great continuity. Rather, we are each of us, every single one of us, born to our human mothers; we are pushed or squeezed, or pulled, sucked or even cut out of her body. We do not emerge from a living death, a vast pre-conscious unknowing; we emerge from *life*, from the very specific, personal, female lives of our specific individual mothers.

And our lives start there, not exactly *in medias res*, but certainly *already in relation* to another person. It is the fact of this inescapable intimacy with our mothers that gives life its basic asymmetry, its uni-directionality. However you tell the story, ours is the tale of a break-up, and its final chapter is always the same. We die. But death for us now is not a sacrifice to the micro-organisms alive within us and around us, nor is it a spiritual eternal rebirth. Our deaths, in this way like our births, can only ever be for us great traumas, for they are forced separations and unwilled goodbyes.

Death is a terrible and undeniable loss of everything we have ever loved and everything we have ever cared about. In this admittedly somewhat melodramatic telling, we do not stand in a symmetrical relationship to life and death. And while we are food for the fishes and fodder for the worms, no doubt, we are more than that. We are persons, we are agencies, we are protagonists.

This is not melodrama, however; it is what biology teaches.

Consider: the simplest living thing, the unicellular organism, makes itself by intaking energy from the surrounding field and using it to build a wall, the membrane that literally defines the cell – or the organism – itself, and marks where the rest of the world begins. Life is this self-making, autopoietic, but fundamentally xenophobic activity of producing, preserving, conserving and insisting on the integrity of oneself.

This process also delivers something like meaning and value. For the cell's universe spontaneously bifurcates into that which is good for the cell and that which it cannot abide.[6] The cell has interests, needs, goals and, in a way, problems, even if, of course, it cannot frame these or think about these for itself. The simplest organism is already a protagonist, and a protagonist is not merely a locus of biomechanical activity. The cell is not a process or a dynamic, but an *it* – as opposed to a he, she or they – and it is that in virtue of which it is an *it* – a kind of unity or integrity – that makes it different from any non-living things that there are.

Now, an amoeba is no person, to be sure. But this much is shared in common. First, to be a person, no less than to be a bacterium, is to be organized. We are organisms, after all. Second, neither the amoeba nor we ourselves are mere chemistry; we are characters, and our stories, whether told by Darwin, or by the journalist or novelist, reveal an order and meaning that has no reflection, none at all, in mere physics.

I pause here, to recapitulate and to set our signts more clearly on what I'm trying to do here. Human life and consciousness is not something that happens inside us; it is something we achieve; like everything else we achieve, it depends not only on our brains,

5 This is the central theme of my books *Action in Perception* (Cambridge, MA: MIT Press, 2004), and *Out of Our Heads* (FSG / Hill and Wang, 2009).
6 This idea, as well as the conception of life as autopoiesis in the previous paragraph, are due to Humberto R. Maturana and Francisco J. Varela. See their *Autopoiesis and Cognition: The Realization of the Living* (Boston: Reidel, 1980). For a later development, see Evan Thompson, *Mind and Life* (Cambridge, MA: Harvard University Press, 2007).

bones, feathers and blood, but on our dynamic involvement with a surrounding environment, including, in our own case at least, the cultural environment. This was Brower's insight, and it was the basic argument of my book *Out of Our Heads*.

But to insist on this world-coupled collective dynamic distributed-ness is not, or should not be, to eliminate or reduce or demote the existential and the ontological significance of the organism or the person. No living being is merely active matter.

And this has everything to do, first, with the fact that life not only self-organizes but always does so in the interest of homeostasis. We make ourselves, we self-organize, and we do this by denying that mere process, that is to say, entropy, can rule us and reduce us to mere biomass. We make ourselves up. You lose sight of this if you give too much attention to the fragility of our hold on ourselves and of our vulnerability to, as well as our productive exploitation of, the fungi and the microbiome.

But there is a second point. To be an organism such as we are is, always, in a way, to be a slave. In the first instance, a slave to the ceaseless demands of life-making, self-making, self-preserving, self-conservation that is our first order of business. But things are more poignant still: we didn't sign up for this, did we? To be an organism is to be *organized*, organized by the demands of this fundamental, existential, and, in a way, terribly constraining task: the conservation of ourselves. But none of us chooses this. In fact, for the most part we do not even understand the ways we are organized and made up by the ways we are organized.

Wittgenstein wrote that a philosophical problem has the form: I don't know my way about.[7] And the aim of philosophy is, in a way, then, to orient, or to enable us to recover our bearings. We need, or we feel the need anyway, to gain an overview of, basically, where we find ourselves.

This is art's basic work, too.

Art aims at ecstasy. I don't mean passion, emotion, or pleasure. Its push is for release and its point is to undo the stasis that is our ordinary, our normal and our most familiar condition.

The key thing is to appreciate that the conditions from which we seek release – for example, in the human case, the basic habits, intelligent automatisms and unthinking skills which constrain us – are precisely that which makes us what we are. Release means something more than enlightenment – Wittgenstein's coming to 'know our way around' – it holds forth the possibility of reorganization, something kin to liberation. Two examples:

Choreography. People dance. Dancing is an organized activity. It is an activity built out of habits. Choreography, the art of dance, however, is not just more dancing. Choreography puts dancing on the stage. It puts the fact that we are dancers, that we are organized by dancing, on the stage. It puts us on the stage. It offers a representation of ourselves dancing. Think of this as writing ourselves down, or as the introduction of a perspicuous representation, like a new notation. And this representation of ourselves changes us, for it gives us new resources for thinking about what we are doing when we dance, and so finally new ways of dancing. You dance differently in a world in which there is choreography. Choreography loops down and changes the dancing of which it is the representation.[8]

7 Ludwig Wittgenstein, *Philosophical Investigations* (London: Macmillan, 1953), §123.

8 This conception of art as looping down and reorganizing us is the main topic of my *Strange Tools* (FSG / Hill and Wang, 2015). The idea of 'looping' itself is due to Ian Hacking. See, for example, his *The Social Construction of* What? (Cambridge, MA: Harvard University Press, 1999).

Merce Cunningham in New York City, 1957. It is likely that Cunningham is here performing *The Changeling*.

Second, painting. People make pictures; they use pictures. We have been doing so for millennia, much as we have been talking and thinking, and dancing for millennia. We are participants in a picture-based economy of exchange. Pictures – sketches, drawings, photos, you name it – are tools for showing, a technology of display. We use them for all manner of purposes. For example, we use them to show something we want to sell, or to record what happened, etc. Crucially, artists who make pictures are not merely participating in this economy of show and display. They are not simply carrying on this *show business*, as I call it a new book. They are not really making pictures at all; they are making art *out of pictures*, that is, out of the fact that we are organized by pictures, that pictures occupy an existentially organizing place in our lives. Painting as an art puts all this on display and does so in ways that give us resources, finally, for making new kinds of pictures and for thinking about the place of pictures in our lives in new ways. Painting starts with habits, with the ways we find ourselves organized by pictures, and then it re-organizes us.

Crucially, again, this is art's job; its work. This is, to borrow Heidegger's pun, the work of art.

If I am right that art serves in this way to unveil us to ourselves and to reorganize us, that art is, fundamentally, about *ek-stase*, a breaking up of the stasis that holds us captive and makes us what we are, then it follows that we must resist identifying the art *object* or the art *thing* with the art work. Dewey warned us about this. To do so is about as wrong-headed as thinking that the California Condor is simply a structure of blood, brains, bones and feathers. To save the condor you need to save the condor's world, for the condor is a way of being in the world. And to save the artwork, or to keep it alive, as it were, you need to preserve the conditions in which it can provide us the needed opportunity to unveil and reorganize.

It is useful to re-frame our question in relation to choreography. Useful because a choreographic work is an artwork, fully-fledged. But also because it is an artwork where, in a way, the ratio of thing-hood or materiality to true significance is as low as can be, and so it serves as a reminder that artwork is not thing, but that, rather, the thing is, at most, a prop. If our job is to conserve or preserve Cunningham's choreographies, for example – a subject of some concern as we now celebrate his centenary – what else is there for us to do but, as it were, stage his works anew? Or perhaps our job is in some other less specific way to carry on an art making practice inaugurated by him.

But isn't that what we need to do too if we wish to preserve paintings, sculptures, films or videos, architectures, or whatever? It isn't just that we need to resist the microbes and the fungi and so keep things from falling apart; we need to preserve their very environment, or our access to their very environment, in which alone the works are actually even works of art in the first place.

And that isn't something we can do, as it were, conditionally. We can't pretend art objects can serve to open up new possibilities for us or give us new resources for understanding if they no longer really do. Art preservation, art conservation, isn't just historical excavation. Thought of as artifacts, artworks are just shards, or pictures, or traces.

But there is another lesson choreography teaches. Every living work of art, of whatever kind you care to select, is, in the sense once articulated by William Forsythe, a *choreographic object*.[9] It choreographs us. Recall Barnett Newman's note on the wall of the Betty Parsons gallery urging visitors to step in close to the works. Newman's note brings out that every painting sets the viewer in motion, bodily, but also cognitively and emotionally. It is in this setting into motion that the work of art happens.

Of course, it is we who set the work into motion by caring about it. So that's the main job of the conservator. To make it possible for us to care about the work of art.

Perhaps we should say: every work of art, then, is a kind of choreographic score; and our question is, how to play it? or, do we want to play it? or why should we play it? Art conservation, then, is about keeping it real; about re-staging, about maintaining the environment, the whole contexture, in which the work can afford what it affords, can score what it can score.

Now this *may* and very often will require that we target the object itself. That is, it is important that the old master paintings and other treasures of that sort receive the kind of careful maintenance that lets them remain physically intact. For their material survival is essential to what they are and to their continued existence, in any form, for us.

9 William Forsythe, 'Choreographic objects', https://www.williamforsythe.com/essay.html.

Sarcophagus of Raphael, the Pantheon, Rome.

But this is not always the case and this need not always be the case. Which is the truer artwork: Veronese's painting in the Louvre, or Factum Arte's copy, returned to the original Palladian refectory (heavily restored in the 1950s) from which it was stolen by Napoleon's troops?

I end with this: there was an engraving on Roman pre-Christian head-stones that was once as common as RIP is today on ours: NF F NS NC – *non fui, fui, non sum, non curo*.

Translation: I was not, I was, I am not, I do not care.

Perhaps it is sometimes good and right that we let artworks die their natural death. It is terrible and scary let things we love go, but there is no genuine alternative.

DISCRETE OBJECTS AND COMPLEX SUBJECTS: FROM MOSUL TO LONDON AND BACK AGAIN

Nicolas Béliard

Nicolas Béliard is the Director of Communications for Factum Foundation and Factum Arte, and was the organizer of the initiative to transport the lamassu facsimiles to Mosul.

Since 2004, Factum Arte and Factum Foundation have been working with the British Museum on a project to send facsimiles of two lamassu to Mosul in Iraq. The colossal statues were excavated in the mid-19th century on the site of ancient Nimrud, a few miles from modern Mosul, but they were shipped to London in 1851. Although the lamassu were scanned at the British Museum in 2004, it was not until autumn 2019 that the facsimiles finally made the journey from Factum's Madrid workshops to Iraq. They are now installed at the entrance to the student building at the University of Mosul, next to the burnt-out library where over one million manuscripts and documents were destroyed in 2016 by war and fundamentalism.

Lamassu are Assyrian protective deities whose hybrid bodies are part human, part bull or lion, and part bird. The two lamassu now in the British Museum originally stood guarding the internal threshold to the throne room in the palace of Ashurnasirpal II (king of Assyria from 883 to 859 BCE).

The first excavations at Nimrud were undertaken in the 1840s and 1850s, conducted by a team led by Austen Henry Layard, a young British archaeologist and imperial agent, and Hormuzd Rassam, the first acknowledged Assyriologist from the Ottoman Empire. The two lamassu sculptures were among the most spectacular of their finds, and following excavation they were transported to London, where they entered the collection of the British Museum to great public acclaim.

In 2004, Factum Arte (before the creation of Factum Foundation in 2009) recorded the original statues at the British Museum using a high-resolution NUB3D Scanner and composite photography. Alongside the lamassu other reliefs from the eastern end of the throne-room of the Northwest Palace were scanned, both in the British Museum and elsewhere – the Pergamonmuseum in Berlin, the Staatliche Kunstsammlungen in Dresden, the Sackler Museum at Harvard University and Princeton University Art Museum. These low-relief scenes once formed a coherent narrative cycle. Originally they were fully coloured and must have inspired awe when viewed in the palace where the walls and ceilings were painted and the floors were covered in carved and woven patterns. The Factum team was scheduled to record all the fragments that remained on site in Nimrud in 2006 along with other pieces that had been moved to Mosul and Baghdad. This trip was called off due to the deteriorating security conditions and the increased risk of kidnapping in the area. Watching the lamassu and the panels being destroyed in 2016 by Islamic State in a highly public iconoclastic attack reinforced the importance of recording whenever possible in times of peace.

The high-resolution scanned data was processed and milled on 3- and 5-axis machines at Delcam's research institute in Birmingham. At the time it was the largest high-resolution routing project undertaken for conservation purposes and the polyurethane 'originals' that emerged set standards that have seldom been matched.

OPPOSITE

Scanning the lamassu in the British Museum in 2004 using a NUB3D Scanner.

THIS PAGE

The lamassu sculptures in the exhibition *Nineveh* at the Rijksmuseum van Oudheden, Leiden, 2017–18.

A flamenco concert organised in Mosul by the Spanish ambassador to Iraq, Juan José Escobar Stemmann, to celebrate the arrival of the lamassu facsimiles. This was the first concert by an international group to be held in Mosul since the end of the conflict in 2017.

OPPOSITE

The lamassu were recreated using scagliola (plaster marble), a material that can be made to closely resemble the Mosul marble from which the original statues were carved.

The lamassu were routed in sections, assembled, moulded and then cast in scagliola. A final coat of wax completed the imitation of the original Mosul marble surface, bringing the colossal winged lions back to life in Factum Arte's Madrid studios. They were then exhibited together at the Rijksmuseum van Oudheden in Leiden, which had facilitated the creation of the scagliola replicas.

After several stalled attempts, facsimiles of the lamassu finally reached Mosul in October 2019, a feat which would not have been possible without the help of Ali

Aljuboori, the director of the centre for Assyrian studies at the University of Mosul, and the support of the British Museum in London, Mosul University, the Rijksmuseum van Oudheden, the Spanish Ministry of Defence, the Spanish ambassador in Iraq and the Iraqi Government. It is hoped that their installation will mark the start of further collaborations between Factum Foundation and the University of Mosul.

High-resolution recording, exact facsimiles and digital restorations can never replace the Assyrian carvings that were destroyed in Nimrud and at the Mosul Museum, but they can play an important role in keeping their memory alive and in sharing their cultural and political significance. The hope is that the installation of the facsimiles will be seen as a gesture of solidarity and a sign of hope for the role that technology and cultural heritage can play in the reconstruction of the Republic of Iraq. Amjad, a remarkable welder who helped to install the facsimiles, said in a very moving interview: 'Our Heritage will never die; our enemies and our friends know this. We don't care if this statue is made of marble or gypsum. It's a statue. It's a symbol. It's our Identity'.

Some of the sculptures destroyed in the Mosul Museum were plaster casts. Many were not. As with medical imaging, different types of technology can generate data that will act as a repository of information for future generations. This will be of great use to monitor conditions when works are attacked and vandalised. It is all that is left when an object is totally destroyed. The lamassu that were removed by Layard are still in the British Museum. The ones that were left on site are not. It's not possible to predict what will happen. The British Museum could have been hit by a bomb in the Blitz, resulting in the destruction of the original sculptures. It is possible to launch a mass campaign of high-resolution recording that will create a new local economy and result in a greater understanding of specific objects and of ways in which the evidence of the past can inform our approaches to them in the present. A training initiative is now being launched which will enable graduates from the University of Mosul and local archaeologists to record, analyse, digitally restore and archive their own heritage using cutting-edge 3D recording technologies.

SHARING SKILLS AND TECHNOLOGIES: TEACHING PHOTOGRAMMETRY IN ALULA

Otto Lowe

Otto Lowe is one of the principal technicians working for Factum Foundation's 3D scanning team, specialising in photogrammetry. He has spent the last three years working on projects in Saudi Arabia and around the world recording cultural heritage for Factum Foundation.

Training and the transfer of skills are a vital part of Factum Foundation's work. The Foundation's educational activities stretch from institutions with a long history of engagement with cutting-edge conservation methodologies (a Factum-led course at Columbia University's Graduate School of Architecture, Planning, and Preservation is now in its fourth year) to locations where the use of digital technology for conservation purposes has no secure existing foothold (teaching programmes have been established at Luxor in Egypt, Makhachkala in Dagestan and Upper Xingu in Brazil). A special emphasis is placed on training people to record their own heritage and on contributing to local economies – a recognition of local actors' privileged perspective on, and privileged access to, heritage assets in their regions.

One important recent programme to support the dissemination of digital recording skills and technologies was that undertaken in the Kingdom of Saudi Arabia in autumn 2018. KSA is currently undergoing important shifts in its relationship to its cultural heritage: five sites have been newly recognised by UNESCO since 2008 and there is increased interest from scholars and tourists from both inside and outside the country, while Saudi Vision 2030 has identified culture and tourism as important pillars of the kingdom's economy and identity in the years to come. As such, this is a critical time for the accurate documentation of KSA's archaeological sites and cultural monuments, many of which have never been recorded at high resolution. These sites include the remains of ancient kingdoms such as the Lihyanites and the Nabateans as well as the artistic and architectural vestiges of centuries of Hajj pilgrimage, visible in particular at Mecca and at the historic port town of Jeddah.

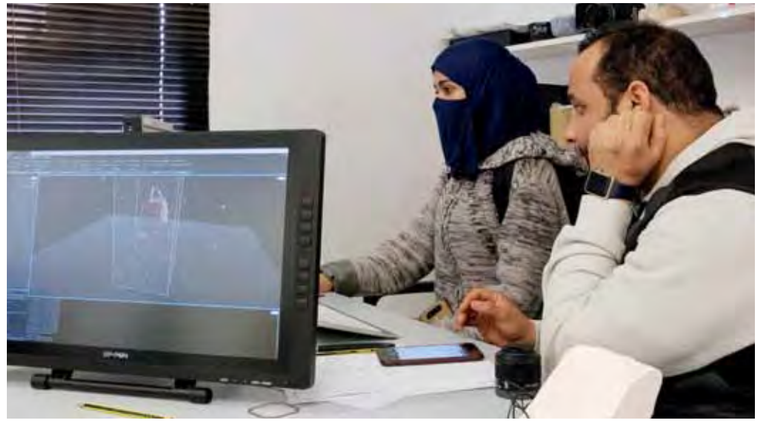
The 2018 project was a collaborative pilot between Factum Foundation, Art Jameel, and the Royal Commission of AlUla (RCU). Factum Foundation led a two-week course in the town of AlUla in the northwest of the country, where a group of fifteen students – ten of them female and five male – learnt to record cultural heritage using photogrammetry. After several classroom sessions explaining the core concepts of recording and processing, the students spent seven days recording at three different sites in the vicinity of AlUla.

The first site chosen was the Lihyanite 'library' at Jabal Ikhmah, a valley that served as a meeting place for the Lihyanite kings. Now part of the UNESCO world heritage site of Al-Hijr, the sides of the valley are covered with hundreds of inscriptions recording their laws and edicts. The other sites were a cliff-face and a gully nearby, whose surfaces are also covered in petroglyphs and inscriptions. One of these sites was suggested as a suitable subject for recording by one of the students on the course.

Onsite at Jabal Ikhmah, the surfaces to be recorded were divided up to ensure complete coverage of the target areas, and the first day was devoted to photogrammetric

OPPOSITE

Two students conducting photogrammetry at Abu Ud.



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Jawharah Albalawi recording the Sepulchre of Cardinal Cisneros in Alcalá de Henares. The Sepulchre was badly damaged during the Spanish Civil War.

Abdulrahim Sugair recording the Sepulchre of Cardinal Cisneros.

Jawharah Albalawi and Abdulrahim Sugair processing data.

OPPOSITE

Otto Lowe demonstrating photogrammetry at the Shaden resort in AlUla.

recording of areas of specific interest. On the second day, students worked together, spaced out along the walls of the valley at intervals of 4 m, to record the site using panoramic photography. Once these results had been processed in the classroom, the students moved on to the second and third sites. Over the course of the two-week period, more than 74,000 images were recorded, with the total data collected amounting to over 1.29 TB.

Two alumni from that course have now undertaken a specially designed advanced course in Madrid, with the aim of allowing them to troubleshoot on complex photogrammetry projects and to teach fellow Saudis how to record cultural heritage in the future. As part of the course, the students recorded the Sepulchre of Cardinal Cisneros, a monument located in the Chapel of San Ildefonso in Alcalá de Henares that was badly damaged during Spain's Civil War. While processing and archiving the data for this complex object, the team learnt a lot about the obstacles that will need to be overcome in order to create effective systems for performing and teaching photogrammetry in Saudi Arabia; a first step will be the translation of an instruction manual into Arabic (something which has already been done for the Lucida 3D Scanner) and the establishment of precise archiving conventions. But although challenges remain, this initiative has given all participants new confidence that it will be possible to build a local team capable of documenting and safeguarding the remarkable cultural heritage of the region.

DIGITISING THE MANUSCRIPT HERITAGE OF DAGESTAN

Eva Rosenthal

The digitisation project has also been supported by the Makhachkala- and Moscow-based Ziyavudin Magomedov Charitable Peri Foundation.

Eva Rosenthal has been leading Factum Foundation's digitisation and training programmes in Russia since 2015, including the recording of tombstones at Kala-Koreysh (Dagestan) and the photography of the Ferapontov Monastery (Vologda region).

When Dagestani Qurans dating from the 18th and 19th centuries were discovered for sale on the London art market, disguised as more expensive Southeast Asian manuscripts through the addition of forged colophons, it was almost impossible to identify the forgeries.[1] Dagestani manuscripts are almost unknown in Europe and America; there are few high-quality images available to researchers; and little recognition of their beauty and originality. They are still being treated as objects of low cultural and monetary value – a situation that endangers their survival.

Since 2015, Factum Foundation has been working in Dagestan, a mountainous region in the Russian northern Caucasus, on a long-term project to record thousands of Islamic manuscripts in the area. Over 3,000 of these are held by the Institute of History, Archaeology and Ethnography (IHAE) in Makhachkala, whose world-class collection contains, amongst other things, notable Qurans of Middle Eastern origin. Perhaps more significant because of their rarity and obscurity in contemporary scholarship, however, are manuscripts of Dagestani origin dating from the 15th century onward: exquisite illuminated Qurans and Sufi tracts, copies of scientific and philosophical texts, historical narratives including several on the feats of the famous 19th-century military leader Imam Shamil, and original works of Dagestani literature.

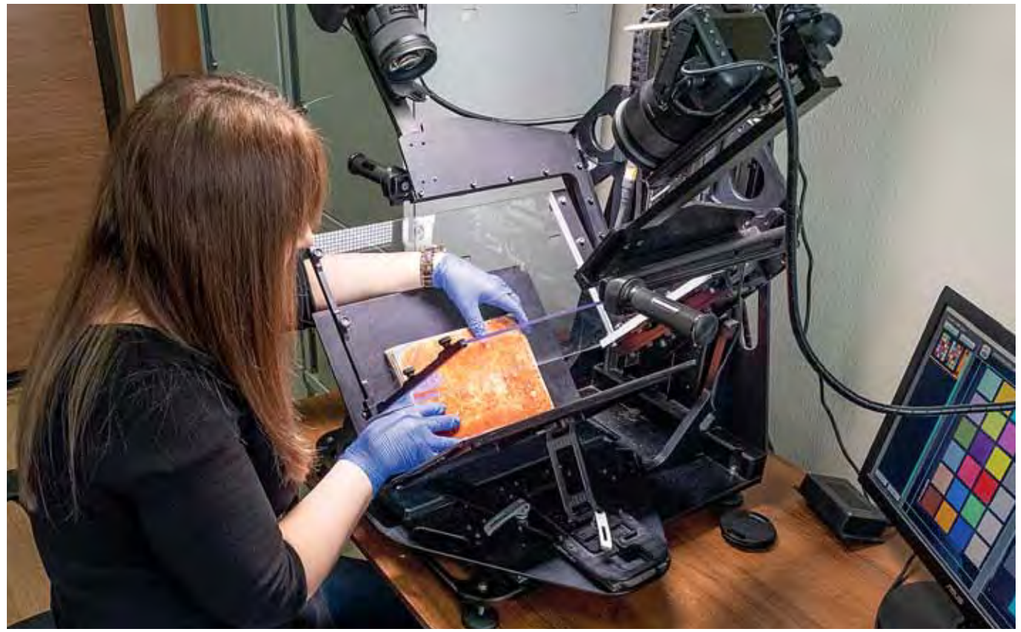
Dagestan's manuscripts are a vital aspect of the region's cultural history. Despite its importance, the IHAE archive represents only a small minority of the over 30,000 manuscripts thought to exist in private Dagestani collections maintained by individuals living in mountain villages, as well as in the countless mosques and madrasas in the region. It is becoming increasingly urgent to document these smaller collections, which are testament to the vibrant manuscript culture that has existed in the northern Caucasus since the Middle Ages. As more and more villagers move to cities in Dagestan and beyond, it is likely that at least some private collections will be lost, alongside valuable history about how and when they were assembled.

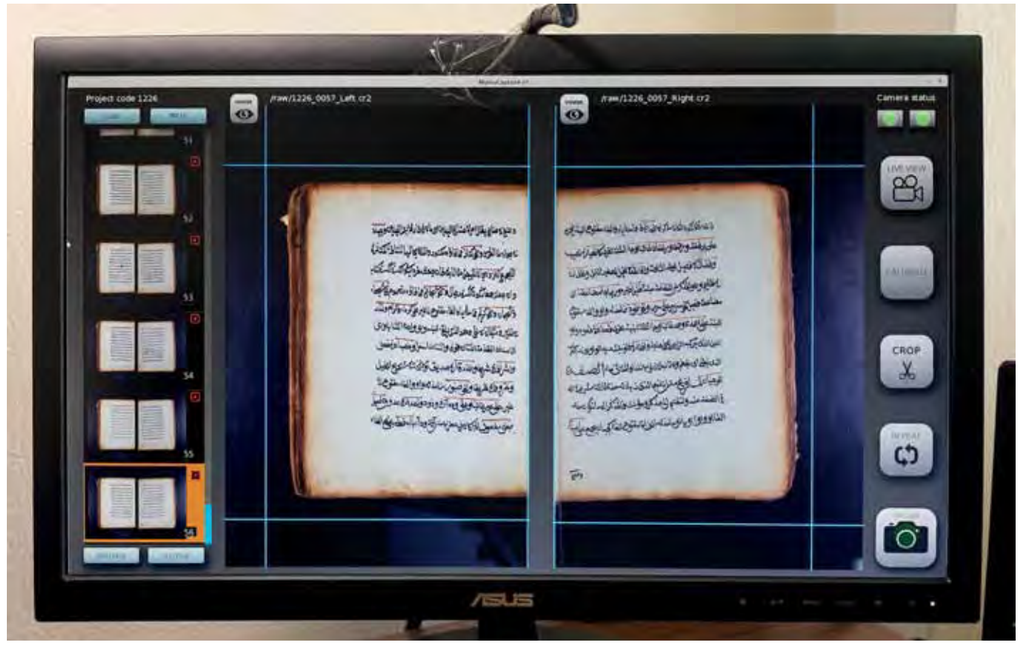
Shamil Shikhaliev, Head of the Department of Oriental Manuscripts at the IHAE, had early recognised the importance of digitisation and the Institute had been slowly recording manuscripts in its archive for some years before Factum became involved. Factum's contribution since 2015 has accelerated the digitisation project. The Foundation has provided two custom-made scanners that produce sharp, beautiful high-resolution images – a 'static' and a 'portable' scanner – and many hours of remote support and training for Habib Seferbekov and Khalisat Shikhalieva, the two main operators at the IHAE.

OPPOSITE

Over 3,000 manuscripts are held by the IHAE in Makhachkala.

1 Annabel Teh Gallop, 'Fakes or Fancies? Some "Problematic" Islamic Manuscripts from South East Asia', *Manuscript Cultures*, no. 10 (2017): 101–28.





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The Portable Manuscript Scanner.

OPPOSITE

Khalisat Shikhalieva uses Factum's 'static' book scanner to record a manuscript at the IHAE.

ManuCapture application open on the computer during digitisation using the Static Scanner © Gennady Viktorov for Factum Foundation.

The initiative has thus far resulted in an archive with high-resolution images of over 1,200 manuscripts – or over 40 TB of data. In 2020, the project will continue with a significant increase in digital storage capacity thanks to a generous donation from Paul and Jill Ruddock. The new year will also bring the publication of a digital library with descriptive metadata for the IHAE's manuscripts, a key resource for scholars working on the region; and although it is a complex and expensive undertaking to make the high-resolution images instantly available via an online library, Factum and the IHAE are studying different options to publish the data for interested researchers.

A parallel programme – which originated from chance conversations between Adam Lowe, the artist Rachid Koraichi, and Bassam Dagestani, an expert on Islamic manuscript conservation from the Juma al Majid Center for Culture & Heritage (Dubai) – is focusing on manuscript conservation. As well as providing training for three young women from Makhachkala, the Juma al Majid Center has equipped a conservation laboratory with state-of-the-art equipment, making the IHAE into one of the foremost manuscript conservation centres in Russia.

In coming years, the IHAE and Factum also want to use the 'portable' scanner to document as many of Dagestan's private collections as possible – an initiative that would ensure the region's rich manuscript heritage is maintained for future generations.

THE RETURN OF AN INTERPRETATION OF CARAVAGGIO'S *NATIVITY*

Bernardo Tortorici Montaperto

Bernardo Tortorici Montaperto is President and founder (since 2001) of the Association of Friends of the Sicilian Museums, and in this role manages eight monumental spaces in Palermo in collaboration with the Cultural Heritage Office of the Curia of Palermo. He has collaborated with the regional administration for the enhancement of the 'itinerari serpottiani', with the municipal administration for the realisation of the Kals'art festival, and with the University of Palermo for the construction of the 'Vie dei Tesori'. From 2002 to 2016 he was President of the Italian Historic Houses Association (Sicily section), and oversaw 20 editions of the event 'Cortili aperti' in various cities of Sicily; he also promoted restoration projects, exhibitions, conferences and publications on the theme of historic buildings and villas. From 2008 to 2012 he was a councillor in Salemi with the Sgarbi council, with a special focus on the town's museums, the historic centre, the landscape, tourism, and cultural heritage. In 2017 he became a member of the Cabinet of the Regional Councillor for Cultural Heritage, Professor Vittorio Sgarbi. Since 2019 he has been President of the Week of Cultures association, which promotes the festival of the same name in Palermo.

OPPOSITE

The re-creation of the *Nativity* was unveiled in 2015. The sheet in front of the artwork shows an image of the empty frame following the theft of the painting in 1969.

The story of Caravaggio's *Nativity with St Francis and St Lawrence* (1600) is one of the worst unresolved art thefts of the 20th century. At some point between 12 and 18 October 1969, the painting was stolen from its location above the altar of the Oratory of San Lorenzo in Palermo, never to be seen again.

Over the intervening years, a range of different theories have been proposed by the Carabinieri, journalists, and mafiosi 'pentiti' (mafiosi turned state witnesses). A repeated theme is the idea that the painting has been destroyed since the theft, although this remains unproven and rests on largely contradictory accounts. The prevailing current line of investigation links the theft to Gaetano Badalamenti, a major player in the Sicilian heroin trade with the US who died in 2004 in a US prison, and as the decades pass the likelihood of finding the painting and unravelling the events surrounding its disappearance becomes less and less likely.

At the time of the theft, only one medium-format colour photograph taken in 1968 by Enzo Bray existed. For many years, a blown-up version of this photo (almost 2 m wide and over 2.5 m high) was exhibited above the altar. The low resolution and the faded colours of its surface after a few years of display offered a clear reminder to visitors that this was only the ghost of a vanished original.

In December 2014, Peter Glidewell invited Adam Lowe to Palermo to meet me in my capacity as the head of the Associazione Dimore Storiche Italiane and of the Amici dei Musei Siciliani, and director at the Oratory of San Lorenzo. As a result of this meeting, Factum Foundation was commissioned by Sky Arts to embark on a full-sized re-interpretation of the lost painting, which would occupy the space above the altar of San Lorenzo for as long as the original remained missing. The production of the new version of the painting became a central element of a documentary about Caravaggio, the theft, and what had happened to the artwork.

In re-creating the painting, the Factum team were able to draw on six large-format black-and-white photographs taken by the Istituto Centrale del Restauro in the 1950s during a restoration of the painting. They also made extensive use of the data they had recorded on a previous project, undertaken in 2009–10, where facsimiles had been created of three paintings by Caravaggio for the Church of San Luigi dei Francesi in Rome. In the first stage of post-processing, Gabriel Scarpa and Anna Paola Ferrara digitally merged the tonal detail of the larger black-and-white photos with colour data from the San Luigi dei Francesi recordings and Bray's photograph.

The resulting file was then printed out at the size of the original painting, showing Caravaggio's distinctive working method (merging a rough ground with directional brushmarks and a process of wiping off a tonal glaze) as well as cracks and later restorations. It was impossible to recreate the texture of a work by Caravaggio using purely

Jordi García Pons adding paint to a digital print of Enzo Bray's photograph.

Rafa Rachewsky printing the *Nativity*. The process of printing, repainting, digitally correcting and then repeating this process several times gradually gave the re-interpreted painting the necessary qualities.

digital methods; so interventions were also made by hand using oil paint. The modified canvas was then re-photographed to integrate the manual interventions into the digital file, and printed again – a process that was performed several times before the final version was reached. The final colour information was printed onto a canvas coated with a layer of animal glue and a half-chalk ground. Factum's flat-bed printer, capable of printing several layers of colour in perfect registration one on top of the other, was critical in the recreation of the deep blacks and rich colours used by Caravaggio.

The *Nativity* was unveiled in December 2015 in the presence of the President of the Italian Republic, and remains in the Oratory of San Lorenzo. It is not a facsimile: it is a 'performance' after the original, a work informed by Caravaggio's painting technique. Because there are so many uncertainties about the original painting and Caravaggio's working method, the recreation involved large numbers of decisions on the part of Factum's team; these choices could have been made differently, resulting in a different final piece, and if a future version is ever made, it may not be identical to this one. Where Factum Foundation decided to replicate some of the damage to the original canvas visible in the black-and-white photographs, another version could have sought to return the painting to its condition in Caravaggio's own time. But while the recreation can only ever be partial, the process of making also brings us closer to the original, forcing us to consider the options faced by Caravaggio himself and to engage with the conceptual and material processes involved in creating it.

The recreated *Nativity* was the catalyst for another development, a series of seven programmes on 'lost' paintings (by Johannes Vermeer, Vincent van Gogh, Graham Sutherland, Gustav Klimt, Tamara de Lempicka, Franz Marc, and Claude Monet) which were recreated for the Sky Arts television series *Mystery of the Lost Paintings*, developed as a collaboration between Peter Glidewell, Ballandi Arts and Factum Arte in 2017. The series explored the possibility of re-interpreting and recreating paintings that were lost, destroyed, or irreparably damaged in the 20th century, using existing photographs, historical research and comparison with other works by the same artists.

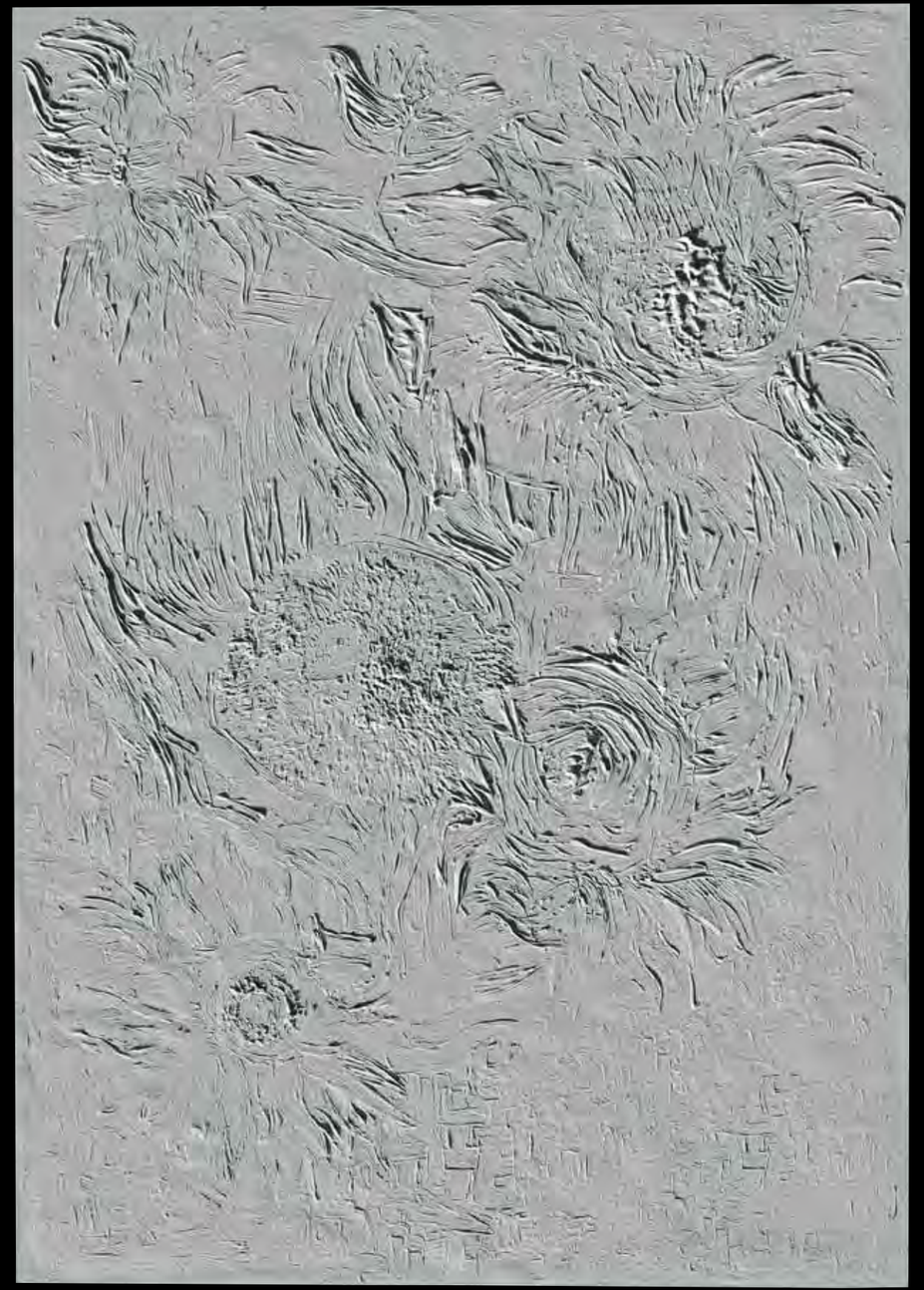
The emphasis is not so much on the recreations themselves, but on the ways in which close study and discussion invites renewed reflection on an artist's biography, the character of the original artwork, and the complex history of each painting. In some of the cases the originals have been lost forever, in others their existence and whereabouts are unknown. Ironically, several of the paintings that were the focus of the television series have achieved greater celebrity because of their disappearance. The seven paintings were displayed at Palazzo Abatellis at the end of 2019, an exhibition that also embraced the *Nativity* in the Oratory of San Lorenzo. The story of Caravaggio's *Nativity* continues to be the focus of media and public attention – hopefully it is a story that is not over yet.

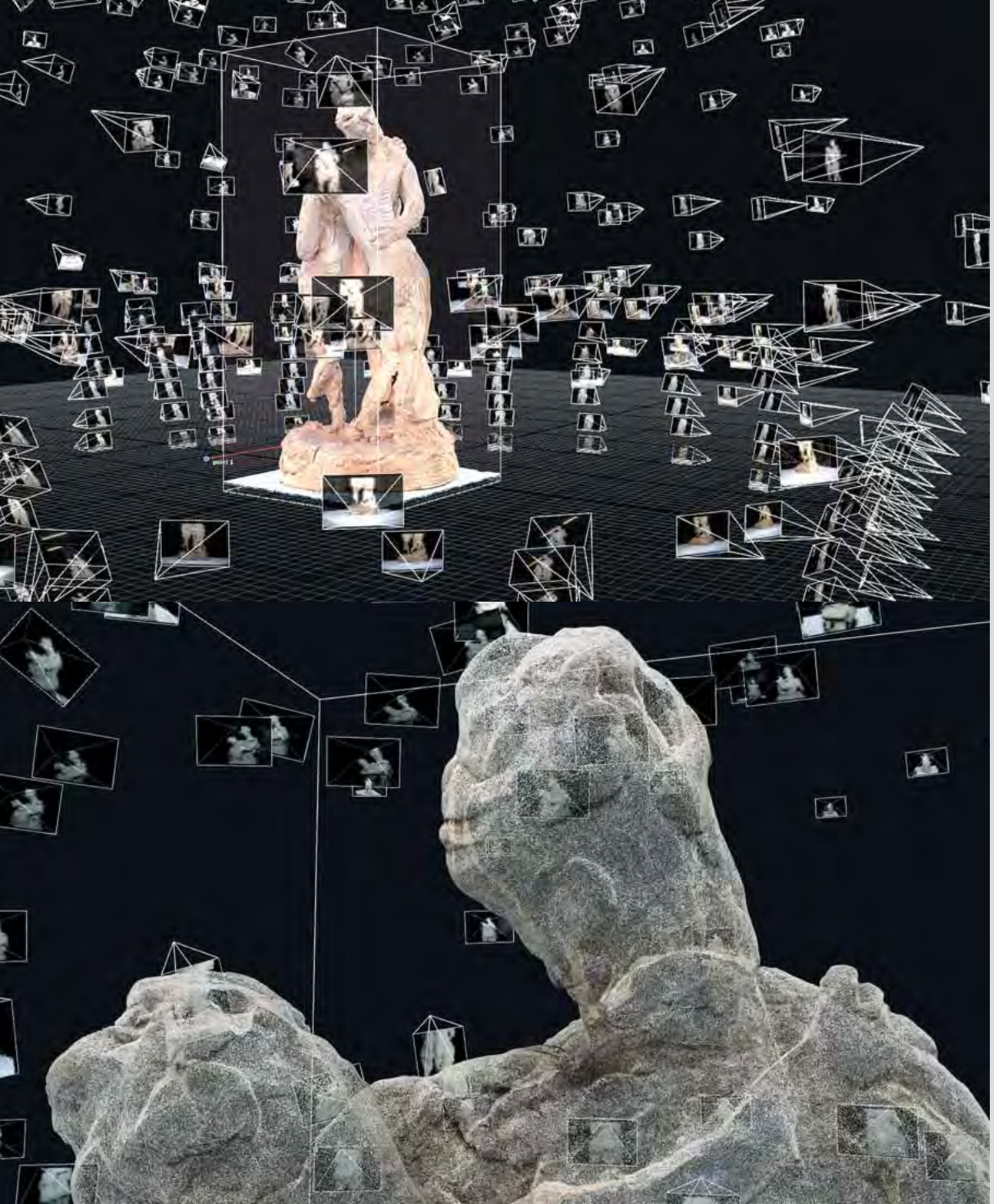
FOLLOWING PAGES

As part of a seven-part television series for Sky Arts produced by Ballandi Multimedia, Factum Arte re-created seven paintings that have been lost or destroyed in the 20th century. One of these was Graham Sutherland's 1954 portrait of Winston Churchill. Printing, overpainting in a transparent white and reprinting were part of the recreation process.

Van Gogh's *Six Sunflowers in a Vase* was painted in Arles in 1888 and destroyed in a fire during the American bombing of Ashiya in 1945. In order to recreate the artwork, a 3D scan of the *Sunflowers* in in the National Gallery in London was used to record Van Gogh's brushmarks. These were then isolated and distorted to fit the imagery of the painting that was destroyed in Japan.

Monet's *Waterlilies* (1916) was severely damaged in 1958 in a fire at the Museum of Modern Art, New York. Factum recorded the burnt canvas and created a version of the artwork with a remodelled surface following other contemporary waterlily paintings by Monet.





CHAPTER 3

NEW INFORMATION GENERATING NEW KNOWLEDGE

ATELIER CANOVA: A NEW VISION OF ANTONIO CANOVA

Chiara Casarin

Chiara Casarin has a doctorate in art history. As Director of the Musei Civici di Bassano del Grappa, she has developed a project that combines ancient collections with contemporary art and has worked on studies of the use of new technologies for the conservation and enhancement of historical and artistic heritage: *Atelier Canova* (Venice: Marsilio Editori, 2019).

Palazzo Bonaguro is one of the locations that make up the Musei Civici di Bassano del Grappa. In the storage units on the ground floor of the building, two large open crates containing plaster fragments of various sizes have been preserved for decades: many parts only a few centimetres in diameter, others much larger. Deformed by their own weight and inflated by the humidity that prevails in these rooms, the fragments are part of a masterful work of sculpture and, when correctly assembled, make up a colossal horse by Antonio Canova.

The large plaster – intact, powerful and elegant – was exhibited in a hall of the museum until 1968, when the then director, Professor Bruno Passamani, asked the Soprintendenza (cultural authorities) about the possibility of dis-assembling it.[1]

Arriving in Bassano after Canova's death, the horse formed part of the collection of works that his half-brother, Monsignor Giambattista Sartori Canova, retrieved from the Roman studio and left in his will to two neighbouring cities, Possagno and Bassano, as a way of perpetuating the undying memory of the Maestro. To Possagno went most of the plasters and paintings, to Bassano the drawings, monochromes, and two colossal equestrian statues. One of these, the model for the monument to Charles III in Piazza del Plebiscito in Naples, was completely destroyed during the bombing raid that struck the Museo Civico di Bassano del Grappa on 24 April 1945. The second, now preserved in storage in Palazzo Bonaguro, emerged unscathed from the world war but was always mistakenly considered the model for the other Neapolitan equestrian monument for Ferdinando I. We will see how, thanks to the new technologies used by Factum Foundation, it has been possible to write a new chapter in the history of Canova's creativity by identifying the existence of a third horse, never previously hypothesized, which was never cast in bronze and which, in fact, was the one dismantled by Passamani. Over the years, only the head had been recovered from those crates and, once restored, displayed again at the last exhibition dedicated to Antonio Canova in Bassano in 2003. Between the time of its dismemberment and the present day, when the dramatic fragments can still be seen, these crates have been moved several times from one location to another, from warehouse to basement within the city, without any sort of protection.

PREVIOUS PAGE

A point cloud of the photogrammetry data for Canova's terracotta maquette of the *Three Graces*, showing the locations of the photographs taken during the recording process.

OPPOSITE

A bronze model of Canova's equestrian statue after digital restoration, reproduced at a scale of 1:10.

1 One can see the long correspondence between Professor Bruno Passamani and the Superintendent in the documents fully reported in *Antonio Canova. Atelier*, ed. Chiara Casarin (Venice: Marsilio, 2019). It was possible to 'dismember' the colossal statue thanks to an internal structure made in wood and iron by Canova himself. The components of this structure, which allowed its transport from Rome to Bassano and enabled it to be rebuilt exactly as the sculptor would have wanted it, are still evident today in the cut-off areas. For some obscure reason, described in great detail in the document (ibid.) signed by the restorer who was commissioned in 2004 to assess the conservation status of the fragments, the great horse was not disassembled along these lines, but 'brutally sawn without following Canova's assembly instructions'.

The day I took up my post as Director of the Musei Civici of Bassano del Grappa coincided with a visit to the museum storage facilities and this horse, if one can believe in a certain symbolism of coincidence, soon became my primary object of study. Returning to the museum headquarters, I asked to see any existing photographs of how the colossal horse had been displayed and to have access to the archive containing all the registered requests and correspondence between the Musei di Bassano and the Soprintendenza, at that time under the direction of Professor Michelangelo Muraro.[2] It didn't take more than a few hours, as I flipped through this incredible and simultaneously fascinatingly documented story, before I made the decision to call Adam Lowe. I had met Adam in Venice in 2007 when he was unveiling to the public the extraordinary restitution of Paolo Veronese's *Nozze di Cana* (*Wedding at Cana*), in facsimile form, to the Benedictine refectory on the island of San Giorgio Maggiore. At that moment, I was in the midst of frantic research for a doctoral thesis focused entirely on the problems of authenticity in art.[3] Thus, the Factum Arte project for the Cini Foundation was extremely interesting: the famous work by Veronese, now exhibited at the Louvre in Paris in the same room as the *Mona Lisa* and admired all over the world, had been taken from Venice by Napoleon as a spoil of war after the defeat of the Serenissima and since then, despite the many promises of the French government, has never been returned. Lowe's team produced a work not only to the highest technological standards, but also demonstrating refined philological study and craftsmanship. With the most up-to-date digital instruments, he scanned the original in Paris and created a facsimile for Venice, for the refectory designed by Andrea Palladio for which it had first been painted. Paolo Veronese had collaborated with Palladio in the construction of the large painting, making it one with the architecture that housed it; Factum's intervention therefore meant that the work was, in a certain sense, finally back home in the place for which it was designed and created.

My initial goal, that first August, was to find our whether Factum Foundation would be interested in 3D scanning all the hundreds of fragments in order to hypothesize a virtual restoration of the great Canovian horse. To be able, at the very least, to visualise it as a whole: how would it look if I could reassemble the plaster? The desire to approach Factum was informed not only by the Venetian experience of a decade earlier, but also and above all by the fact that in the meantime their skills had been refined via a series of high-profile projects completed in some of the world's richest deposits of artistic culture. Not least among these was a project for the Victoria and Albert Museum of London for which they studied and made facsimiles in different materials of Antonio Canova's *Paolina Borghese*. They were, therefore, the only ones with the abilities necessary to undertake this operation. Lowe didn't hesitate and, during the same phone call, he promised me that he would come as soon as possible. A few months later, standing in front of the crates, our shared feeling was one of amazement mixed with enthusiasm, incredulity, and the desire to act immediately.

It is often the case that large projects are born from one initial element, from a single object of study, and then grow, refining themselves as they broaden their range of action. They then allow surrounding case-studies to flourish and contribute to a

2 The letter of Michelangelo Muraro, Superintendent of the Galleries and Works of Art of Venice, sent to Bruno Passamani, reads 'Dear Passamani, after so many uncertainties, the Ministry has authorised the dismantling of the Canovian horse under the agreed conditions (storage in a dry place)…' The letter dates to 25 January 1969.
3 Chiara Casarin, *L'autenticità nell'arte contemporanea* (Treviso: ZeL Edizioni, 2015).

The plaster statue in the Museo Civico di Bassano del Grappa prior to dismemberment in 1969. The statue was intended for an equestrian monument commissioned by Giuseppe Bonaparte in 1807, which remained unfinished at Canova's death in 1822.

harmonious and comprehensive project. This is how *Atelier Canova* was born – a name that with merciless concision refers to the study and application of the finest digital technologies in order to conserve and better understand the Canovian heritage of Bassano del Grappa. Starting from the necessity – which could no longer be postponed – of reconstructing, or better, virtually restoring the fragments of the colossal horse in Palazzo Bonaguro, we soon came to the conclusion that we could and should do more. Bassano houses the most important collection of Canovian drawings in the world: 99 per cent of all those in existence. These almost 2,000 drawings collected in ten large study albums, as well as eight travel notebooks rich in visual notes, were known to few people. Due to the conservation requirements of the paper, these graphic masterpieces are not often exhibited, restricted to only a few temporary loans to the multiple exhibitions on this Possagno artist who is sought after by the whole world. How, then, to narrate this rich heritage? How to offer visitors to the Museo Civico the chance to experience this extraordinary corpus? To offer the opportunity to leaf through the drawings in a way now permitted only to experts, to facilitate closer contact, to allow a closer look without the barrier of glass and a frame, to transmit the feeling of the texture of the paper chosen by Canova: these were the outcomes that we wanted to deliver to the visitors. The creation of facsimiles immediately seemed a good solution: very high-resolution scans of every single sheet, paper made specifically to have the same rendering as the original paper used, even covers which would be indistinguishable from those that held together Canova's specimens. I chose two representative albums: Album A, that of female positions, and Album B1, that of the male proportions – the priceless results of Canova's intensive studies in the academic style. In Canova's production practice, these drawings would first have become maquettes in terracotta, then plasters, and finally

marble or bronze sculptures, passing on the way through those wonderful and *modern* monochrome paintings that considerably enrich Bassano's heritage.

Until the mid-1960s, the original drawings were permanently exhibited in the Museum and were therefore accessible to the public during visits to the collections. On 16 November 1966, the Superintendent Professor Michelangelo Muraro emphasised the need to ensure the preservation of this legacy by ordering all sheets to be returned to, and guarded within, the Museum's prints and drawings cabinet 'to prevent the light from damaging the precious material'. As concerns about light mean that the drawings still cannot be viewed, it was decided to create a complete digital database in high resolution in order to ensure optimal preservation conditions. It was to this end that Oak Taylor Smith of the Factum Arte team came to Bassano and began the delicate work of recording and documenting all the drawings.

But there was another work by Canova that could be included in this study, demanding the same level of attention as the drawings, and subject to similar limitations due its fragility: the famous terracotta maquette of the *Tre Grazie* (*Three Graces*),[4] the most celebrated work of Antonio Canova, modelled by the gestures of the artist's own hands in a plastic material prior to execution in plaster and then marble. The small sculptural group, pale brown-pink in colour, about 25 cm high, which carries several of Canova's fingerprints, had been kept in a glass case for decades, only leaving the Museo Civico di Bassano for a brief exhibition held in nearby Possagno. In the case of this small sculpture, a number of elements had to be analysed in order to assess the feasibility of the project: was it possible to have a scan so accurate and detailed as to provide minute references in case of any damage or micro-cracks in need of restoration? Could I realise the dream of a model that could be touched by the blind or visually impaired? At that time I was preparing a project, now completed to the great satisfaction of interested users, for greater accessibility to the permanent collections for visitors with sensory disabilities. Otto Lowe, Adam's son and a vital Factum collaborator, arrived in Bassano with equipment equal to that of a film production company. He was not only able to build an archive of digital data of the maquette that was detailed enough for even the smallest details to be preserved, but thanks to Factum's thorough study of materials and their ability to refract light, it was possible to create a facsimile of the maquette of the highest scientific and curatorial standard, accessible to the touch of the blind and which could be lent to exhibitions.

This was the beginning of *Atelier Canova*. More than three years after my first visit to Palazzo Bonaguro, we exhibited all the results obtained so far in the Canova Hall of

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Otto Lowe recording the head using photogrammetry.

Recording elements of the horse using structured light scanning.

OPPOSITE

A model of the horse at 1:10 scale made using 3D-printed parts, used to inform the digital restoration.

4 On the sculptural group of the *Tre Grazie*, see the essay by Fernando Rigon in the cited volume *Antonio Canova. Atelier*. Regarding the maquette in terracotta, see C. D. Dickerson and Emerson Bower, ibid.

the Museo Civico di Bassano, retracing and recounting the exciting journey of a project that had initially seemed too difficult to accomplish. In fact, two stories should be told in this volume: on the one hand, that of a neoclassical sculptor who left to the whole world an inheritance which in some aspects is still little known, a heritage that has been hidden and defiled, and in many cases not sufficiently protected despite the tools we have today. On the other hand, however, this book would be the ideal opportunity to explain how difficult it still is to solve the problems of conservation and to enhance visitors' experiences through the creation of facsimiles that use the non-invasive techniques and materials required by law. Shedding new light on Antonio Canova and his creations also means updating the theoretical tools of museology and museography.

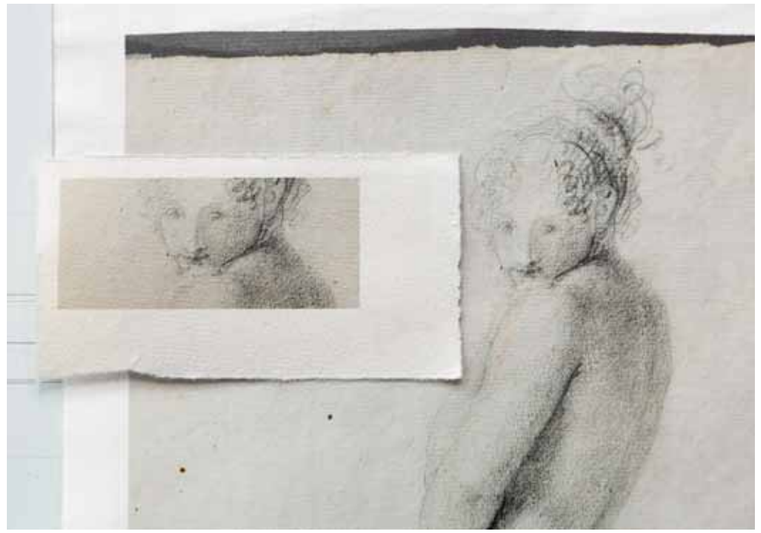
The Museo Civico di Bassano houses 60 plaster casts, including sculptures and busts, which were damaged in the bombing of April 1945. Among these casts, we find many that clearly show the so-called *repères*, the black nails placed at precise points on the sculptures, indispensable for reproducing the work.[5] The manual modelling of the plaster allowed for the formation of physiognomies and accurate details that were then enhanced by chiselling the marble in the most accurate way possible. Several, if not many, examples of each work could be produced. Another fact of particular relevance – the

5 See the essay by Adam Lowe in *Antonio Canova. Atelier*.

reasons for which will shortly become clear – is the consideration that Canova, when commissioned to create a monument in bronze, would deal with all parts of the design, from the drawing through the terracotta maquette and up to the assembly phase of the large plaster casts for equestrian monuments. Certainly, Canova did not directly deal with the casting – he declared as much in some of his letters – because the bronze did not allow him to give the famous 'finishing touch' that made his marbles so velvety, the recognizable sign of the artist.

The main theme of this delicate part of our work is therefore the question of authenticity. Can a museum exhibit work not directly by the artist? Can a director endorse the possibility of exhibiting facsimiles? Can heritage conservation use the information preserved by replicas as a basis for decisions about restoration work? The school of thought is not univocal, and during the development of the *Atelier Canova* project there was frequent discussion on these topics. In the case of this particular project at Bassano del Grappa, one requirement of the Code of Cultural Heritage seemed particularly relevant: the Code holds public appreciation and understanding to be of equal importance to conservation. It considers and inaccessible collection as detrimental to our shared knowledge.

The creation of the two facsimiles of Antonio Canova's drawing albums has made it possible to exhibit them in the Canova Salon, inside elegant display cases that preserve their beauty and functionality. Alongside them is a label reading 'Album of Antonio Canova's drawings. Atelier Canova. Facsimile created by Factum Arte for the Musei Civici di Bassano del Grappa, 2018'. Close to this, on a base that seems to have been created specifically to receive it, is the facsimile of the terracotta maquette of the *Tre Grazie*. Lacking the glass case of the original, a work of formidable perfection and identical working just a few metres away, the maquette invites tactile encounters on the part of visitors.



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Test for the facsimile of Canova's Album A, a sketchbook of female poses.

OPPOSITE

Technical display of a pointing machine, used by Canova and his workshop to create accurate copies of statues, at the Museo e Gypsotheca Antonio Canova at Possagno.

And what of the colossal plaster horse? Today, a screen in the Canova Salon shows a film with strong emotional impact, describing all of the phases of the horse's virtual restoration. Next to the large plaster head is a small bronze horse, a 1:10 scale reproduction, showing us how the sculpture would look if it were reassembled today.

Before I arrived in Bassano, there had been important studies conducted on the feasibility of a physical restoration of the impressive plaster. But due to the conditions in which it had been preserved, in rooms that were not climatically controlled and in crates that did not allow for the correct preservation of the fragments, it would have been impossible to carry out an intervention that was not extremely long, expensive and, no less important, arbitrary. We firmly believe that Antonio Canova did not model the plaster casts for their own sake, but that these were simply models for the realization of a final sculpture that, in this case, would have been cast in bronze by a master founder. It seems a fascinating and natural consequence of the work done so far to create a monument of this horse dedicated to Antonio Canova, to be placed at a central point of the city of Bassano del Grappa as a tribute to the collections housed at the Musei Civici and in memory of the donation that his half-brother Giambattista Sartori Canova made in 1858 to the city. Almost two hundred years after the sculptor's death and exactly two hundred years from the creation of the horse in plaster (and fifty years after its destruction in 1969), this celebration stands out as a moment of great openness to the world of Canova's background, creating an opportunity for new awareness about the necessity to update the methodologies of interpreting and enjoying our cultural heritage via state-of-the-art technologies.

RESTORING THE CORPUS OF ARCHIE CRESWELL

William Owen

William Owen is a founder and partner at Made by Many, a company of designers, engineers and inventors making their way through the outer reaches of digital commerce and culture.

In 1958 Archie Creswell wrote to the art connoisseur and collector Bernard Berenson that 'Following my principle – the only sound one – of always going back to original sources, I had photographs made of about 14 pp of the MS of Ibn Asakir preserved at Damascus which no orientalist, even those living on the spot, had thought of doing, and the result was a pricked bubble'.[1]

And so he settled a decades-old debate about the origins of the Umayyad Great Mosque in Damascus: it was an original Islamic building, not a conversion of an earlier Byzantine church.

Creswell's first principle is a good one, but sometimes hard to follow when the original source is packed away, undigitised or uncatalogued, in a library stack or museum vault. Our understanding of great works becomes immeasurably greater when they – and their records and representations – are connected with the objects, ideas and individuals with which they are associated; and yet we spend much more time, money and effort on recording the individual artefact than we do on works about those artefacts or the many components that form a complete study or body of work. This might be because until quite recently, the cost has been too great for items considered awkwardly numerous and relatively prosaic.

Our opportunity now is to appreciate the potential of the digital archive to remove the kind of physical constraints that Creswell overcame through his despatch to Damascus for copies of the Hadiths of Ibn Asakir; it's a way of bringing together any variant of a work or group of works, across both time and space, no matter what their original physical form.

The benefits of reconnecting fragmented works through digitisation have become evident in practice. Factum Arte has made successful demonstrations by recording and remaking the scattered parts of the tomb of Seti I and by reuniting as facsimiles the 16 paintings that once formed the *Polittico Griffoni* in Bologna; at the Cini Foundation, meanwhile, it transformed millions of photographs of the art of the Veneto into a digital archive. Made by Many has redirected the lessons it learned in making the world's largest digital archive of advertising to one of the great photographic collections, creating prototypes that experiment with ways in which a collection can be organised according to themes, narratives and personalities.[2] These are early steps towards the high ambition of digitising the entire output of an individual mind or collective cultural impulse.

OPPOSITE, CLOCKWISE FROM TOP LEFT

Pendentives of dome of the mosque of al-Mahmudiyya, Cairo.

Dome of the mausoleum of Mamluk Amir Qawsun.

Pendentive of dome in the mausoleum of al-Sawabi, Cairo.

Minaret of the mosque of Ahmad Ibn Tulun, Cairo.

1 Archie Creswell, letter to Bernard Berenson, 31 January 1958. Berenson Archive, Villa I Tatti, Harvard Library.

2 Made by Many worked with the V&A through 2015–17 to redefine its digital strategy and build a new digital platform. In the course of that work we created a number of prototypes that demonstrated ways in which the photographic collection (recently enlarged by the acquisition of the Royal Photographic Society collection) could be made accessible online.

By reuniting the corpus and its many components, digital representation and distribution enables scholars to drive new paths through it and see the individual pieces in the context of the whole, often for the first time. The result is inevitably illuminating, producing new ways of seeing and making new connections.

Creswell own life's work is a good case in point.

Over 61 years from 1912 to 1973, Archie Creswell created a body of work that was instrumental in establishing Islamic Studies as an academic discipline. Using his own detailed survey drawings and introducing the art of photography to the making of archeological records, Creswell measured and analysed hundreds of significant examples of Early, Medieval and Ottoman Islamic sites in Syria, Iraq, Turkey, Tunisia, Palestine, Lebanon, Jordan and, most extensively, in Egypt. His conclusions were informed by studying the writings of Arab antiquarians and sometimes scoffing the thinly evidenced theories of his European contemporaries. The result was a panoptic history of Islamic architecture and comprehensive bibliography of Islamic arts, crafts, sciences and architecture.

Creswell's work now lies in fragments, some large, others small, mostly hidden; it is spread across half a dozen of the world's leading museums and libraries in a state of mean, partial or restricted accessibility. The component parts are three major works of scholarship, numerous essays, innumerable bibliographies, thousands of topographical photographs, precise survey notes, sketches and drawings, precis and workplans, correspondence with institutions and patrons, and an immense collection of rare books.

These scattered pieces are now destined to be reconnected, returned to their proper order and laid alongside each other, not simply so that we can read both sides of Creswell's correspondence at the same time and in the same place – which would be a bonus – but to appreciate the extensive and intricate knowledge embodied within the sum of the work.

Creswell's legacy is not well known beyond a circle of historians of Islamic architecture and of photography, primarily in his adopted home of Egypt, where he taught for six decades, but also in Europe and the United States. If it were not for the three archival digital records of his photographic prints at the Victoria and Albert Museum, Harvard Library and Ashmolean Museum, his legacy would be virtually obliterated.[3] Even now, although each of these institutions has digitised the photographic records, these are available to the public at inadequate resolution; the Ashmolean Museum has withdrawn public access. Until very recently, none of the letters, documents or drawings were digitised and many were not even catalogued. This may soon be changing in a programme of work that aims to create a public digital record of Creswell's entire output.

The most important component of the work, Creswell's books – sumptuous, rare and expensive – are all out of print. His masterwork, the elephant folio two-volume *Early Muslim Architecture*, sponsored by King Fu'ad and published by Oxford University Press in 1932 and 1940, was revised for a 1969 edition and last reprinted in New York in 1979; the two-volume *The Muslim Architecture of Egypt* published by OUP in 1952–59 was an edition limited to just 550 copies gorgeously printed in 13 colours,

3 The largest collection of Creswell's prints is at the American University of Cairo; it was until very recently undigitised with only a small part available online.

Portrait of K. A. C. Creswell.

an example of which is advertised for sale at time of writing for just under £16,000; *The Mosques of Egypt* (1946, with several reprints, the last in 1992), written with Al-Bakouri and Ahmad Hassan, is available for between £2,000 and £5,000 from good antiquarian booksellers; the relatively compact Pelican edition of *A Short Account of Early Muslim Architecture* is easier and cheaper to come by, especially the Beirut edition; *A Bibliography of the Architecture, Arts and Crafts of Islam* (begun in 1912, completed in 1960, and published by AUC in 1961) has been digitised in two different editions by Google Books but neither has been distributed as an eBook. The assiduous cataloguer of Creswell's life's work will find a further 60 academic essays and articles in vintage periodicals and academic journals. The last immensely valuable piece, Creswell's vast personal library of rare books on Islamic arts, remains intact in his former study at the American University of Cairo.

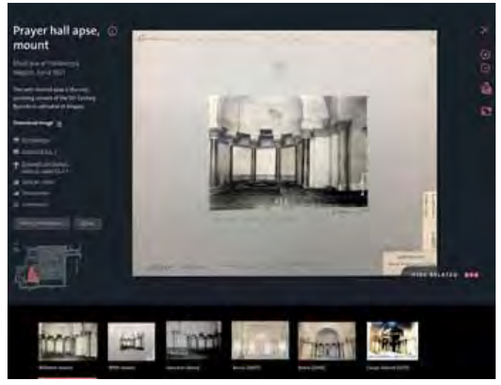
I first stumbled across K. A. C. Creswell in 2015 when my company, Made by Many, was advising the V&A on its digital strategy. While examining the photography collection in the digital archive, I found a photograph of a colonnaded apse in Byzantine style that I recognised from a visit to Aleppo in 2004. The caption – 'A view of Syria' and 'Interior looking south' – was uninformative and the photographer, Creswell, unfamiliar. A quick Google search turned up an identical image in the Harvard Library collection; this was an inferior reproduction at low resolution and seemingly inverted from the negative but, unlike the V&A example, was correctly identified as the madrassa al-Halawiyya. There I found two more interior and two exterior photographs of the madrassa, also by Creswell. Looking further in both the Harvard Library and V&A there were hundreds of his views of sites in Aleppo taken between 1916 and 1919. In 2015, at the height of the civil war and with the city undergoing widespread devastation, one could see immediately the value of the archive as a record for future restoration or reconstruction.

At the V&A, it turned out that there were others interested in Creswell and his work. Erika Lederman, a photography curator, was researching the correspondence and transactions that described Creswell's relationship with the V&A. In the 1920s, during visits to London he had given talks on Islamic architecture that had packed out the museum's lecture theatre. Omniya Abdel Barr, an Islamic scholar, was using Creswell's photographs to identify ornament and fixtures looted from Mamluk sites in Cairo after the 2011 uprising.

The story unfolded. There were, it transpired, 3,374 of Creswell's photographic prints in the V&A, all digitised, but imperfectly. Most of the images online were low-resolution versions of high-resolution masters. The mounts were only partially recorded and the descriptions they contained were absent from the digital catalogue. That single digital record of the apse in the madrassa embodied both the value of the collection and the constraints imposed by its incomplete recording and accessibility: when we obtained a high-resolution image of the apse and enhanced it, an apparently black tablet above a shrine was revealed to have an inscription – the only asymmetric subject on the image – that confirmed it was the V&A print that was inverted, probably by Creswell who did all of his own darkroom work; the caption, 'Interior looking

south', should have read 'west'; the name of the site was recorded on the mount and missing from the catalogue; one of the six known images of the site was missing, a print of the fabulous wooden mihrab in the madrassa; this was later rediscovered in a file inside a cabinet, still undigitised, now catalogued.

Abdel Barr made an audit of the complete known Creswell photographic archives; it turned out that the V&A holdings were a part of a corpus of some 12,000 images scattered across at least six institutions in three continents. The American University in Cairo has the largest portion, 7,850 prints and some negatives; others are at the Harvard Fine Arts Library in Cambridge, Massachusetts, the Berenson Archive at Villa I Tatti in Florence and (a smaller collection of prints) at the Met in New York and in private collections in Cairo. Creswell willed his 8,000 or so large glass and plastic negatives to the Ashmolean Museum, and in 1974, one year after his death, they were transported from Cairo to Oxford on a Royal Navy destroyer via Port Said and Portsmouth. The Berenson Archive has Creswell's letters to Bernard and Mary Berenson, who supported Creswell financially over many years, while the Ashmolean has Berenson's replies to Creswell as well as an extensive collection of other correspondence, survey notes and sketches. This is soon to be transferred to an institution within the University of Oxford that might be better suited to keeping it: the Bodleian Library. The urgent question now began to arise: 'What if these could all be brought together as a single archive of Creswell's work, including the content of the great books?'



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The apse at the madrassa al-Halawiyya as shown in the prototype for a digitised archive.

OPPOSITE

The apse at the madrassa al-Halawiyya photographed by Creswell, c. 1919.

This question begs others, of course: Who was Archie Creswell and what is the sum of his achievement? Giving him his full title, Sir Keppel Archibald Cameron Creswell, he was an anachronism, a Victorian living in the 20th century. He was a formidable and self-taught surveyor, historian and photographer; 'an eccentric and delightful personality'[4] who 'could not abide any form of cruelty'; a perfectionist and a dandy, vain and apparently insecure; an occultist, imperialist, anti-semite and noisy racist;[5] he was funded in part by wealthy Americans, and the cost of producing his books was affrayed by the patronage of two Kings of Egypt, where he lived and taught for most of his working life. A Briton, he remained in Cairo through the Suez crisis but lost his living at King Fa'ud University only to find another for himself and his library at the American University in Cairo. Sometimes feted and lately knighted by his own country, he is today largely unknown there, but in death he was able to command the resources of the British Navy to safeguard his archive. (This last act may have been at the behest of Robert Hamilton, Keeper of the Ashmolean Museum from 1962–72).

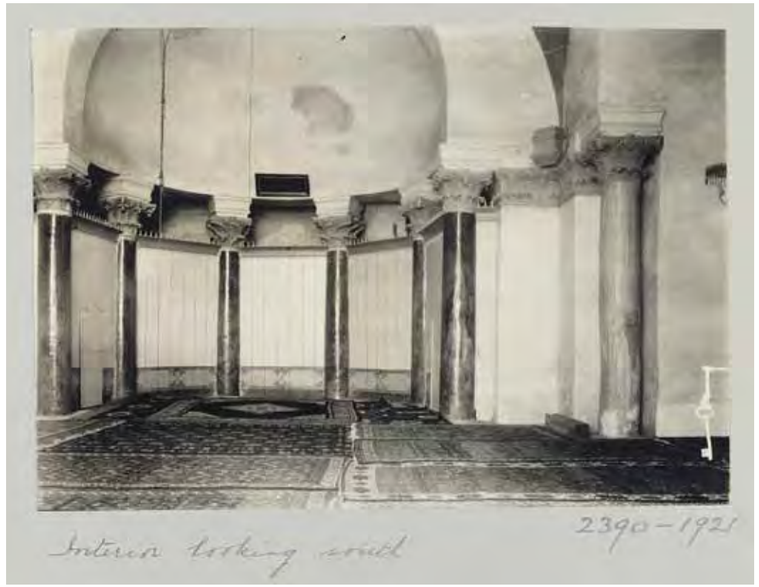
There is a friendly but revealingly frank memoir of Creswell by Hamilton, published by the British Academy after Creswell's death in 1974.[6] It tells us, in summary, that

4 Margaret S. Drower, *Flinders Petrie: A Life in Archaeology*, 2nd ed. (Madison: University of Wisconsin Press, 1995 [1985]), 348.
5 R. W. Hamilton, 'Keppel Archibald Cameron Creswell', https://www.thebritishacademy.ac.uk/sites/default/files/60p459.pdf, accessed 4 January 2020.
6 Ibid.

Archie was born in London in 1879 and educated at Westminster School, where he excelled at mathematics and physical fitness. He trained as an electrical engineer, working for Siemens, and developed an interest in photography (note his background in technical sciences rather than the humanities). He was a member of Golden Dawn, the occult masonic sect that included W. B. Yeats, Maud Gonne, Aleister Crowley and others, where Creswell nurtured an enthusiasm for the Qaballah and ancient Egyptian mysticism. In an unsuccessful application to join the Archaeological Survey of India in 1914, he expressed his appreciation for Muhammedan – but explicitly not Hindu – architecture. On the outbreak of war he joined the Royal Flying Corps and in 1916 was posted to Palestine; three years later he was made General Allenby's inspector of monuments in the occupied territories. Stationed in Aleppo initially, this set him on a lifelong career of surveying, recording and analysing buildings out of which evolved his detailed explanations of the origin, chronology and form of Islamic architecture.

Creswell was not an *a priori* speculator. Everything he did was grounded in fact and the facts were often represented in numbers. 'Archaeology was for him an empirical discipline directed strictly to measurable facts.'[7] The words methodical and meticulous are often applied to his work, with the criticism that his ideas were too rigidly fixed in chronology and in the form of architecture rather than its place in peoples' lives: humans are present in his photographs for the purposes of providing scale, not character. The letter from Creswell to Bernard Berenson in 1958 concerning the origins of the Great Umayyad Mosque in Damascus says more about both his method and motivation; it records his victory in a dispute with Réné Dussard, Watzinger and

7 Ibid.



OPPOSITE

Prototype of homepage for the Creswell digital archive created for the V&A in 2017.

Prototype page for Creswell digital archive created for the V&A in 2017.

Wulzinger, Lammans, Herzfeld, Marcais and Strzygowski, all of whom had proposed or repeated the 'impossible theory' that the present mosque is merely the church of St John the Baptist 'converted'.[8]

Creswell discovered that eight out of nine of the varying versions of Ibn Asakir's original manuscript stated that the church remained a church, *until al-Walid pulled it down*, with one varying version, according to which the church was converted:

> By a curious fatality, Ibn [Sharkir, who based his history of Damascus on Ibn Asakir's hadith] has incorporated this divergent version only, and Quatremère's translation has given it 120 years of publicity.
> *You will find all this in detail in my fourth chapter, and many other things, for example architecture… and argument to show that a church like the sanctuary of the Great Mosque can never have existed.*[9]

This is Creswell as both 'a perfect model of scholarly devotion, research, persistence and acumen',[10] and also an impish, proud and gleeful intellectual jouster. In the fourth chapter of *Early Muslim Architecture* he devotes 4 out of 13 pages on the Great Mosque to this particular theme, recording his researches, debunking his more elegant, aesthetically inclined and less scientific (or *scientist*) academic opponents and applying his 'elegant decisive draughtsmanship and calligraphy' to personally surveyed plans and elevations and his technically precise and carefully composed – factual – photographs.

And so while there might be an excess of emphasis on the origins of the building, there is also a complete and accurate record of its form in different media, some of which is present in the books, most of which remains in museum storage.

Oleg Grabar, who edited an entire edition issue of the journal *Muqarnas*[11] devoted to Creswell and his work, is very precise about the limitations and strengths that make this a sound foundation of scholarship – to be built on – and therefore (if we project his views forward thirty years) a grounding that should be made available in each of its many parts online: photographs, written descriptions, drawings, diagrams, sources, correspondence, etc.

> It is essentially a collection of monographs on individual monuments, it is not a history of early Islamic architecture … it avoids hypotheses and prefers the practical concrete statement to the theory and to the interpretation …
> The book is a superb dictionary of forms and of monuments.
> …
> Creswell shares with the Dictionnaire Larousse two unusual features… that it is indispensable for so much more than the definition of words and that it needs constant revision … Creswell did not lie or fudge willingly and rarely interpreted wittingly. He may not have said everything there was to be said, but it is always

8 The author can attest that in the 21st century this story is still repeated by guides to the Great Mosque.
9 Creswell to Berenson, 31 January 1958.
10 Donald N. Wilber, review of 'The Muslim Architecture of Egypt, I. Ikhshıds and Faṭimids, A.D. 939–1171' by K. A. C. Creswell, *The Art Bulletin*, vol. 36, no. 4 (December 1954).
11 Oleg Grabar (ed.), 'K. A. C. Creswell and His Legacy', *Muqarnas, an Annual on Islamic Art and Architecture*, vol. 8 (Leiden: E J Brill, 1991).

> possible to add new information, new facts, even new interpretations, provided they are documented in the same careful and footnoted manner.[12]

Grabar continues:

> In short, Creswell's books are always perfectible, they are never finished. The heavy green bindings are not protectors of an absolute and definitive truth, but holders of a constantly evolving knowledge. Just as he annotated the books of others, so are we allowed to annotate his, to add bibliographies at the end of his long lists, to modify dimensions or change plans as new or alternative information arises.

Today, the collective development of this knowledge is tied to the timescales and vicissitudes of conventional academic discourse – the book, the journal and the conference – as well as being hidebound by inadequate access to the original work. This is why a digital archive of Creswell's complete works is such an attractive proposition. Those who are able to study them will no longer be islands of individual thought – they will be able to connect to each other and share their own additions or revisions. Not only is the complete work absent today from public view, but so are the connections that could be made between Creswell's foundation and contemporary Islamic studies. Each of its parts can be brought together without being subject to the rationing necessitated by print. Creswell's entire photographic sets on each site can be made available (there are over two dozen of the Great Mosque; he spent 49 days photographing the mosque at Al Azhar, Cairo, of which only a fraction of the dozens of images made appear in the printed edition).

Independently of Grabar's position, a team loosely centred around the V&A, AUC and Made by Many and including representatives of the Berenson Library and Ashmolean came to the same conclusion that *the site or monument* is the unifying element, the basic atomic matter and organising principle of all of Creswell's work. Made by Many created a design prototype that tested this assumption alongside a secondary classification according to chronology, typology, material form and location (as in Ayyubid / madrassa / dome / Aleppo). The prototype explored how each of the different representations of the site in text or image – wherever they may be held and accessed, via APIs or locally – could be brought together as a coherent body and related to relevant thematic commentaries or analysis.

Alongside proving the concept, a grant from the Barakat Trust has enabled Omniya Abdel Barr to pursue the digitisation of the keystone photographic archive across each of the five main holding institutions. All of the 2,810 prints at the Berenson Archive were digitised at high resolution in 2019; in 2020, the letters and other documents will follow. Digitisation and indexing of the 7,850 prints and negatives at the American University in Cairo is well under way under the direction of photography curator Ola Seif, and should be completed in 2020.

The gap between digitising the images and making them accessible to the public is a wide one. The value of a public digital Creswell archive can be released in three ways: first, by making the entire record of photographic images available; second, by connecting the photographic site records to available texts, plans and survey drawings, notes, correspondence, etc.; third, by enabling a layer of public annotation, commentary or revision to the record index or Creswell's original texts.

The challenges now facing the team working on the archive are not really technical but ones of organisation, fundraising, design and diplomacy – keeping five institutions in four countries aligned – and in particular, obtaining the release of any residual rights. The immediate priority is to make the complete collection of photographic images available to the public at the highest available resolution through a common server or API[13] protocols, viewable and annotated using iiiF open source standards,[14] and to implement a proposal for a common standard for indexing – a substantial task – alongside translation from English to Arabic and the enabling of annotation of images or public commentaries.

Discussions are to commence with Oxford University Press to secure access to copyrighted material. Further conversations will be needed following the transfer of the main archive of documents from the Ashmolean to the Bodleian Library. When funds become available, we can start work on implementing common storage and indexing and on the design of the public archive. This is an enticing challenge.

The huge presence of the books as artistic objects in their own right raises interesting questions about the design of a digital archive. Their literal size and heft was a measure of the huge physical and intellectual effort that had gone into their production. Creswell demanded and got the highest standards of printing and design. However, we are not producing facsimiles of gorgeous books, but bringing together a body of knowledge. The opportunity we have to solve is to aspire to the same virtues of craft and careful measure in new ways, to represent adequately the beauty of the subject matter and to enable the making of the most rewarding pathways through it.

12 Oleg Grabar in *International Journal of Middle East Studies*, vol. 3, no. 2 (April 1972), in ref. *Early Muslim Architecture*, 2nd edition 1969.

13 Application Programming Interface.
14 International Image Interoperability Framework.

THE RAPHAEL CARTOONS AT THE V&A: CLOSE-RANGE DIGITISATION AT A MONUMENTAL SCALE

Carlos Bayod Lucini

Carlos Bayod Lucini is an architect and Project Director at Factum Foundation, where he is responsible for the digitisation of paintings and oversaw the recording of the *Polittico Griffoni* (2012–15). He is Adjunct Professor of Historic Preservation at Columbia University and is a PhD candidate at Madrid's Universidad Autónoma, where he is writing a thesis on the relief of paintings.

In August 2019, a team of 3D-scanning and photography specialists from Factum Foundation carried out the recording of the Raphael Cartoons at the Victoria and Albert Museum in London, probably the most important series of artworks from the Italian Renaissance in the UK, which have been loaned to the Museum by Her Majesty the Queen from the Royal Collection. This project was one of Factum Foundation's most ambitious digitisation projects undertaken to date, more logistically complex even than the recording at the Prado in 2019 of the entire series of Goya's Black Paintings, and has broached new frontiers in the large-scale, high-resolution digital documentation of low-relief surfaces.

The project employed non-contact digital technology to capture detailed information for the surfaces of the seven monumental Cartoons, and provided the original and processed data to the V&A for study and dissemination. In the first phase of the project, a total area of about 115 square metres was digitised using two complementary methods: four Lucida 3D Scanners were employed simultaneously to record the relief of the Cartoons at a resolution of 100 microns (generating render images at 254 dpi at 1:1 scale), and panoramic photography was employed to obtain accurate colour and infra-red information (with a capture resolution of 400–450 dpi at 1:1 scale). The Lucida 3D Scanners were fixed and secured to scaffolding towers, reaching a maximum scanning height of about 5.5 m and with the laser head positioned at a constant scanning distance of 10 cm from the surface of the artworks. Scanner stability was essential to guarantee the highest level of safety and optimal data quality.

In order to complete the recordings, a team of specialists from Factum Foundation worked around the clock in three shifts for a period of five weeks, during which time the gallery was closed to the public. By following a carefully planned schedule it was possible to coordinate the recording of the Cartoons with the removal and replacement of the vast frames, production of conservation condition reports and other tasks carried out by the Museum's staff. Fluent communication and coordination between the different teams was key to the success of this first phase of the project.

The second phase, underway at the time of writing, consists of processing the digital information captured on site in order to prepare data sets in a format compatible with different applications. In order to do this, the raw files have to be edited and stitched together to compose full panoramas. Since the 3D data recorded by the Lucida system is generated as greyscale depth-map and shaded images, it is possible to employ panoramic composite software like PTGui to align the tiles; a similar semi-automatic process is followed with the photography and infra-red images. As a result of these stitching operations, three panoramas are generated for each Cartoon: a 3D render panorama (which is used as a base), a colour panorama and an infra-red panorama, each with a final resolution of 300 dpi at 1:1 scale.

OPPOSITE

The Cartoons were recorded using panoramic photography, infra-red recording, and the Lucida 3D Scanner, 2019. © Her Majesty Queen Elizabeth II.

THIS PAGE

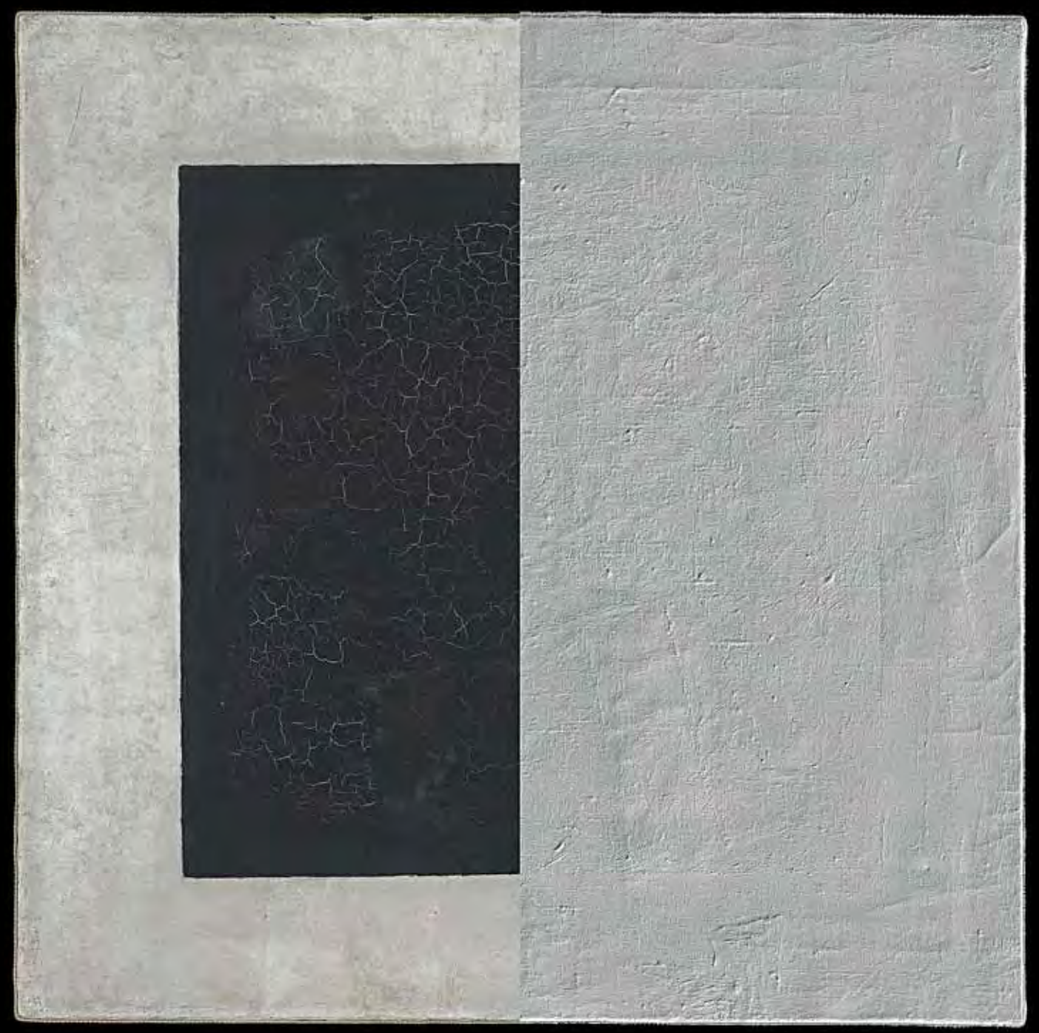
Making a facsimile of Raphael's *Sacrifice at Lystra*, a tapestry cartoon recorded by Factum at the Victoria and Albert Museum, London, 2020. The Cartoons have been loaned from the Royal Collection by Her Majesty Queen Elizabeth II.

OPPOSITE

Putting the finishing touches to the re-creation of Raphael's *Christ Falls on the Route to Calvary* ('Lo Spasimo', c. 1517), 2019.

Viewing files like these presents its own problems. Simply to open one file of 40GB (the size of one of these panoramas) will freeze an ordinary computer for some time, and to compare three different datasets is even more memory-intensive. But such multi-layered navigation is key to understanding the surface of complex artworks like the Cartoons. Thanks to the multi-layered browser, an application that has been developed and perfected by the Factum Foundation in the last years, paintings and other low-relief artifacts can now be studied and shared as the complex subjects that they are, in ways that render their historic trajectories evident and traceable. This ability to focus on a specific detail and to turn the different layers (relief, colour and infra-red information) off and on in an intuitive way constitutes a radical new way of approaching the study of pictorial art.

The vast amount of data from the recording of the Raphael Cartoons gives rise to practical questions that go beyond the complexity of the scanning itself. How can a recording project of this scale transform the way the data is processed, stored, disseminated and displayed? To what extent can modern technology bring to life previously unknown capabilities and qualities of an object? While the monitoring and safeguarding of a work of art through new technologies and high-resolution recording methods involves decisions that can only be made by the owner of the object, an organisation like Factum Foundation can contribute to this process by developing innovative, repeatable processes to ensure imaginative, consistent and secure digitization. Factum software engineers are continually working to improve the automated processing of data: to speed up processes, improve alignment, and understand and exploit the elasticity of the cloud in which the data is stored and through which it is processed. The recording, processing and outputting of data from the Raphael Cartoons project has proved an important spur to the development of such processes, opening the field for new reflection on the role of AI in the preservation of cultural heritage.



MALEVICH'S *BLACK SQUARE*

Eva Rosenthal

This significant project was strongly supported by the governance of the State Tretyakov Gallery and realized thanks to the many efforts of their departments and staff. The research component was provided by the Advanced Research Department of the State Tretyakov Gallery, particularly Yulia Dyakonova, Irina Kasatkina, Andrey Mareev, Nikolay Mitrakov, Kirill Shumikhin and Yulian Khalturin as Head of the Department.

Eva Rosenthal has been leading Factum Foundation's digitisation and training programmes in Russia since 2015, including the recording of tombstones at Kala-Koreysh (Dagestan) and the photography of the Ferapontov Monastery (Vologda district).

OPPOSITE

Render showing the 3D relief (right) and colour registered onto 3D relief (left) for Malevich's *Black Square* (1915).

Look closely at the surface of Kazimir Malevich's original *Black Square* from 1915 and you will see that the black paint is crisscrossed by a network of fine cracks that reveal the bright colours of earlier compositions below. *Black Square*'s extraordinary texture is evidence of the urgency with which Malevich created this 'first' Suprematist work – the white paint did not even have time to dry before the black was applied. Cracks started forming soon after the painting was finished, to such a degree that the artist painted another version of *Black Square* in 1929.

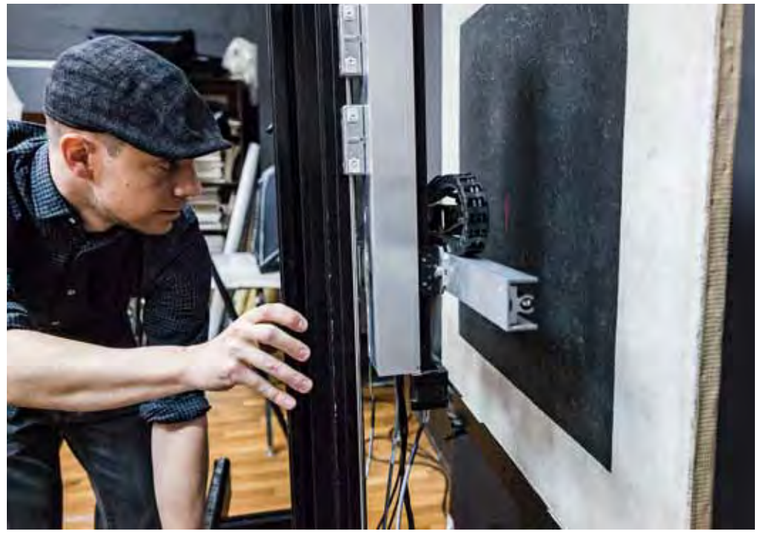
The *Black Square*'s surface can be appreciated in an intriguingly different way when its colour is 'removed'. This is what Factum Foundation did in 2018 as part of an innovative research project with the State Tretyakov Gallery (Moscow). With enthusiasm from both sides and an unusual approach to 3D scanning, the initiative was an excellent example of international cooperation in the arts. A Factum team used a high-resolution laser scanner – the custom-built Lucida 3D Scanner – to isolate the 3D texture of *Black Square* (1915). The render of the 3D data uncovered cracks and brushstrokes alike in minute detail, enriching our understanding of the creation and history of this iconic work. As part of the recording, the team also captured a high-resolution colour image that was later precisely registered or 'mapped' onto the 3D to create a 'digital facsimile' of the painting.

When studying a painting like the *Black Square*, however, one must look beyond the surface. In 2015, X-ray images taken by the Advanced Research Department at the Tretyakov Gallery revealed a series of abstract shapes below the black square that were interpreted as belonging to at least two different compositions. With improved technology in 2018, the Tretyakov Gallery was able to produce higher-resolution X-ray and infrared data, which was mapped onto the 'digital facsimile' to create a 'multi-layered archive' – a multi-dimensional record that stores extant information on a work of art in one place, making it easier to access data from different time periods and of different types.

The Tretyakov Gallery / Factum project went one step further. If the digital images – colour, 3D, infrared and X-ray – are loaded into one of Factum's custom data viewers, the layers of information can be seen in relation to one another rather than in isolation. For instance, it's now possible to study Factum's colour data showing the vivid blues, yellows, greens and reds visible through the cracks simultaneously with the X-ray image revealing the works underneath. Beyond its usefulness for monitoring the painting's condition, the multi-layered 'digital facsimile' has become an important tool for specialists at the Tretyakov Gallery working to decipher the hidden compositions.

It was only in the 1970s that art historical research unequivocally demonstrated that the 'original' *Black Square* was painted in 1915, rather than in 1913 as the artist wanted the world to believe. More than forty years later, Malevich's avant-garde masterpiece

continues to challenge preconceptions about its genesis, history and meaning within the artist's oeuvre. The experimental approach facilitated by the 'digital facsimile' and data viewer is allowing researchers at the Tretyakov Gallery to compare and juxtapose the painting's multiple layers – a novel way of looking at the *Black Square* that may in time kindle new answers to the complex questions it still poses.



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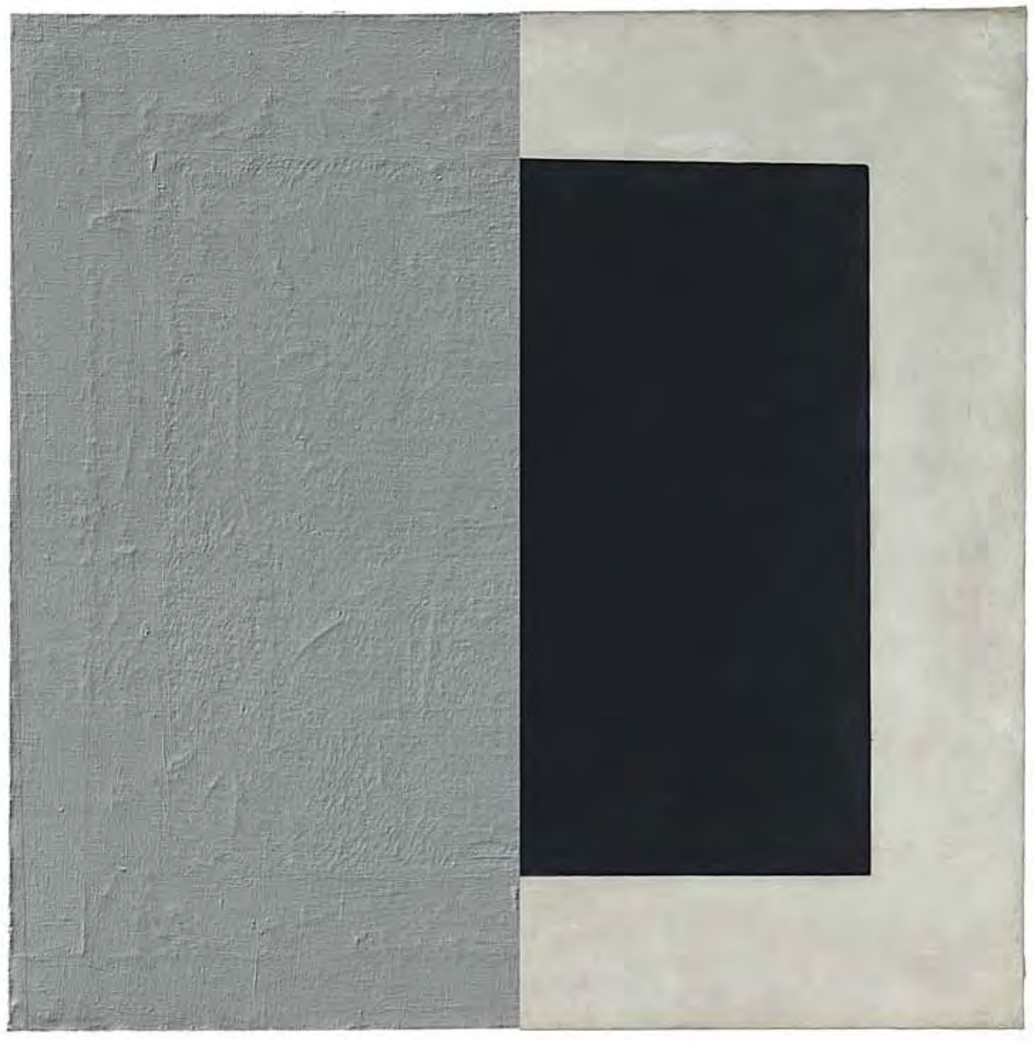
Eva Rosenthal recording the relief surface of *Black Square* in the State Tretyakov Gallery, Moscow, 2018. © State Tretyakov Gallery.

Carlos Bayod Lucini recording with the Lucida 3D Scanner. © State Tretyakov Gallery.

OPPOSITE

3D and colour data for *Black Square* (1915).



OPPOSITE

Photography students from ISIA, Urbino, use photogrammetry to record busts and statues in the Palazzo Grimani, Venice, 2019.

Re-SEARCH

Clare Foster

Clare L. E. Foster is a British Academy Post-Doctoral Fellow at CRASSH looking at the Western concept of the 'original'. An affiliated lecturer in the Faculty of History at Cambridge, she has taught theatre, film and classical reception studies at Harvard, UCLA, UCL, Birkbeck and Cambridge. From 1994–2009 she was a full-time screenwriter based in Los Angeles. She currently runs the 'Re-Network', an interdisciplinary research network investigating how and why cultures repeat, reframe, restage, remember, etc. and why this is a topical question in a digital era.

Anyone who visits Factum's workshops in Madrid can feel the excitement that underpins the work that is going on. But this activity has yet to be systematically researched: that is, described, studied, transmitted to others, and given theoretical foundation. This matters because the recording and rematerialising software and hardware that Factum Arte has bespoke-designed arguably represents a revolutionary change in the context in which all artworks now exist. The ability to capture an exact material state in the form of digital data, and to re-produce it exactly, again and again, opens new channels of access and ownership. Use-values multiply; potential future applications expand. Stakeholders are re-empowered to engage once more with works that have been lost, damaged, sold, or removed. Most obviously, this technology promises to transform the fields of preservation and conservation. Institutions like Britain's National Gallery and the British Museum are now beginning to record their works using Factum's scanners, whether as a guard against future damage, prior to irreversible processes of 'restoration', or simply so that visitors can continue to experience works without the physical conditions of display causing further deterioration. But art history departments, and art colleges, are not yet pushing for policy change towards recording as a national arts funding priority, as part of their mandate to preserve. Nor are there many calls, yet, for replicas to be made so that artworks whose parts have been separated, or that have been deracinated from crucial contexts, can be appreciated once more in their original state. Why is there not more celebration that a material object can now co-exist with its compositional digital data, as a kind of re-performable text, or score? Instead, replication is associated with fakery, danger, and a lessening of value.

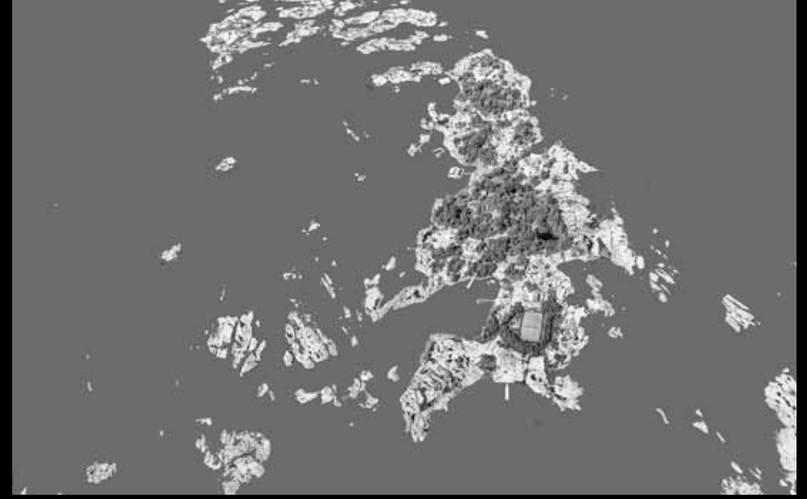
Part of Factum's contribution to knowledge, in the broadest sense, has been to draw attention to how many different kinds of values are simultaneously at play in art objects. Once copies can be made that are materially identical to originals, attention inevitably turns to the people who engage with, care about, and care for these objects, and how many different (often conflicting) kinds of stakes are involved: owners, curators, authors, authorities, communities. The idea of an 'original' is revealed as a highly social phenomenon, agentive, culturally and historically specific (to the West and the 19th century), and a complex nexus of commercial and attributed values. A focus on original, unique, verifiable objects is also the foundation of many of our modern academic disciplines, which, fighting to be taken seriously in the late 19th and early 20th centuries, needed above all to have a clear and distinguishable subject *matter*. Factum's work demonstrates the need to rethink this foundational object-focus in a digital world – i.e. a world of reproduction and recognition, with entirely new potentials of equivalence, access, identity and existing in an interactively- and continuously-produced public sphere. Here what matters is *why*,

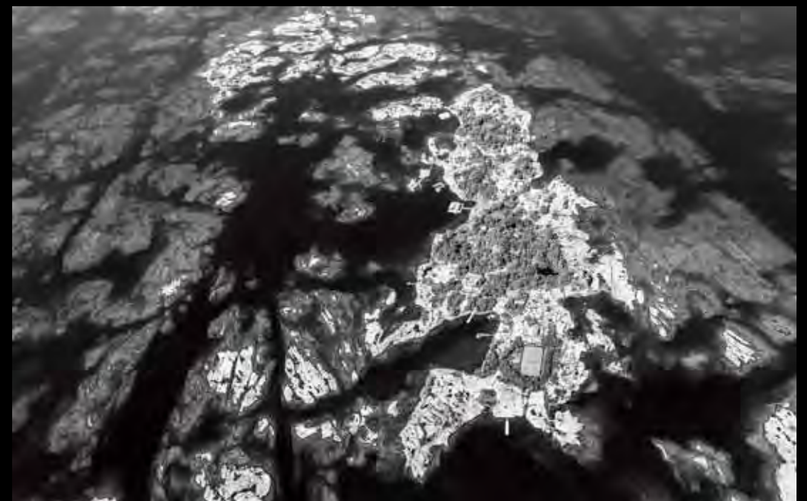
Students from Columbia's Graduate School of Architecture, Planning and Preservation record a tiled wall within the Casa de Pilatos, Seville (2018), as part of the annual Advanced Preservation Technology Studio taught at Columbia and on-site by members of the Factum team.

and above all, *for whom*, something is being redisplayed, reframed, revisioned, re-enacted, revived, replaced, reconsidered, restored, rematerialized, etc.

For academic disciplines, a foundational preoccupation with 'originals' has persisted partly because of the economic structure of academic institutions. Principles of academic validation and evaluation are driven by tradition. Competing disciplines, anxious to establish themselves and then to demonstrate continuing relevance, defend their territories. Publishers need distinct markets to appeal to, which sustains disciplinary categories. Interdisciplinarity, although highly valued in theory, in practice is the luxury of those who already have security in some disciplinary base or another and can afford to do something for which there is no existing teaching demand. So academic environments, in direct contrast to business environments, have inbuilt reasons to be resistant to change. They tend to be precedent-driven, and risk-averse. This makes them ill-equipped to cope swiftly with the changes brought about by the digital era – until recently, associated with science and technology rather than the arts and humanities. Unsurprisingly, art historians and computer scientists have entirely separate funding streams and systems of validation: they exist in discrete ecosystems or communities of knowledge, using often incompatible vocabularies, skillsets, and outputs. Factum's work, an extraordinary marriage between applied technology and the art world, not only falls outside any one discipline's purview, but struggles to be recognised against this long-naturalised division: indeed, it troubles that distinction itself. But the fact it promises to challenge some of the assumptions on which current disciplinary traditions are based is one of its values. Like world-changing digital practices of other kinds, it helps alert the Arts and Humanities to the need to rethink its conventional approaches, categories and concepts. Many universities, and some cities, have centres or departments for interdisciplinary study, designed specifically to fund research that crosses disciplinary boundaries: that follows a current need, or question, rather than what was last said in this or that secondary literature. But it is usually left to individuals to take the initiative to raise the funds piecemeal for one-off temporary research projects at such centres, from grant-giving bodies such as the ERC, UKRI, Leverhulme or other major organisations. This can be as labour-intensive and risky an investment of time as the Factum Foundation's own direct fundraising efforts to reconstruct and enable the restitution of a specific art object.

The scale of the potentials and stakes involved here deserve attention beyond such random processes of individual initiative. There needs to be a systematic thinking through of who should own digital data, and how it is to be preserved for the long term. Commercial operations, under the guise of protection and preservation, are already recording at extremely low levels of quality, or using methods that damage original objects. They are eager to be the first to claim ownership of rights to datasets about objects and buildings of world heritage status for which no clear legal framework exists. It is worth asking how academics, bound by their national and institutional competitive funding priorities, could better support understanding of these profound global changes, of the new theoretical questions being raised, and of the unprecedented ethical issues and risks involved. How can research become more responsive to rapid, urgent change? If we could figure this out, what Factum is learning by doing would, perhaps, already be at the centre of our debates.





RETHINKING OUR THINKING ABOUT THINKING: EPISTEMOLOGY, ARCHITECTURE, AND WORLD

Brian Cantwell Smith

Adapted and extracted from Brian Cantwell Smith, *The Promise of Artificial Intelligence: Reckoning and Judgment* (Cambridge, MA: The MIT Press, 2019). Henceforth *Promise*.

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There is an idea – associated with Descartes, but of much longer pedigree – that thinking, at its best, involves moving rationally and logically between and among 'clear and distinct' ideas: ideas with unambiguous meanings, determinate extensions, and context-independent implications. For centuries this idea has served science and mathematics well; it has also had enormous impact on contemporary models of epistemology. The idea also underwrote the development of the modern computer, whose foundations are formulated in terms of digital states (modeled on ones and zeroes), discrete symbols, and strict and unambiguous logic. In turn, the success of computation has reinforced the sense that logical moves among discrete conceptual ideas must be an intrinsic norm on rationality.

This 'logicist' conception of rationality holds such sway in the contemporary intellectual imagination, in fact, that those who believe that human mental life is not best or fully captured by it often conclude that there must be more to 'good thinking' than rationality – turning for additional resources to such alternative categories as emotion, affect, and qualia. Others, such as devotees of the enactive and embodiment camps of cognitive science, argue that focusing on the mind as a way to understand intelligence is itself misguided.

But these projects that focus on alternatives are relatively recent. It is no surprise that the first serious attempts to model human thought on computers, in the first wave of artificial intelligence (famously dubbed 'Good Old-Fashioned Artificial Intelligence', or GOFAI, by philosopher John Haugeland), developed architectures to implement the classical model of discrete conceptualist thinking. Perhaps the most extreme examples were theorem provers and other systems explicitly based on formal logic. But even when some of the most restrictive strictures of logic were eased, such as in the replacement of logical theorem-proving with a more practically-oriented idea of 'satisficing',[1] most of the logicist conception was retained: the idea that thinking involved clearly separable concepts, represented in discrete symbols, on the model of discrete words in a language.

OPPOSITE

Fig. 1: Islands in Georgian Bay (a masked version of Fig. 3, with land clearly separated from water).

Fig. 2: A computer-generated diagram showing the shape and layout of the islands in Figure 1.

Fig. 3: The original aerial photographs of islands in Georgian Bay, revealing the submarine topology.

1 The term 'satisficing' is most strongly associated with Herbert Simon, an early AI pioneer who promoted the idea that rationality was best understood as having the goal of coming to conclusions that were good enough for the purposes at hand, not as aiming for logical perfection. Persuaded by Simon's argument, and motivated by the unrealistic resources required for theorem proving, many projects in 'first-wave' AI research focused on the development of *heuristics* – methods of coming up with practicable answers in a reasonable amount of time using modest resources. But as stated in the text, this and other themes in first-wave AI amounted to adjustments, rather than rejections, of the classic 'logicist' framework. It was not until the development of second-wave AI that logicism as a model of rationality was replaced.

It was assumed that the vast variety of the world could be captured by combining these symbols, according to the rules of a conceptual grammar, into logical complexes analogous to full sentences, on what was called a 'compositional' model of meaning.[2]

1. SECOND-WAVE AI

Recently a new computational architecture, based on networks of interconnected nodes running parallel statistical algorithms, has transformed AI's approach to modeling cognition. The approach was catalysed by the development of a particular architecture called 'deep learning', though various generalized and alternative forms have been developed within the same general architectural approach. So successful has the new approach been to a class of previously unsolved problems that AI has entered a new phase, called 'second-wave AI'. Second-wave architectures are now often referred to under the general label 'machine learning', but since (i) there have been proposals for machine learning since AI's early days, and (ii) it is presumptuous to assume that the particular form of learning currently being investigated covers even a significant fraction of the full range of possible epistemic techniques to acquire knowledge and skill through study, experience, or instruction, I will use 'second-wave AI' as a label for the entire new class of system.

Second-wave AI systems work in a manner that is almost the exact opposite of the classical model. Rather than using one or a small number of serial processes to carry out explicit inference over conceptually symbolic structures, these new systems consist of thousands or millions of nodes in a network or graph performing, in parallel, relatively simple numerical calculations. Their forte is the prediction and exploration of the consequences of huge numbers of extremely weak correlations between and among vast numbers of numerical or statistical weights. In addition, and of great consequence, these statistical correlation machines are capable of what is called 'learning'. When 'trained' on enormous troves of data, they can adjust the weights used in their calculations so as to home in more and more accurately on the outcomes desired, and therefore reinforced, by their users and designers.

Second-wave AI techniques have been stunningly successful when applied to a variety of problems for which classical (first-wave) AI proved inadequate. Perhaps the most dramatic successes are in the realm of perception and classification. Face recognition, image classification, handwriting recognition, etc. are now well-developed technologies that rely on these second-wave AI techniques. But the triumphs of second-wave AI are not limited to perceptual and classificatory tasks. In the fall of 2017 Google changed the technology underlying its vaunted machine translation service to use second-wave techniques, unleashing a dramatic advance in the quality of the resulting text.

Indeed, the triumphs of second-wave AI have been sufficient to trigger a public wave of sometimes almost unbridled enthusiasm, leading to predictions (and fears) that in many areas humans will be replaced by more competent machines, and that so-called 'general purpose artificial general intelligence' (AGI), of a quality equal to or greater than that of people, is just around the corner.

2. ONTOLOGY

Why do second-wave AI systems work so much better than first-wave – at least in the areas in which they excel?

The answer is ontological. First-wave AI was based on an assumption that the world consisted of what I call 'formal ontology': discrete objects, exemplifying distinct properties, standing in well-defined relations, grouped together in sets, etc. That is, first-wave AI presumed that the 'furniture of the world' – the stuff of reality itself – consisted of arrangements of such familiar ontological kinds as *objects*, *types*, *properties*, *relations* and *sets*, such as people, cars, trees, rooms, countries, mountains, conversations, and the like. Suppose a room was represented, in a first-wave AI system, as containing a table, four chairs, a rug, a sideboard, and three people. Then if the representation was 'correct', it was assumed that what it represented corresponded exactly to what was 'out there', fundamentally and ontologically: a table, four chairs, and the rest. Issues of abstraction and idealization were relevant only to *perception* – to identifying those objects correctly, and to recognizing the properties they exemplified (their distinctness, their chair-ness, their rug-ness, their humanity, etc.). The representer's task (human or machine) was to come up with a representation that was *true* – that corresponded to what was really the case in the represented domain.

Second-wave AI was developed as a (computationally implemented) mental architecture – not as an ontological thesis. But the way it works, and the fact that it is so successful, suggests a very different picture. The task of perception is not assumed simply to be a case of looking out and figuring out what is ontologically 'out there', as if God's labels for pre-individuated reality could be read off the incoming data stream. Rather, the realm that perception is trained on is treated as a potentially unbounded and vastly variegated (often quite low-level) data stream, to be clustered and clumped and 'coarse-grained' for the purposes at hand, into a resulting classification.

It is easiest to understand this approach in terms of a metaphor. Figure 1 is a photograph of some islands in Georgian Bay, in the Great Lakes north of Toronto. Already, one can see that the real-world topography fails to support the cut-and-dried ontological registration that GOFAI assumed. Figure 2 'cleans the picture up' in a way reminiscent of logic and GOFAI, making the islands, though still relatively detailed, 'clear and distinct', and also internally homogenous, in the way that is assumed in conceptual models, such as in data bases and logical statements such as 'ISLAND(X)'. The question of 'how many islands are there' may have a determinate answer in Figure 2, but the same is not true of the world depicted in Figure 1. As I put it in *Promise*, 'distinctness flees, as realism increases. In the world itself, the question lacks a determinate answer' (p.33).

2 Conceptually structured representations of a similar sort are far from unique to AI. They are familiar in myriad other forms – databases, computer-aided design (CAD) systems, architectural blueprints, government records and so forth. Discrete conceptual representation is also the model on which programming languages are constructed. Though conceptual structuring is most obvious in the case of digital representations of the sort we have been talking about (written language, logic, programming, classical AI, etc.), at a more abstract level it also underlies traditional analog representations – those that represent continuous quantities in the represented domain (the domain of the problem to be solved) with continuous quantities in the representation itself. Imagine constructing an analog representation, in an electrical circuit, of air flow through an organ pipe, or of wind in a weather system. To do this, one would set up a correspondence between a selection of conceptually articulated properties of the electrical circuit and conceptually articulated properties of the moving air. Given this discrete mapping of concepts, real-valued quantities in the represented domain (air pressure, wind velocity, etc.) would then be modeled by real-valued quantities in the representing domain (voltage, current, etc.). Traditional first-order logic can thus be considered first-order conceptually discrete; standard analog representations such as these, *second-order* conceptually discrete. Classical physics also represents continuous quantities in the represented domain, such as mass, velocity, charge, etc., but it does so by employing digital (discrete) representations: '27.342 kilograms', '$x_f = x_i + v_i t + \frac{1}{2} a t^2$', etc. So, like logic, it too is first-order discrete. What distinguishes analog representations is continuity in the *representation*, not continuity in what is represented.

More telling yet, though, is Figure 3. This is the photograph on which Figure 1 was based, revealing the submarine topography (i.e. with the filter used in Figure 2 removed, which blocked the transparency of the water). Compared to the world's messiness, the image is still simple: gravity is a single dimension of salience, the water line is relatively sharp, the image is gray scale, and so on. Nevertheless, if the islands in the image are taken as analogs for properties, then the images suggest what in fact is true: that if viewed through the imposition of conceptual boundaries, then the distinction between and among ideas may seem sharp, but as soon as one relaxes the imposition and presses for detail, distinctions multiply without limit. A richly connected texture is exposed that underlies and interconnects all of the parts that happen to project above the surface.

Whereas first-wave AI assumed that the ontology of the world was given, that is, the suggestion implicit in Figure 3 is that reality itself is arbitrarily detailed, and that any ontological 'parse' into discrete objects and properties results from how it is viewed – or as I put it, how it is *registered*. What we do, that is, not only in the course of pragmatically navigating the world and conducting our projects, but in thinking and reasoning about it, is to register the world – render it intelligible in ways appropriate to our projects and perspectives.

Discrete concepts – those expressed by words – have perhaps misled us into thinking that the world comes discretely articulated. But two facts, both highlighted in the metaphor, belie the simplicity of that conception. First, 'beneath the level of the concepts' – beneath the level of the objects and properties that the conceptual representations represent – the world itself is recognized to be permeated by arbitrarily much more thickly integrative connective detail. It is not just that our concepts do not always meet the standard of being 'clear and distinct' and instead sometimes have vague or unclear boundaries. It is that the facts we conceptually represent – whether vaguely or not – tell on a world that itself is not clear cut. Secondly, and crucially, it is only in part with reference to the registration scheme (in conjunction, needless to say, with references to the world thereby registered), that questions of identities and boundaries can be answered. Taking the water level to represent the conceptual 'cut' imposed by the registration scheme, that is, there are no facts about identity except at least in part with reference to it.

Is an obstreperous child the same as or different from a rambunctious child – or an obstreperous CEO? If we are climbing an 8,000 m peak in Nepal, and there is another local maximum 400 m away from the summit we have reached, do we need to go over and climb that one as well? Where does one 'fog' end and another start? If a bacterium splits, is the result two new bacteria, or one old and one new, or a bipartite old one? *Reality will not tell us.* If we want 'clear and distinct' answers, we need to employ conceptual schemes that impose them – schemes that *register the world in terms of imposed idealizations, abstractions, and cuts*.

3. REGISTRATION

What are the consequences of these insights for AI? What follows from recognizing that the nature of reality is as suggested in Figure 3: a plenum of surpassingly rich differentiation, which intelligent creatures ontologically 'parse' or register in ways that suit their projects?

Overall, it means that AI must take on board one of the deepest intellectual realizations of the last 50 years, joining fields as diverse as social construction, quantum mechanics, and psychological and anthropological studies of cultural diversity: that taking the world to consist of discrete intelligible mesoscale objects is an *achievement* of intelligence, not a premise on top of which intelligence runs. AI needs to *explain* objects, properties, and relations, and the ability of creatures to find the world intelligible in terms of them; it cannot assume them.

How we register the world – how we make it ontologically intelligible in such a way as to support our projects and practices – is in my view the most important task to which intelligence is devoted. Developing appropriate registrations does not involve merely 'taking in what arrives at our senses', but – no mean feat – developing a whole and integrated picture accountable to being in the world. It is not just a question of finding a registration scheme that 'fits' the world in ways locally appropriate to the project at hand, but of relentless attunement to the fact that registration schemes necessarily impose non-innocent idealizations – inscribe boundaries, establish identities, privilege some regularities over others, ignore details, and in general impose idealizations and do an inevitable amount of violence to the sustaining underlying richness. This process of stewardship and accountability for registration, never imagined in the GOFAI project, is of the essence of intelligence.

And it is from this perspective that we can begin to understand the power of second-wave AI. It is an architectural approach that starts to give us a handle on registration.

4. EXAMPLES

Three examples will illustrate. First is the game of Go, long considered one of the world's most challenging board games. Even recently, many AI researchers believed that a computer program capable of playing championship Go was unlikely to be constructed for many more years (with some even doubting that it would ever prove possible). In March 2016, however, an AI program called Alpha Go[3] defeated Lee Sedol, one of the best Go players in the world. Over the next couple of years, a successor to Alpha Go defeated Ke Jie, then ranked as the best Go player in the world, and subsequent versions are recognized as playing Go better than any humans ever have, or likely ever will.

A second example of a second-wave AI success: reading x-rays. Research on using deep learning programs in radiology has recently been a subject of intense investigation, and just as this was written *Nature* reported on an AI system capable of surpassing human experts in breast cancer identification in mammograms.[4] Similarly, another cancer diagnosis AI system, in this case for prostate cancer, has just been reported, which identified features indicating cancer more accurately than those developed by humans.[5]

A third example is a proposed joint project by Factum Arte and Case Western Reserve University to use deep learning to identify the brushstrokes in paintings

3 Developed by the Deep Mind division of Google. See D. Silver, J. Schrittwieser, K. Simonyan et al., 'Mastering the game of Go without human knowledge', *Nature* 550 (2017), 354–59.

4 Scott Mayer McKinney, Marcin Sieniek, Varun Godbole et al., 'International evaluation of an AI system for breast cancer screening' , *Nature*, 577 (2020): 89–94, doi:10.1038/s41586-019-1799-6.

5 https://www.itnonline.com/content/artificial-intelligence-identifies-previously-unknown-features-associated-cancer-recurrence.

attributed to El Greco. The aim is to accomplish something that has to date been beyond human ability: to discriminate strokes painted by the master himself from those painted by others – including by painters working under his direction in his studio.

What distinguishes these cases, and others like them, is that the identifying 'signs' or 'signature' of the phenomenon being looked for (a winning strategy for Go, the presence of cancer indicated by an x-ray, the hand of El Greco in the case of the paintings) is almost certainly not betrayed by any single, or even by a few, local, conceptually articulable properties of the underlying image. Rather, just as humans are now believed to identify faces by recognizing extremely complex patterns of very weakly correlated microvariables in the images of those faces, second-wave AI systems use deep learning and other associated techniques to similarly compute complex correlations over thousands or even millions of similar microproperties.

5. EPISTEMOLOGICAL CONSEQUENCES

Many of the epistemological consequences of the success of second-wave AI approaches remain unexplored.

The most obvious consequence is their prowess. It is evident, in part because they are able to retain vast amounts of detail, to pour through extraordinarily massive data sets, and to operate at millions of times the speed of the human brain, that second-wave AI systems are liable to – and in many cases already do – demonstrate much greater prowess than that of which humans are capable, at least on the tasks at which they excel.

Another implication that has received attention is pragmatic, having to do with jobs, employment, and deployment of human skill. Computational devices have for a long time been so much better than people at complex arithmetic tasks that it would be quaint for a person to persist in doing arithmetic computations 'by hand', rather than employing a calculator or computer. By analogy, it may be that if automated second-wave AI systems are more accurate at diagnosing cancer in mammogram images than radiologists (reducing both false negatives and false positives), it will become comparably quaint (and likely dangerous) to insist that people shoulder the task of reading x-rays without computational aid.[6] And if that and similar reconfigurations of labor come to pass, the disruption and reconfiguration of the employment landscape may be substantial and disruptive.

Other issues have attracted attention, such as the resulting bias of algorithms trained on datasets infected with human prejudice, but many of the deepest epistemological questions remain open.

One issue explored in some depth in *Promise* has to do with whether such systems can be said genuinely to recognize people or cancer (as opposed to merely sorting images of them), to actually 'make decisions', or in fact to be the locus of anything genuinely epistemological. Another, not explored there but worth briefly examining here, has to do with what, if anything, we humans will learn through computers developing such 'skills', however it is that we end up choosing to characterize them.

If a second-wave AI system performs better than people at some task, for example, will people become better as a result? Strikingly, Lee Sedol, at least initially, was not dismayed at being beaten at Go by a machine; he was reputed to be thrilled that Alpha Go gave him a glimpse into previously unexplored regions of the game – regions that he might never have known about without its leading him into them, but that he could now study, understand, and perhaps even master. It should be noted, though, that in 2019 Lee Sedol retired from playing Go, commenting that 'with the debut of AI in Go games, I've realized that I'm not at the top even if I become the number one through frantic efforts. Even if I become the number one, there is an entity that cannot be defeated'.[7] Overall, it is fair to say that the impact on the Go community has been huge – an impact with which it is still coping. And while it may be that humans will never again defeat the best AI programs, it seems very likely that human play is improving in virtue of their existence.

Whether radiologists will learn how to read x-rays better because second-wave AI systems can do so is not immediately clear, but it, too, is by no means impossible – especially since this will be more a case of collaboration than of competition. Suppose a radiologist and an AI system 'read' the same x-ray, but differ on their conclusions. Suppose, too, that in due course it emerges that the AI system was correct, and the radiologist wrong. It may become possible, in such a situation, for the radiologist to examine what part of the x-ray was crucial to the AI system's diagnosis, or to examine artificially constructed images that differ only minimally from the real one but that would have led the AI to the alternative diagnosis, and to learn thereby how to make discriminations that they had previously been incapable of making.

Similarly, if an AI system is able to distinguish brushstrokes made personally by El Greco from those made by others in his studio, art critics may be able, again by examining examples of each, to develop the capacity to make such discriminatory judgments themselves.[8]

Why not simply ask the AI system to *describe* which aspects of the image were critical to its diagnosis? Essentially that is the aim of a major research effort currently underway, under the heading 'explainable AI': to build transparent second-wave AI systems that can *explain* how and why they reach the conclusions that they do. It is my sense, however, that any such dream may be unrealistic, and possibly even counterproductive – because of facts that reach directly into the fundamental reasons why second-wave AI is successful in the first place.

The difficulty is that the full scope of 'reasons' why a second-wave AI system comes to the conclusion that it does may not be 'effable' – may not be conceptually articulable, expressible in a finite and comprehensible linguistic form. As we have already seen, the AI's conclusions are likely to rest on thousands or millions of extraordinarily weak correlations between and among innumerable microproperties of the original image. It is exactly because of its ability to make use of vast numbers of weak correlations that second-wave AI systems are as powerful as they are. Asking for explainable AI is in some

6 As opposed to prescribing treatment as a result of such diagnoses, which is likely to require judgment; see §6.

7 https://www.theverge.com/2019/11/27/20985260/ai-go-alphago-lee-se-dol-retired-deepmind-defeat. Downloaded 19 January 2020.

8 At present, suppose we are unable to make this discrimination. Then we may at present have two sets of paintings or fragments of painting for an art critic to study: some made by El Greco himself, and some made by *either* El Greco or another painter in his studio. What we do not have, though, is the comparison set that might be critical for learning: one set by El Greco, and another set *not* by El Greco but by one of his studio painters. If the AI system could learn to make the discrimination, then it could be used to construct these non-overlapping comparison sets, which might enable human painters to learn to detect the difference.

sense asking for second-wave AI systems to revert to being first-wave AI systems. And there was a reason that first-wave AI failed at the very sorts of task on which second-wave AI succeeds.[9]

If the reasoning processes of second-wave AI systems are intrinsically ineffable, however, does that mean that can never be communicated to us at all – that they will remain forever alien and incomprehensible? No, that does not follow. It would only be true if the conceptualist model of thinking that underwrote first-wave AI *were true of human cognition*. But as I have been at pains to suggest, not only is there no reason to suppose that it is constitutive of human cognition (i.e. no reason to suppose that we think purely conceptually), but if it is true that second-wave AI is starting to implement processes of perceptual registration that people already do extraordinarily well, then the ways that these new systems work may not remain alien after all.

How, and in what ways, could we understand, or be affected by, such systems? The answer – or at least a glimpse of it – requires understanding how we end up in the cognitive states that we do, and with the relation between our cognitive states and the words we utter and understand. In particular, suppose a perceptual registration system (human or AI) 'outputs' or reports the result of a perceptual registration in a single word or token. Nothing about such behavior implies there that the state of the system that manifests such behavior must thereby be reduced to a single choice selected from a set corresponding to the set of conceptual terms we use for such expressions. To think that would be to *presume* that, like first-wave AI systems, we think solely in terms of conceptually formulated representations. But it is that very assumption that we are challenging.

Suppose in particular that, as the result of looking at a facial image, a system generates a 1,000-dimensional array, with an 8-bit number entered as the value for each dimension representing the image. Such a representation would require just 1 kilobyte of computer storage – very little by present standards. Yet the value of such an array identifies one point in a space of $256^{1,000}$ ($\approx 10^{2,408}$) possibilities. Suppose further that only a tiny fraction (let's say 0.001% or 1 in 10,000) of these potentially representable images are comprehensible (recognizable as human faces expressing emotions), and that fewer than 1% of those are classified as representing 'anger'. That still means that there are $10^{2,400}$ different images representing anger. If, given one such image, the system were to make an inference as to what that particular angry person might do next, there is no reason that that inference process might not rely, in reaching its conclusion, on the details of the representation of that person's facial expression. That is: just because the system can 'effably' *report* the emotion it has perceived using the single word, nothing mandates that the complexity of the system's state representing that emotion – the state being reported – need be thereby reduced to the simplicity of the verbal expression used to express it.

The question of whether the state of 'being angry' is an effable state, in other words, is far from straightforward. On the one hand, there is a sense in which 'being angry' is almost tautologically effable, since we have just demonstrated a way to express it in words: 'being angry'. On the other hand, it would surely be widely agreed that at least the first-person *phenomenology* of anger should be deemed *ineffable*, since the full, nuanced, multi-faceted[10] experience of being angry is vastly richer than can anything that can be 'captured' in words. What the discussion of face recognition suggests, however, is something stronger: that ineffability need not be limited to the first-person case. As the discussion of face recognition suggests, and other modalities would amplify and support, an external observer's sense of someone else's anger, though plausibly radically simpler than that of the person who is the subject of the anger, may at the same time be indescribably richer than anything that mere words can encompass. Even if, in terms of Figure 3's metaphor, our words are in some sense restricted to labeling what is 'above the water line', there is no reason why those of us who *use* language, even in the midst of verbally expressing our thoughts, ever need to abandon the submarine richness that is leading us to utter those words.

For another example, consider laughter. Suppose someone says 'they laughed at him because of what he was wearing', or 'she could make anyone laugh, no matter the situation'. We hear such statements, and understand them, in part because we understand the word 'laugh'. But what does that understanding consist in? Does it mean that in our thought we merely instantiate some mental analogue of 'LAUGH(x, t)'? Not necessarily. On the mental model we are considering, our reception of the word may index or trigger some or many of the million-dimensional ineffable state(s) that we know, first-person, from ourselves having laughed, and from having interacted with others who laugh. Is that ineffable richness part of the 'meaning' or 'content' of the word 'laugh'? Has that ineffable richness been *communicated*? On the logicist model the answer might be thought to be *no*. But what second-wave AI systems are suggesting is that that negative answer may not be correct. At a minimum, if the ineffable state unleashed by hearing that someone laughed is used as the grounds for further inference or reflection, there is no reason to suppose that the bare (logicist) conceptual framing 'LAUGH(x, t)' need figure as the premise or argument for any subsequent conclusion. *Rational deliberation, that is, and the interpretation of linguistic expressions, may just as much involve a wealth of ineffable submarine detail as does perception*.[11]

It is this kind of conclusion that starts to open up the real epistemological implications of the successes of second-wave AI. If meaning or content refers to what resources a statement supplies in for a competent hearer to use in reasoning and deliberation, then meaning or content should perhaps be understood as the *richness that utterances of words evoke or signify*, not merely an analog of the bare skeletal form of the utterance itself. There is no doubt that the successes of DL systems with respect to language translation, inferences from Big Data, etc., suggest that it is these systems' capacity for employing

9 It could be argued that there is at least one sense in which these states could be given conceptual form: simply to list, in English, the values of the weights on all the nodes and links in the network. However, not only would the result be pragmatically useless; it is not what 'explainable' means. A listing of gigabytes of data, consisting of massive numbers of triples of node labels and an 8-bit value of the strength of the connection between them ('0.147 on the link from node #3,227,019 to node #9,234, 972', for example), and of pairs of node labels and similar 8-bit node values, would provide absolutely no epistemological insight into the rationale for the resulting output – and not merely because of the incomprehensible mass of the data. One could as well claim that conscious emotional states could be 'rendered effable' by listing the total configuration of organic molecules in the brains of people in such states. Having one particular such list would yield no insight on what other configurations of nodes and weights (or arrangements of organic molecules) would lead to the same output (or underlie the same emotional state), and thus would be incapable of supporting any attempts to generalize or identify regularities. In essence, the problem is that the articulation would be at a wholly wrong level of abstraction or implementation.

10 The term 'multi-faceted' implies that the space of angry feelings has conceptually separable dimensions – as does the suggestion that it might be represented in a DL system by a 5,000 dimensioned array. But in the latter case the array might well be best characterized as an *implementation* of a representation of anger; the rich regionality of anger at the level relevant to a person's phenomenal experience may not be higher-order conceptual at all. These and other such issues should be explored in a fuller discussion.

11 This likely in part explains the success of Google's new language translation algorithm.

the richness that the networks are capable of representing that leads to their inferential success. Perhaps in fact the whole idea of a 'third-person' stance on language, and the conception of what a 'competent language user' is, should be questioned. If, for example, 'x laughed' can only be understood by a creature who has laughed, or who has had ineffably rich contact with others who laugh, perhaps we need to adopt the idea that language and communication should be understood as second-person plural ('we') phenomena – where 'we' means those of us who have laughed.[12]

Second-wave AI is surreptitiously powerful. Epistemology should take note.

6. JUDGMENT

Given the successes of second-wave AI, should we expect that general-purpose AI (AGI) is just around the corner? Will computers soon be as intelligent as humans?

Not remotely. Even in our three examples, the limitations of these second-wave systems is as evident as their successes. Alpha Go and its successors may play Go well, at least in some sense of the word 'play', but they have no sense of what a game is – no sense that Go was invented in China thousands of years ago, no sense that it has been viewed as a game of such difficulty as to challenge people's sense that it would ever succumb to computational approaches, no sense of the magnitude of their own accomplishment. By the same token, no current 'x-ray reading' systems have any sense of what lung cancer is, no understanding of chemotherapy, no sense of whether an elderly person will want to suffer worse quality of life in order to extend their life expectancy. Similarly, what makes an artwork significant – what brings it together as a whole, what its subject matter or style or expressive quality signifies, etc. – all these things not only fall outside the scope of a deep learning system, not just a little bit, but profoundly and completely.

In fact, nothing in current approaches gives these AI systems any sense that the data they deal with *represent anything at all*. They may present us with symbols or images or responses, but in a literal sense they have no idea what they are talking about. They may produce labels associated with particular patterns (*damezumari*, *adenocarcinoma*, *El Greco*) but to them those words are yet more meaningless patterns. They mean something to us, and we configure the systems, tune and debug them, deploy them in specific situations, and feed them with data in ways that mean something to us. But so far that is all. To them it is all merely an endless play of signifiers.

To use language developed in *Promise*, first-wave AI systems automated a kind of computational *reckoning* – the sort of calculative prowess that we are familiar with from all manner of computational system, including spreadsheets, databases, web searches, and the like. Though their ontological assumptions are different, and their architectures different, and because of those facts they are strikingly more capable in many types of situation, second-wave AI systems are still reckoners – still instruments that amplify our intelligence, but not themselves genuinely intelligent at all.

We humans, in contrast, possess or at least aim for what I call judgment – a kind of dispassionate[13] deliberative assessment of a situation, appropriate to the entire context in which it occurs, ethically responsible, and accountable to the world as a whole. By judgment, that is, I mean what we get at when we say that someone 'has good judgment' – the sort of judgment that we require in a baby-sitter, so that even though it is impossible to put into words – to register in advance – every conceivable situation that could come up (keep in mind the ontological picture sketched above), the baby-sitter is nevertheless held accountable for dealing with any situations that arise *in a way that is accountable to the world, to the child being cared for*, etc. Critically, accountability is not ultimately to language, but to the world that language registers.

What does judgment require? The bulk of *Promise* is devoted to an exploration of that question. Here I can say just this: judgment of an entirely different order from reckoning. Moreover, judgment will not even be seen, let alone understood or approached, and perhaps not even acknowledged, through anything like research of the sort that has brought us first- and second-wave AI. I see nothing on the horizon – in scientific or technological or intellectual imagination – that suggests that we are about to construct, or indeed have any ideas as to how to construct, or are even thinking about constructing, systems capable of full-scale judgment. As I argue in the book, judgment can only be a property of:

- Systems existentially committed to the world they register, represent, and think about;
- Systems that will go to bat for the truth, reject what is false, balk at what is impossible – and know the difference;
- Systems not only *in* and *of* the world, but *for which there is a world* – a world that *worlds*, in the sense of constituting *that to which all is ultimately accountable*;
- Systems that know that the world that hosts them, the entities they reason about, and all of humanity and community as well, must be treated with deference, humility, and compassion.

It is this kind of judgment, I believe – a seamless integration of passion, dispassion, and compassion – that ultimately underwrites what matters about human cognition.

Where does that leave us? We should be humbled by the inadequacy of first-wave AI, given the depth of the very real insights on which it was based – and open to a potential radical reconfiguration of rational deliberation that uses staggeringly complex ineffable (subconceptual) states as its ingredients. We should honor, but be cautious about, the successes of second-wave AI – respect and make use of its merits, and appreciate its epistemological implications, but remain forever mindful of its limitations and restrictions. But mostly we should stand in awe of the capacity of the human mind, and of the achievements of human culture, in having developed registrational strategies, governing norms, ontological commitments, epistemic practices, and existential forms of being that allow us to comprehend, exercise judgment, and go to bat for the world as world.

12 Cf. Wittgenstein's famous remark in the *Investigations*: 'If a lion could speak, we could not understand him'.
13 In the original sense of the word, as not being ruled or swayed by personal emotions, self-interest, etc. – i.e., as closer to impartial than to lacking motivational force.

THE HAND OF THE ARTIST: GRAPH ANALYSIS AND EL GRECO

Adam Lowe

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The digital recording and digital analysis of El Greco's paintings will significantly enhance our understanding of this artist, famed for his idiosyncratic and highly personal paintings. He is the epitome of the individual artistic genius. Doménikos Theotokópoulos was an artist from Candia (the name given to Crete during its period as a colony of the Republic of Venice) who had worked in Venice and Rome before moving in 1577 to Toledo, where he ran a successful studio until his death in 1614. Artistic practice in Spain in the late 16th century was controlled by strict professional codes. Theotokópoulos worked with a team of painters and assistants including his son, Jorge Manuel Theotokópoulos, who continued to run the workshop for some time after his father's death.

The analysis of the painted surface, recorded using high-resolution 3D laser scanning and confocal profilometry, will provide the data for a new graph-analysis software that is being developed at Case Western Reserve University in Cleveland. This research project is an initiative of the Factum Foundation and Case Western Reserve University, in collaboration with the Fundación Casa Ducal de Medinaceli and The Auckland Project. The analysis involves AI machine-learning (ML) techniques using neural-net methods reacting to the three-dimensional characteristics of the surface relief. The aim is to identify different hands at work during the production (and restoration) of El Greco's paintings. The individual technique of each artist leaves its trace on the painted surface. These traces can be clearly read if they are recorded with enough detail. With El Greco, there are often several hands working together to produce a single coherent and recognisable style.

The Baptism of Christ has already been recorded in the chapel of the Hospital of Cardinal Tavera, Toledo. *The Annunciation*, in the collection of Banco Santander, is scheduled for recording in the spring of 2020. The aim is then to record the other paintings from the Hospital of Cardinal Tavera that are amongst the last produced by El Greco and Jorge Manuel. Permission will be required from the National Gallery of Greece and the Metropolitan Museum to 3D scan the *Concert of Angels* and *The Opening of the Fifth Seal* in their collections. The aim is also to record and analyse two very similar crucifixions by El Greco or his studio belonging to the Cleveland Art Museum and The Auckland Project. The close similarity of these two paintings suggests that El Greco's studio may also have been using a system to improve the speed and accuracy of the copying. This collaboration between institutions will hopefully help establish the importance of recording the surface of paintings and reveal new information about the working practice of El Greco's studio.

OPPOSITE

Colour data for El Greco's *Bautismo de Cristo*, 1608.

MACHINE LEARNING TECHNIQUES

Artificial intelligence (AI) for image recognition and image analysis has been successful in recent years, with applications ranging from art to ecology, national security to healthcare. The same techniques for clustering and recognising images can be applied to any 2D array of image data, such as a render of surface topography. In the case of the El Greco paintings, one experiment will be to train a machine learning (ML) algorithm on regions that a specific connoisseur has attributed to El Greco (Category A) vs. regions attributed to his son (Category B). Then we will apply the trained algorithm to the unknown regions. By applying the algorithm to unknown regions, the AI will suggest with a numerically defined certainty that these regions fit best into one of the trained categories (e.g., Category A with 85% certainty). We expect the results to illuminate the physical qualities used in determining attribution, and perhaps lend insight into the role of reconstruction and damage in this determination. Further, information encoded at different length scales within the paintings will contribute to these results. Understanding which length scales the algorithm weighs highly for its determination could result in novel analytical tests for studying paintings. Additionally, we plan to study various imaging modalities, such as panoramic photography, for the ML algorithm, and understand the robustness of the results, so that we can begin to identify the surface information (height, directionality, colour, etc.) contributing to the attribution.

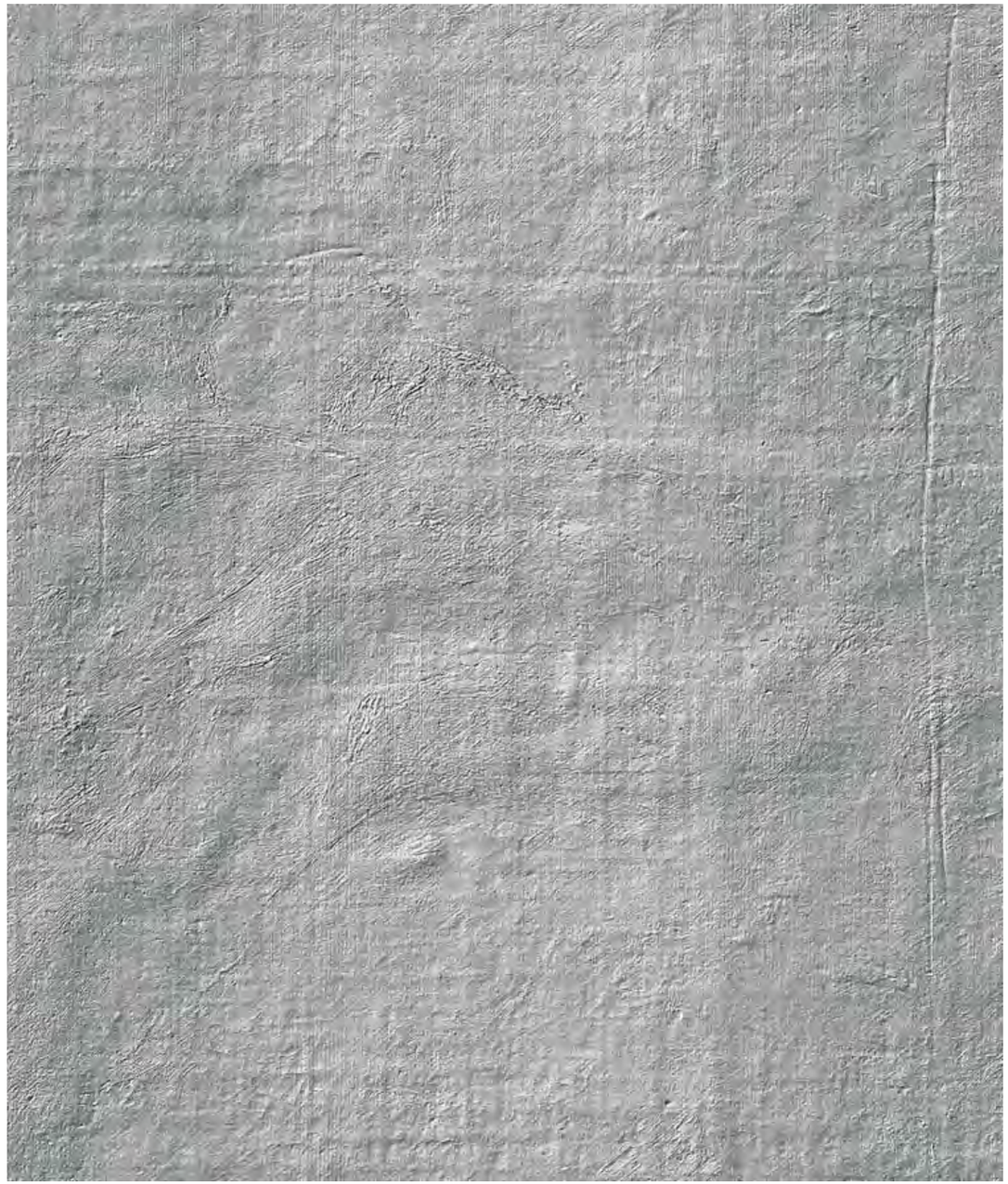
Finally, clustering via AI can be applied to the measurements of the paintings. With clustering, the AI will group similar patches of the paintings with no training. By using various metrics to cluster the data spots or spot sizes, we may see groupings arise within and across the paintings. Then, meaning can be designated to the groupings using knowledge obtained by archival and art-historical research. This method has been known to lend support to conclusions and enlighten new roads of interpretation.

Initial tests on the ability of machine learning to differentiate between artists using surface profile images have been carried out using a methodology developed at Case Western Reserve University in Cleveland. Working with high-resolution 3D recording and data analysis software in a scientifically controlled environment, the team was able to identify the brush-marks made by two different hands with more than 90% accuracy after initial analysis. The three paintings by El Greco contain more 'noise' and have undergone several undocumented interventions that will obscure some data. By use of different models and careful training using sections of each painting, it is hoped that we will be able to allocate characteristic traces to the way each hand applies the paint. It is anticipated that this will reveal the presence of several hands at work on each canvas.

The project aims to offer a unique look at these paintings by El Greco through the filter of cutting-edge technologies. It is hoped that through digital analysis we will provide new data about how works are made, who made them, and how they have been conserved, demonstrating that paintings are both complex and dynamic in terms of content, context and material evidence. The recording and ML analysis will hopefully contribute to the knowledge and appreciation of some of the most representative works of the last stage of El Greco's career. Factum Foundation has been committed from its formation to the recording of the surface of paintings as a way to learn more about their historical and artistic significance. The link with Case Western Reserve University will result in the writing of new software to analyse the 3D information.

OPPOSITE

3D relief data for El Greco's *Bautismo de Cristo*, 1608.



BUILDING A MIRROR WORLD FOR VENICE

Frédéric Kaplan and Isabella di Lenardo

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Isabella di Lenardo is a researcher in Digital Humanities and Urban History at ÉPFL. She is a specialist in cultural heritage digitisation and digital urban reconstruction. She has worked on many projects in collaboration with leading European institutions such as the Bibliothèque nationale de France, Louvre, Institut National d'Histoire de l'Art, Getty Research Foundation and Giorgio Cini Foundation. She coordinated the Replica project held by ÉPFL in collaboration with Factum Arte, digitising one million photos of artworks in the Giorgio Cini Foundation (Venice) and producing a pattern extraction through a search engine for visual similarities.

OPPOSITE

Photogrammetry point cloud of the Tetrarchs on the façade of St Mark's, Venice.

Venice is known to face the combination of two major threats: flooding due to the continuous sinking of the city and rising of global sea levels, and social petrification caused by the increasing imbalance between the number of the city's inhabitants and its tourists. As UNESCO recently warned by putting Venice on its 'endangered' place list along with war-devastated sites, the situation is critical. Although many scenarios can be envisioned for the future, a first step for any urban policy should be to provide a tool for monitoring the current state of the city and its yearly evolution, and for linking these dense urban models with maximum information about the city's past.[1]

Between 2012 and 2019 'The Venice Time Machine Project' developed a new methodology for modelling the past, present, and future of a city. This methodology is based on two pillars: (a) the vast digitisation and processing of the selected city's historical records, (b) the digitisation of the city itself, another vast undertaking. The combination of these two processes has the potential to create a new kind of historical information system organised around a diachronic *digital twin* of a city.

A digital twin can be considered as a one-to-one digital overlay, directly mapping information to each street, door or stones of the current city, a digital representation not only as vast as the territory itself but adding deep historical thickness, directly connecting the present with information and models of the past. In 1992, David Gelernter coined the term 'Mirror World' to describe the usage and experience associated with such high- resolution digital twins of evolving cities.[2] In his book, he not only developed many scenarios in which decision makers could use the Mirror World to manage and administrate the city in a more efficient manner, but also discussed what it changed for citizens themselves. In the early 1990s, the kind of interface that would allow the editing and visualisation of such representations was difficult to imagine. The concept of a Mirror World as 'a universe in a shoebox' recalled ancient iconographic figures of emperors and kings holding in their hands an orb containing the entire representation of the world. Its potential was perceived as immense, but technological solutions were lacking to implement it.

The advent of Mirror Worlds may inaugurate in the next decade a fundamental new way of using and structuring information, as the World Wide Web did 30 years ago.[3] In the post-web age, the Mirror World is now conceived as a dense information skeleton, a consolidated reference structure for organising data in 4D (3D + time). In principle, it could be accessible from any digital device, but in the same way that the Web found its

1 Frédéric Kaplan and Isabella di Lenardo, 'Is it too late to save Venice?', *Apollo Magazine* (January 2019), https://www.apollo-magazine.com/is-it-too-late-to-save-venice/.
2 David Gelernter, *MirrorWorlds or the Day Software Puts the University in a Shoebox… How It Will Happen and What It Will Mean* (New York: Oxford University Press, 1992).
3 K. Kelly, 'AR Will Spark the Next Big Tech Platform – Call It Mirrorworld', *Wired* (February 2019).

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Point cloud model of the Basilica della Salute, Venice.

OPPOSITE

Point cloud model of Campo Sant'Angelo, Venice.

canonical usage on the desktop, and social networks on smartphones, the Mirror World may be experienced primarily through augmented reality interfaces, made for rich and situated digital experiences.

It is relatively easy to estimate the efforts involved in building a first 'basic' Mirror World for a city, a representation of the city in its current state. In the case of Venice, a prototype was developed in 2019 for the district of San Barnaba.[4] It consists of a 3D reconstruction, documenting precisely the state of the city. The San Barnaba district consists of 640 m of Venetian *calle*. It was documented taking about 4 photos per linear metre, at a rhythm of one photo every 10 seconds (6 photos per minute). Using a photogrammetric pipeline, a high-resolution 3D model of the district was obtained along with metadata about the precise location and time of each photo.

Estimating the total length of Venice's street network at 225 km plus an additional 100 km for canals, 1,300,000 photos should be enough to build a 3D model of Venice. This corresponds to 3,600 hours of work. This means that a hundred volunteers can make the 3D model of the entire city in one week of intense work or, more reasonably, in a month, working part-time. On this basis, the model could be updated every year, documenting the evolution of the city in time as a continuously changing 4D model. In a not so distant future, this updating of the model may be done seamlessly with the same augmented reality device making it possible to interact with it.

The million photos that serve to create the first 3D model of the entire city are extremely precious assets. Each photo can be segmented into distinct regions corresponding for instance to the object seen in the picture. This can be done manually or using state-of-the-art machine vision algorithms. These segmented areas are first projected onto the 3D model and then retro-projected onto all overlapping pictures. This means that a single annotated region can automatically lead to dozens of subsequent annotations. In addition, the resulting segmentation directly structures, with one-to-one mapping, the underlying reality, like an invisible digital layer on top of every object or architectural element from the physical world.[5] In such conditions, each 3D segment becomes a symbolic anchor that can be annotated, linked to, searched for, or assigned with an unambiguous unique identifier like any page of the World Wide Web.

This rich and dense representation of the present of a city is the starting point for reconstructing its past. The relevance of a historical map or ancient photo is directly linked to the possibility of connecting its content with the dense 3D models of the city through the matching of pairs of 'homologous' zones identifying the same underlying stable reality. These networks of homologous pairs permit the merging of high-precision measurements of the present with the documents of the past.

This principle motivates a specific selection and prioritisation of certain types of historical records. The order in which the sources are digitised and articulated with the Mirror World, progressively densifying its 4D structure, is key to the efficiency of the resulting reconstruction. Priority should be given to the sources which can be linked through a maximum number of pairs of non-ambiguous homologous zones to the 3D segments of the Mirror World model, thus extending their virtual existence deeper in the past.

Ancient photos, paintings, engravings, drawings and other iconographic sources constitute a first family of records that can be directly incorporated into the growing 4D structure. Each iconographic source can itself be segmented and annotated, allowing for instance the identification of multiple views or of elements of an ancient construction that are now destroyed, and making it possible to reconstruct a partial 3D model of the missing parts.

Cadastral maps provide further important information linking clearly defined parcels of land with entries in large tables. Both the maps and the tables can be automatically parsed and read with satisfactory results using 'cadastral computing' approaches.[6] These sources offer direct access not only to the ancient geometries of the city but to the population of owners and tenants. Each person mentioned in cadastral sources receives

4 The San Barnaba 3D subcentimetric model was produced by Albane Descombes based on the photographic survey by Francesca Zugno, Davide Drago and Valentine Bernasconi.

5 The related concept of *epiderme numérique* (digital skin) has been developed by Livio de Luca. See for instance Livio de Luca, 'Étudier le passé avec les technologies du futur', *TEXxAvignon*, YouTube, https://www.youtube.com/watch?v=WPMmcpCt1Is.

6 Sofia Ares Oliveira, Isabella di Lenardo, Bastien Tourenc and Frédéric Kaplan, 'A deep learning approach to Cadastral Computing', Digital Humanities Conference, Utrecht, The Netherlands, 8–12 July 2019.

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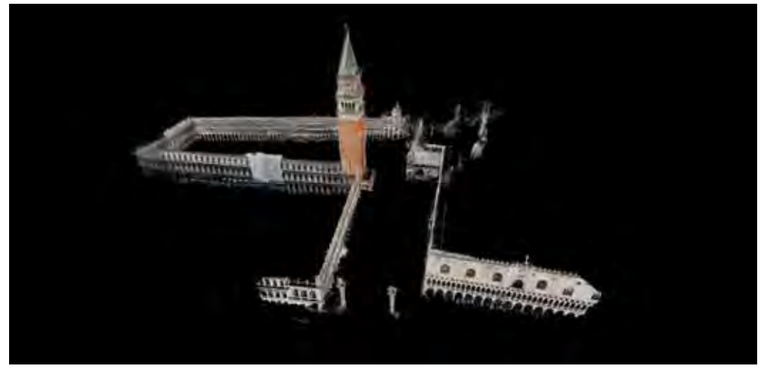
Point cloud of Campo Sant'Angelo, Venice.

Point cloud of San Giacometto, Venice.

OPPOSITE

Point cloud of the façade of St Mark's, Venice.

Point cloud of Piazza San Marco, Venice.



a unique identifier that can sometimes be matched with names and addresses in other historical records like directories and almanacs.[7]

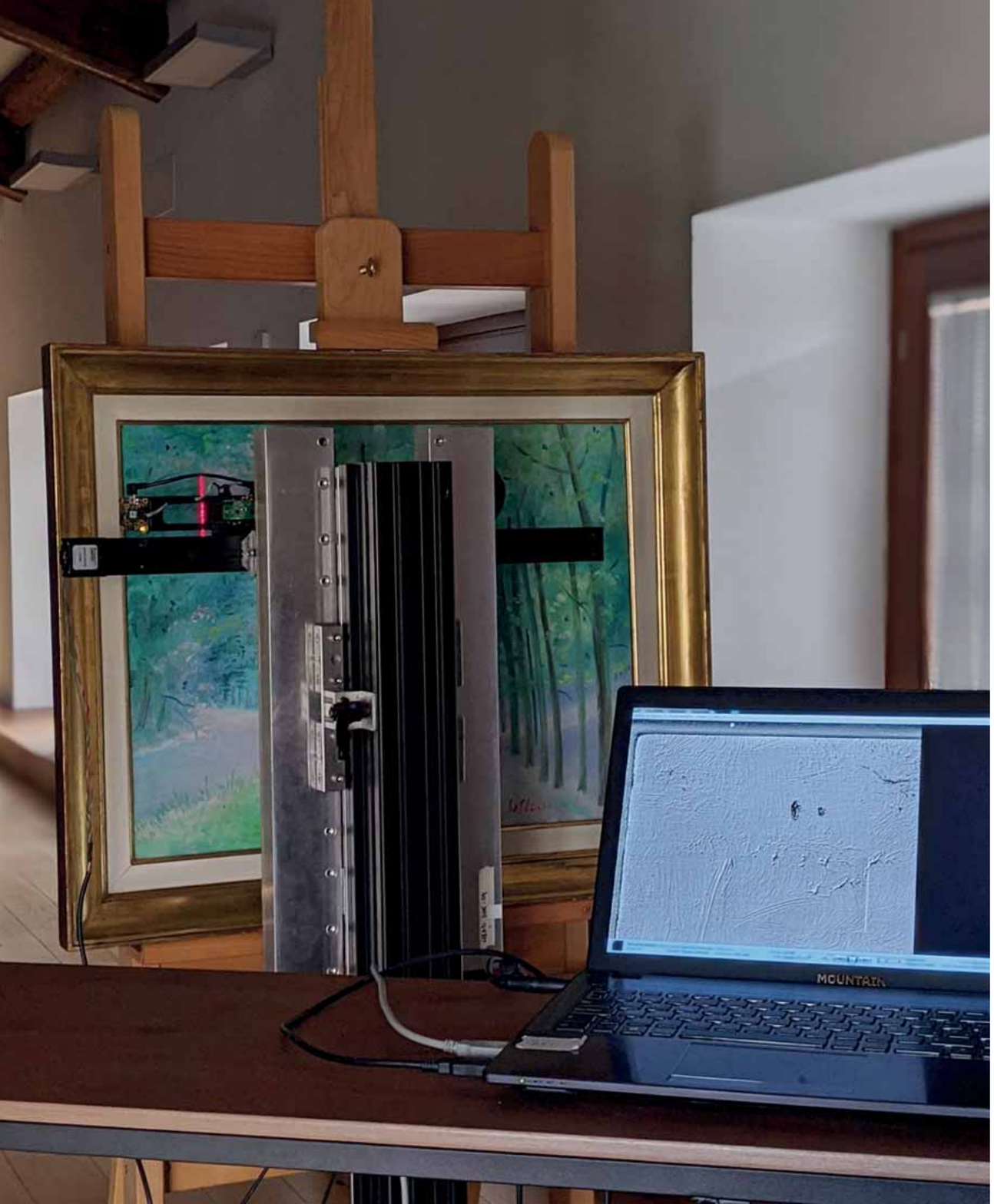
The population model extracted from the totality of cadastral sources and directories serves as a node around which can be organised additional sources like fiscal documents, testaments and inventories, compiled genealogical sources, birth and death certificates and an ocean of other typologies of notarial documents. Thus, the Mirror World extends its information branches, grabbing more and more data from isolated archival records. As it extends, the resulting spatiotemporal architecture facilitates disambiguation of names, detects and helps resolve unknown incoherencies, and allows the planning (in an agile manner) of complex digitisation logistics in order to progress with the construction of a coherent and unified set of 'Big Data of the Past'.[8]

In practice, a single digitisation hub may be enough to digitise an entire city and to progressively organise the continuous scanning and processing of its historical records. In the case of Venice this hub is the ARCHiVe centre on the island of San Giorgio Maggiore. It was created as an alliance between the Giorgio Cini Foundation, Factum Foundation and the Digital Humanities Laboratory of ÉPFL to record, analyse and archive digital data. Several different types of scanner, both purpose-built and off-the-shelf, permit the recording of a wide variety of documents of different types. These range from large ancient maps to very small 3D objects. This centre is also the operational base from which the logistics of the city digitisation are planned and where volunteers, most of them from the city itself, can be trained. ARCHiVe intends to be the prototype of a generic digitisation hub, easily replicable in any city across the world that wishes to build and update its own 4D digital twin.

The urgency of providing Venice with a way of harnessing its historical records to help make decisions related to its survival is an incentive to push the boundaries of urban modelling. Cultural heritage preservation and management of climate change are interlinked issues, especially in Venice. Many forms of knowledge are currently isolated and unconnected, lost in their own safe storage. These need to converge into a single consolidated 4D model. The Venice Mirror World may be a first node of an international network of connected sites, progressively densifying a new global information platform that should fundamentally change our relationship with our past and our future.

7 Isabella di Lenardo, Raphael Barman, Albane Descombes and Frederic Kaplan, 'Repopulating Paris: massive extraction of 4 million addresses from city directories between 1839 and 1922', Digital Humanities Conference, Utrecht, The Netherlands, 8–12 July 2019.

8 Frédéric Kaplan and Isabella di Lenardo, 'Big Data of the Past', *Frontiers in Digital Humanities* 4, no. 12 (2017): 1–12.



OPPOSITE

Recording the surface of a painting from the Giorgio Cini collection, part of a workshop for IUAV graduate student at ARCHiVe.

ARCHiVe: ANALYSIS AND RECORDING OF CULTURAL HERITAGE IN VENICE

Adam Lowe

Adam Lowe is the Director of Factum Arte and the founder of Factum Foundation for Digital Technology in Conservation.

ARCHiVe, the centre for Analysis and Recording of Cultural Heritage in Venice, is a collaboration between the Giorgio Cini Foundation, Factum Foundation and the Digital Humanities Laboratory of the École Polytechnique Fédérale de Lausanne (DHLAB-ÉPFL). It is primarily funded and supported by the Helen Hamlyn Trust. ARCHiVe is dedicated to innovation in the recording, archiving, interpretation and sharing of the world's cultural heritage. Its main areas of work are:

I) Developing and applying diverse recording technologies: Understanding the right technology for a specific task is critical. The main areas of focus at ARCHiVe are high-resolution 3D recording and composite photography (colour, infrared, ultraviolet), but other recording technologies are required for specific tasks. These are being developed, pooled and shared according to need. In each case the data is recorded in ways that are repeatable and scientifically verifiable. The data must contain the history of its capture, processing, and all stages involved in its transformation and mediation from one state to another.

II) Transfer of skills and technologies: Transferring skills and technologies to local communities is not only possible but has now been demonstrated on three continents. This approach ensures local guardianship and has the potential to generate income at a local level. The data gathering seeks to identify, record and archive written documentation, photographs and works of art building on the archiving work of previous generations. Simply bringing data together in a place where it can be located and accessed is fundamentally important.

III) Archiving: Plans must be put in place to establish long-term archiving and to ensure compatibility and easy access without expensive proprietary software. Long-term archiving of digital data is a significant task on which there is little existing professional agreement. Metadata systems and archiving protocols can ensure it is possible to find digital data when it has been misplaced. The data in the public domain should be prepared so that it can be accessed easily and freely. Ensuring future generations have access to archives in a post-crisis scenario is an important consideration.

IV) Data ownership: ARCHiVe's policy is that all rights to the data that is recorded should belong to the custodian of the object for all current and future applications that can generate income. In return for this clear statement of ownership, the 'custodian' will agree to make it freely available for academic

and conservation applications. Data ownership (both current and future) is a key issue. Sharing and providing access to the data nurtures understanding and helps in the development of knowledge and human skills; it can generate new audiences and reveal the importance of cultural heritage as evidence that communicates across temporal, religious and cultural divisions.

V) Condition monitoring: The uses of high-resolution archives are extensive. Monitoring the condition of objects is one of the most critical. Demonstrating the rate of decay provides an objective basis for decisions relating to the protection of objects. Providing forensically accurate evidence before and after restoration procedures is also important.

VI) Digital restoration: The recording work that is being carried out is 100 per cent non-contact. It aims to provide the data required by conservators and restorers for in-depth study and analysis. Digital restoration is a fast-growing application of digital technology. Through diverse types of high-resolution information, it is possible to understand the physical nature of all objects and to create a forum in which consensus can be reached before any actions are carried out on original objects. Another important element of digital restoration is reuniting fragments of a single object that have been separated over time in both digital and facsimile form.

VII) Data presentation: Digital technologies used to be associated with virtual representations. Augmented Reality, Virtual Reality and Mixed Reality are rapidly developing and will become a popular platform for sharing and communicating the importance of cultural objects. But the primary target is to preserve the evidence of the past at the highest resolution allowed by the diverse technologies. Data can always be optimised to make it easier to access and share, but if it is not recorded correctly this possibility does not exist. Evidence of the quality of the data can be seen when it is rematerialised as a physical object. Visualising 3D and colour files on screen requires less information than re-materialising the object using additive or subtractive technologies. This level of resolution normally produces vast files that cannot be handled by most computers. The packaging and presentation of data is of critical importance to ensure the widest access.

VIII) Intelligent computer-vision software: Software developments are increasingly demanding high-resolution images that can be used with self-learning neural networks. Increasingly historical records, cartography and 3D models are being merged to produce 'four-dimensional maps' of the past. As the algorithms get more precise, and as the data becomes freely available, these technologies will redefine the relationship between the past and the present.

Other important aims of ARCHiVe are to record the Cini Foundation's archive and to offer its services to assist in the recording of other archives and collections. Sharing knowledge and training are also central aspects of ARCHiVe's approach.

In its first year, it completed the digitisation of the Cini Foundation's entire photo library using Factum's purpose-built Replica scanner (the Replica project was the foundation upon which ARCHiVe was built). Over 439,700 double-sided A3 documents

Gabriel Scarpa uses panoramic photography to record a Banksy mural threatened by rising waters in Venice.

were recorded in about 10 months. Each document was recorded at 700 DPI at 1:1, producing an archive of 879,400 files (a total of 43.93 terabytes) that was automatically collated and downloaded with specially written software.

There have also been extensive educational and training projects at ARCHiVe with 121 people receiving varying levels of training. This included practical work with graduate students from Columbia's School of Architecture, Planning and Preservation recording the altar, tombstones and frescoes in the Knights of Malta's headquarters in Venice. The University of Urbino recorded a selection of sculptures in the Sala della Tribuna at Palazzo Grimani for Venetian Heritage. While this was going on, a Factum Arte team was installing a facsimile of Giuseppe Salviati's painted ceiling, *The Dispute of Minerva and Neptune* (recorded at the Musée Jacquemart-André, Paris) into the next door room. Between the three partners, many interns, training courses and educational initiatives have run in parallel.

The shared belief is that digital technology is opening many doors. The potential is vast, but structures are needed that can facilitate genuine research. ARCHiVe has the potential to respond rapidly and is growing the infrastructure to support the individuals who are asking questions and experimenting. The research and development are being conducted within the field of digital preservation in an independent and open-minded

THIS PAGE

Participants in a 3D scanning workshop at ARCHiVe inspecting a sample of elevated printing.

OPPOSITE

In one of the first projects carried out by ARCHiVe, Guendalina Damone and Fabio Martinello record the surface relief of Veronese's painting of the *Prophet Isaiah*, part of a diptych owned by the Gallerie dell'Accademia. The painting was scanned both before and after conservation by the conservation company Open Care, allowing comparison between these two states.

way. The scholarship, hardware, software and resulting data are being made freely available. The focus is on the study, protection and preservation of cultural heritage in its diverse forms. Related to this is a focus on developing inexpensive hardware that can be built and repaired even in relatively remote locations.

Data storage is a major challenge faced by ARCHiVe. If data is to be made widely available and has to be stored indefinitely, there must be a focus not only on increasing the speed of data capture and improving the quality of the resultant data, but also on simplifying file formats and developing capacity for long-term data storage in physical form. Rune Bjerkestrand at PIQL in Norway, Ken Singer at Case Western Reserve University (both have partnership agreements with Factum Foundation), Professor Peter Kazansky at Southampton University and others are all working on this issue. ARCHiVe can hopefully benefit from and apply their innovations.

ARCHiVe is an ambitious venture. In order for it to succeed, it is vital that others follow the lead of the Helen Hamlyn Trust and provide enlightened support allowing recording technologies to be developed and disseminated, and the resulting data to be processed, archived and used. The outcome is designed to be inclusive, drawing together digital pioneers from across the world. This will offer global resonance and access to highly localised cultural heritage, while at the same time leaving agency in the hands of local actors and contributing to local economies and skills.

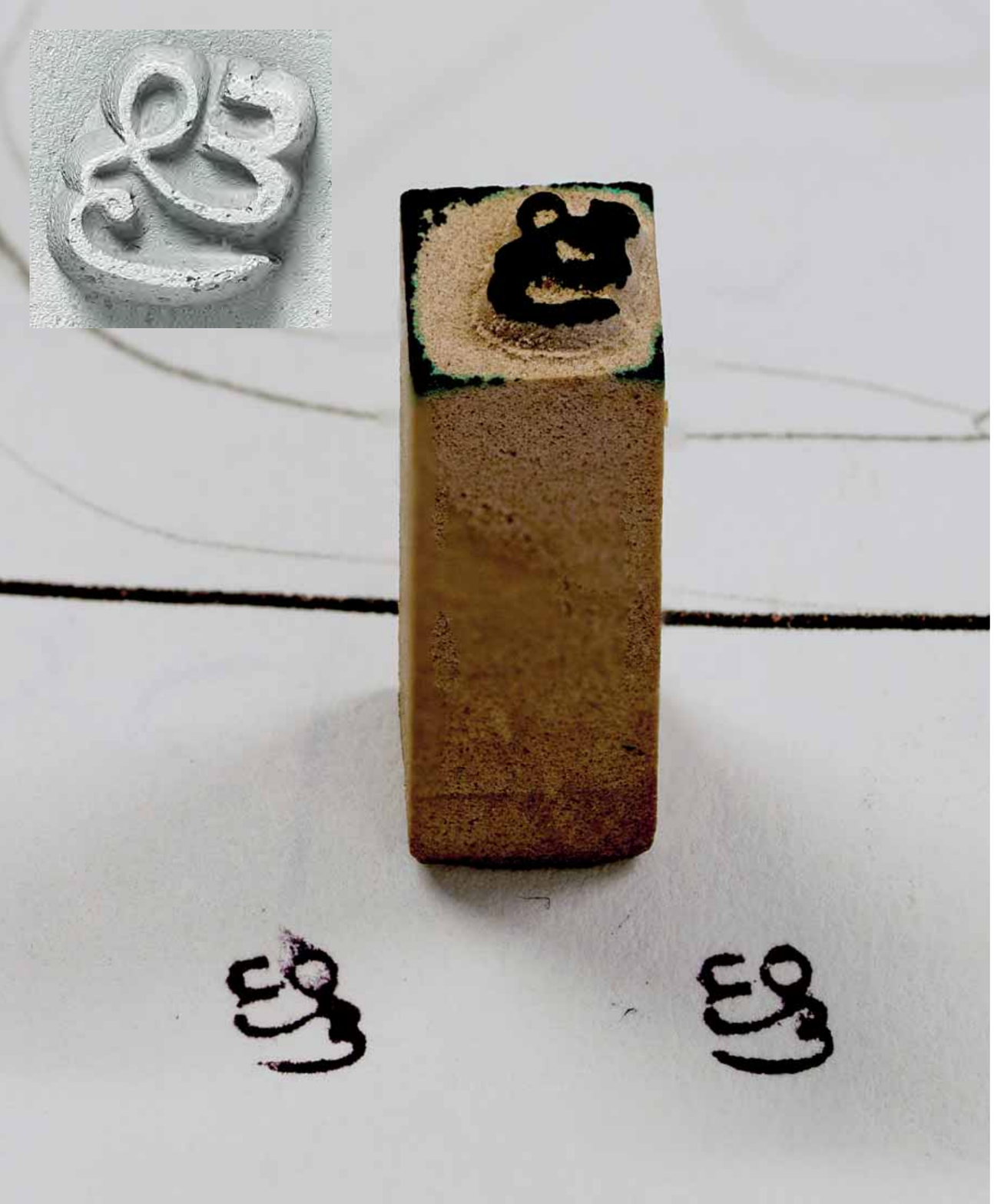
In 2019, Gianluca Vacca, Undersecretary at the Italian Ministry of Cultural Heritage and Activities wrote that:

> … as a ministry we are working on a single control room, so that all digitalisation projects can be set within the same framework … The model launched at ARCHiVe (the Analysis and Recording of Cultural Heritage in Venice) by the

Giorgio Cini Foundation in collaboration with Factum Foundation and ÉPFL brings together philology, recording and the analysis of data. This mix of knowledge and technology is urgently required.[1]

Many managers of cultural heritage are still from the generation of post-war 'baby boomers' brought up in a pre-digital world. A new generation of managers are starting to shape the debate, and their relationship to technology is more intuitive. The 'digital natives' are also coming of age and their ability to work with and apply digital technologies will lead to an explosion of new recording and display technologies. If the technicians are given the funding, framework and computing power they require, this new generation will shape the future by providing the high-resolution information needed for in-depth study, AI self-learning programmes and the forensically accurate analysis and dissemination of cultural data.

1 Gianluca Vacca in *Antonio Canova. Atelier*, ed. Chiara Casarin (Venice: Marsilio, 2019).



ARCHiVe CASE STUDY: EXPLORATION OF AUTOMATIC TRANSCRIPTION FOR THE INDEX CARDS FROM THE DANIÉLOU COLLECTION

Rashmi Gajare

Rashmi Gajare is a preservationist, Indologist, and architect with a Masters in Preservation and Planning from Cornell University. She carried out the Daniélou research project at ARCHiVe while attending the master's program in Digital Humanities at the Università Ca' Foscari, Venice. She is currently pursuing a PhD in Architecture at the University of Texas at Austin.

Early digitization projects created vast amounts of data in formats that might not be easily adaptable to ever-evolving technological processes. The current challenge is twofold – to make older data usable in the present day and to ensure that future digitization projects consider the inevitable process of technological obsolescence.

In 1949, Alain Daniélou, a French musicologist living and studying Hindustani classical music in India for over a decade, launched an ambitious project to create an archive of all available treatises on Indian music – *Sangita Śastra*. The process he followed involved recovering the texts, making copies (microfilms), transcribing the works into modern Devanagari script, and comparing them with other manuscripts of the same works. A translation of the texts followed. During this process, almost 300,000 index cards were made with key information about the manuscripts, the authors, various musical instruments, Ragas and so on.

From 2001–04, a majority of the Alain Daniélou collection index cards (about 250,000 items in total) were scanned using a desktop office scanner. In 2019 the ARCHiVe research team, headed by Professor Giovanni Giuriati, started a project to convert these older scans into machine-readable, transliterated text. However, the low resolution of the 2001–04 images (150 dpi) as well as the diversity of data on these cards posed a challenge for the creation of both a searchable and a semantic database using Optical Character Recognition (OCR) and Handwritten Text Recognition (HTR) processes.

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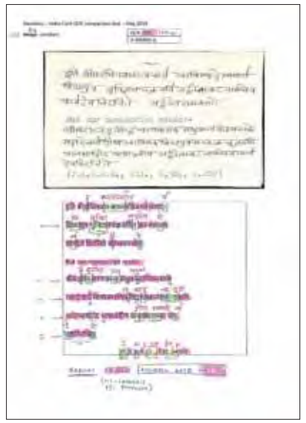
Automatic transcription of an index card, with mark-up revealing the degree of accuracy of the OCR software.



This more recent project explored various methods to find the optimal solution to automatically transcribe all the index cards (approximately 300,000 in total) from the Alain Daniélou collection.

The first stage involved running Optical Character Recognition (OCR) algorithms on a set of 30 scanned cards from the 2001–04 images and analyzing the results; the same set of cards was then redigitized using different instruments and settings, and the OCR was run once again to compare results. Both steps used the free, cloud-based Google Vision API for OCR. For the re-digitization, two scanning methods were adopted: digital photography using CANON EOS 5D

OPPOSITE

In a separate initiative relating to typography, Factum Foundation has been working with the Type Archive, London, on a pilot project to establish digitisation methods for their unparalleled collection of historic type matrices. The Foundation used a focus stacking scanner (in collaboration with the Natural History Museum, London) and CNC milling to produce a new positive from the original matrix for this Gujurati character.

Helen Hamlyn meeting the ARCHiVe team in May 2019. A generous donation from her Foundation made the creation of this innovative centre possible.

(50mm lens, EOS Utility software); and FUJITSU Image Scanner fi-7160 (portable with 80 sheets Automatic Document Feeder), iSOP (Intelligent Sonic Paper Protection) and PaperStream Capture 2.5. RawTherapee 5.5 was used for image processing.

The results from the three scanning methods – office desktop scanner (150dpi); FUJITSU Image Scanner fi-7160 (600 dpi); and CANON EOS 5D (300 dpi) – were compared for error rates and estimated time for scanning and analysis.

The accuracy of the OCR algorithms increased by an average of 7% when using present-day digitization techniques – probably due to the increased image resolution, from 150 dpi to 300dpi and 600 dpi.[1] Despite the marginal increase in accuracy, it was decided that the estimated time required for rescanning the entire collection could be better employed to manually create a set of transcriptions that could be used as a training model for a Handwritten Text Definition (HTR) software.

For the Daniélou collection index cards, error rates were higher for the Devanagari script than the Roman alphabet, probably due to the large database of Roman alphabet transcriptions available online for the Google Vision cloud-based software. By training the machine reading model with a manually transcribed sample, the error rates could be reduced. The recommendation is to use an HTR software, such as Google Auto ML Vision or Transkribus, a READ project with funding from the European Union's Horizon 2020 Research and Innovation program. Another suggestion is to create an online project to crowdsource corrections by uploading the Google Vision API OCR results (even with high error rates). This would create a platform for public participation, whilst fostering a sense of stewardship of heritage and creating awareness about the collection.

While enhanced OCR techniques can make it far easier to read the *textual* information on these low-resolution scans, low-resolution image documents might present a very different set of challenges; it would probably make more sense to re-record those at a higher resolution.

Once Alain Daniélou's index cards become machine-readable, the next step in the project will be to do the same for the manuscripts and link them to the relevant index cards. Where the present archive is hard to navigate even for those researchers working within the Cini Foundation, the new digital archive will make this unique resource on Indian music accessible to researchers across the world.

1 It must be noted that a larger sample size might offer more precise results, but these preliminary observations could lead to time saving measures.

FOLLOWING PAGES

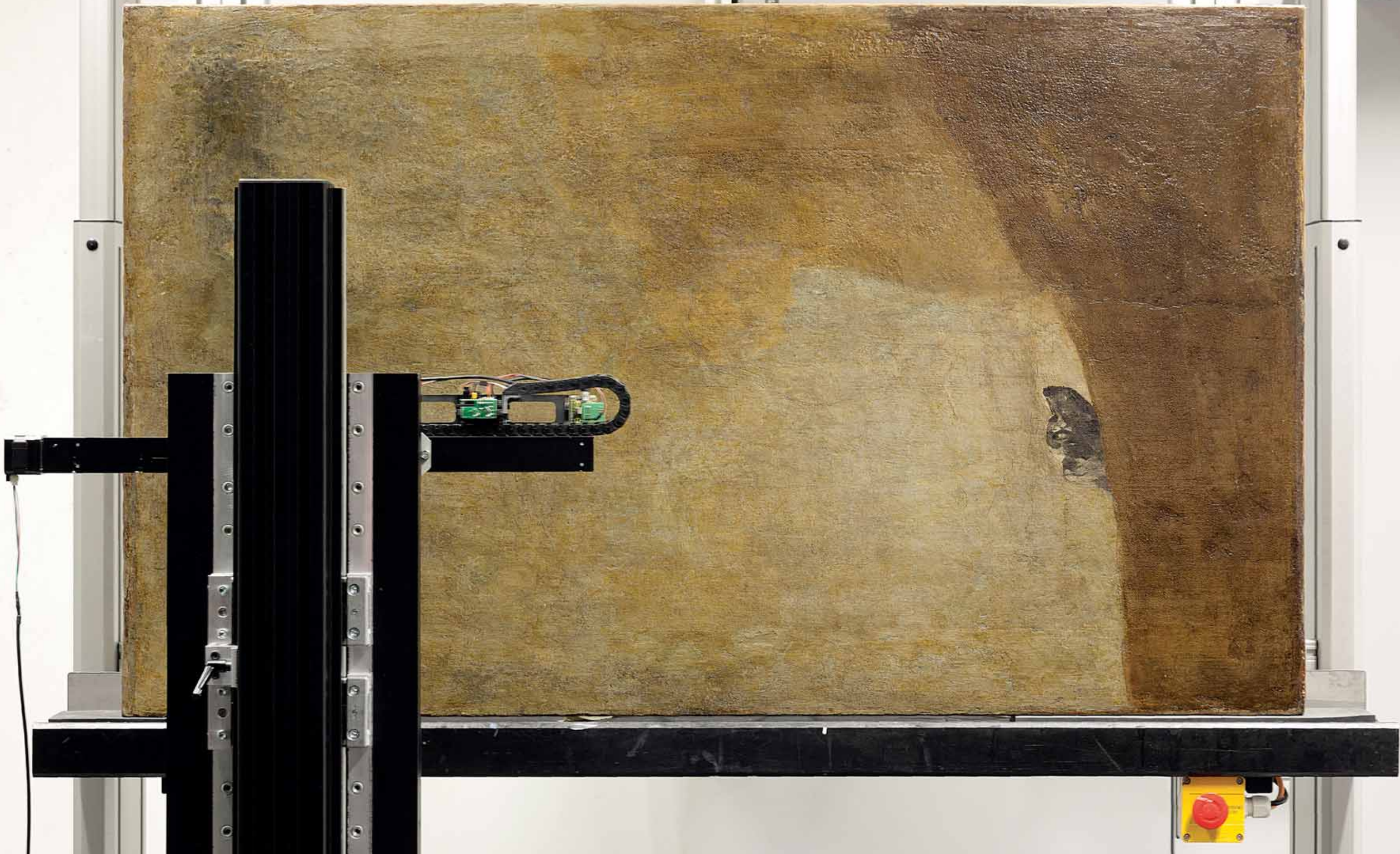
Recording the surface relief of Goya's *The Drowning Dog* (1820–23) using the Lucida 3D Scanner, Factum's main recording technology for low-relief surfaces. The Lucida was designed and made by artist and engineer Manuel Franquelo with support from Factum Foundation.

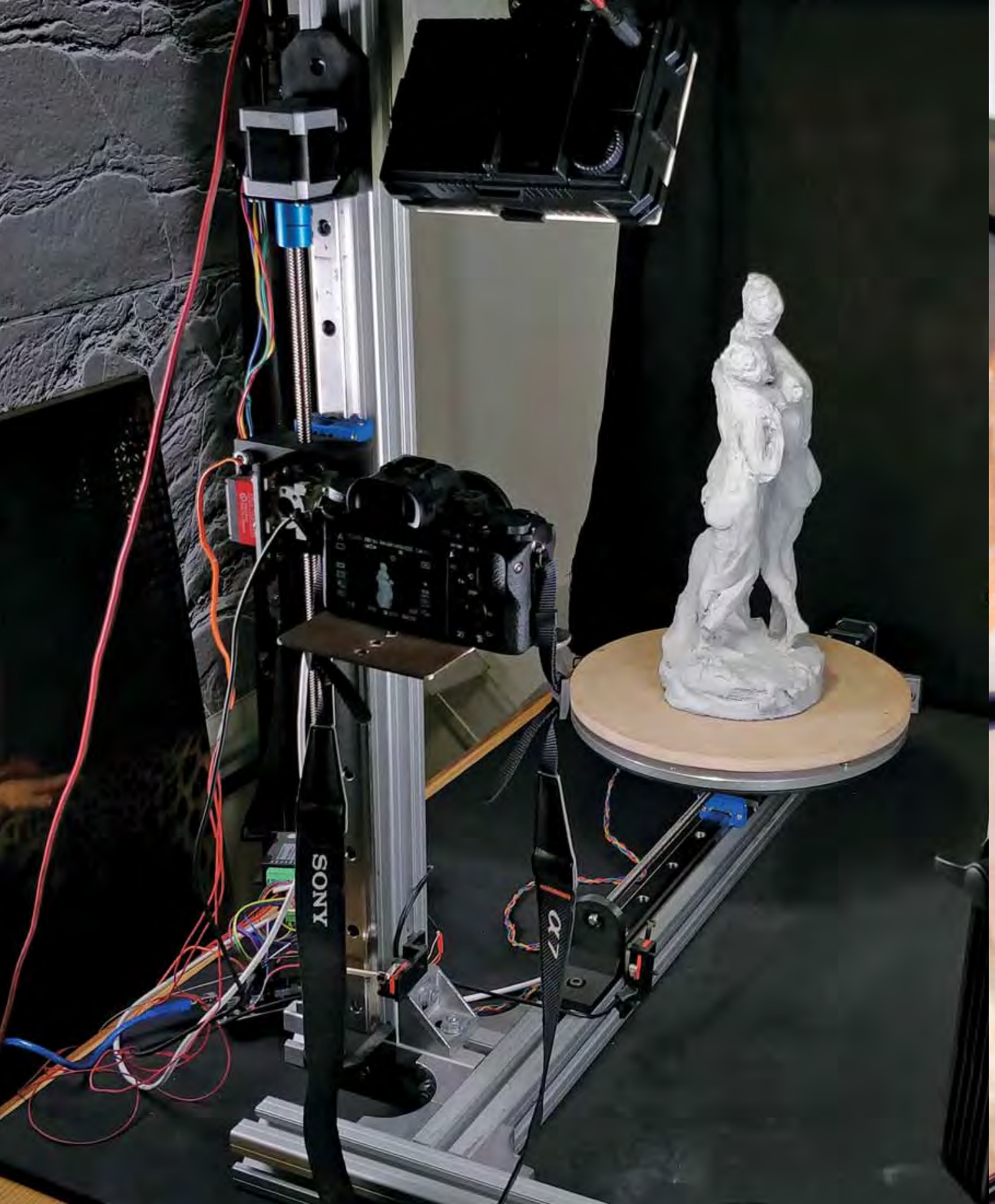
The Small Objects Scanner is an automated photogrammetry rig designed to 3D-scan objects up to 30 cm tall. The object is placed on a mechanised rotary table and as the table rotates, the object is photographed from different angles with a camera that can move towards and away from it on two axes. The scanner is being developed by Matt Marshall, Quinner Baird and Otto Lowe.

Abhijit Dhanda working on the prototype of the Photometric Scanner. The system uses computational methods to extract detailed information about the surface of an object using 2D images taken under differing lighting angles, and will provide a fast and lightweight way of recording low-relief surfaces. It is being developed by Jorge Cano and Enrique Esteban from Factum Foundation's engineering department together with Dhanda, who is based at the Carleton Immersive Media Studio at Carleton University, Canada. Adam Weigert from CIMS has also made significant contributions to the technology's development.

The portable manuscript scanner was designed in order to quickly record fragile manuscripts at remote locations in Dagestan. It was created at Factum Foundation by a team led by Enrique Esteban.

The miniature book scanner was designed specifically to scan *L'Offiziolo di CarloVIII*, a late 15th-century book of hours with pages measuring 6 x 4 cm, which could only be opened to a maximum of 50° and was impossible to record using a conventional scanner. This technology uses a mirrored optical-glass prism / camera system to overcome this problem. It was designed by Dwight Perry (scanner) and Ben Gaskell (mirrored glass prism).

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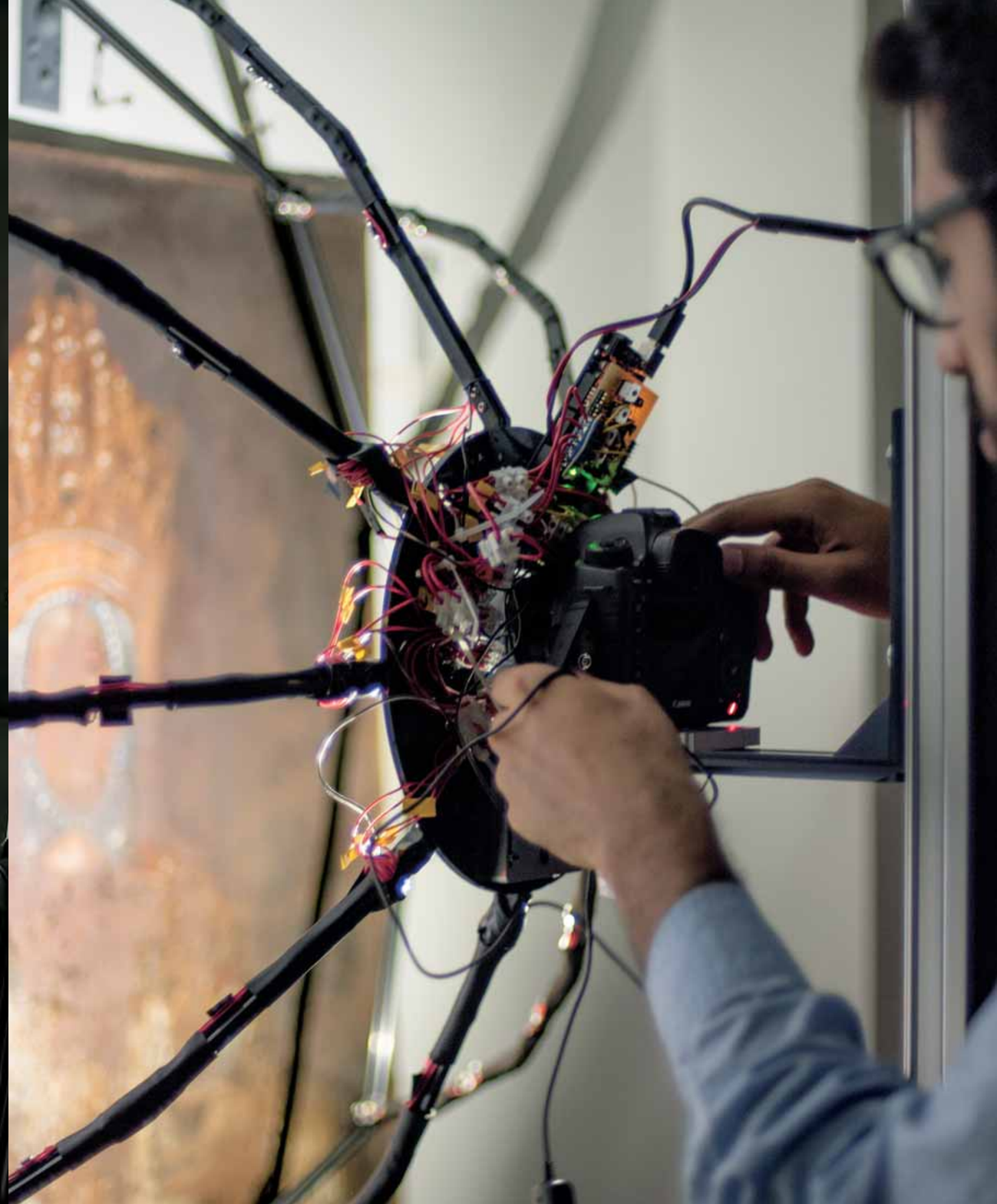


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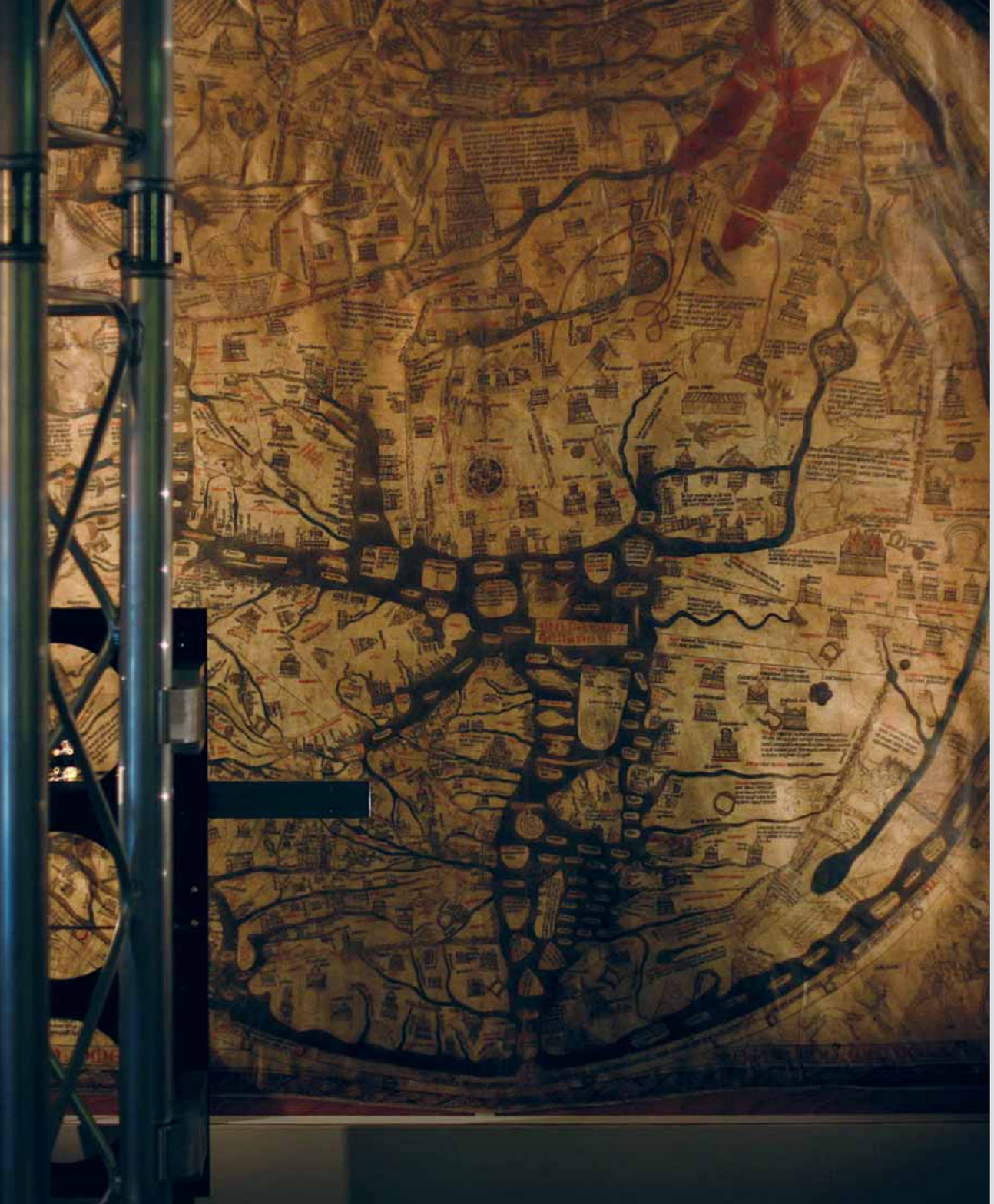


CHAPTER 4

CARTOGRAPHY: RECORDING SHAPE, MAPPING SURFACE

THE WORK OF MAPPING IN AN AGE OF DIGITAL MEDIATION

Jerry Brotton

Jerry Brotton is Professor of Renaissance Studies at Queen Mary University of London. He is the author of numerous books on the history of mapmaking, including *A History of the World in Twelve Maps* (London: Penguin, 2012).

The commonly accepted definition of a map comes from the multi-volume *History of Cartography*, first published in 1987 under the editorship of J. B. Harley and David Woodward, who claimed that 'maps are graphic representations that facilitate a spatial understanding of things, concepts, conditions, processes, or events in the human world'.[1] This definition, aimed primarily at historians of cartography, also drew on a generation of critical thinking embracing disciplines as diverse as philosophy, geography, urban planning and architecture that represented a 'spatial turn' in the humanities, in which thinkers began to understand that the analysis of space as much as time offered an understanding of personal and social change.

The tradition can be traced back to the phenomenological analysis of Gaston Bachelard's *The Poetics of Space*, first published in French in 1957. 'Inhabited space', argued Bachelard, 'transcends geometrical space'.[2] Subsequent writing on the poetics and politics of space by Michel Foucault, Henri Lefebvre and many others culminated in Fredric Jameson's essay defining postmodernism, written in 1984. Jameson argued that a form of 'cognitive mapping' was required to understand the complex social and spatial environments in which late modern individuals found themselves towards the end of the 20th century.[3] This turn to space and mapping largely predated the rise of the Internet and World Wide Web, a digital revolution that, as these names suggest, represented a vast and growing map ('web' and 'network' of graphic relations connected in virtual space). It did however coincide broadly with the development of computerised Geographical Information Systems (GIS) capable of using computer hardware and software to manage and analyse large amounts of geographical data. In the 1960s, the English geographer Roger Tomlinson grasped that the introduction of transistors in computers allowed for hitherto unknown speed and memory in data collection and reproduction. In 1962 Tomlinson established the Canada Geographic Information System (the first ever GIS) for the Canada Land Inventory, describing it as a system in which 'maps could be put into numerical form and linked together to form a complete picture of the natural resources of a region, a nation or a continent. The computer could then be used to analyse the characteristics of those resources'.[4] To paraphrase Harley and

PREVIOUS PAGE

Recording the surface topology of the Hereford Mappa Mundi (c. 1300) in Hereford Cathedral, 2013.

OPPOSITE

Factum Arte's recreation of the lost silver world map made by the 12th-century cartographer al-Idrisi for Roger II of Sicily.

1 *The History of Cartography*, Vol. I, Book 1: *Cartography in Prehistoric, Ancient, and Medieval Europe and the Mediterranean*, eds. J. B. Harley and David Woodward (Chicago: The University of Chicago Press, 1987), xvi.
2 Gaston Bachelard, *The Poetics of Space*, trans. Maria Jolas (Boston: Beacon Press, 1969), 47.
3 Fredric Jameson, 'Postmodernism or the cultural logic of late capitalism', *New Left Review*, vol. 146 (1984): 53–92. See also Michel Foucault, 'Of other spaces', *Diacritics*, no. 16 (1986): 22–27 (based on a lecture given in 1967), and Henri Lefebvre, *The Production of Space*, trans. Donald Nicholson-Smith (Oxford: Blackwell's, 1991), first published in French in 1974.
4 Roger Tomlinson, 'Geographic Information Systems: A New Frontier', in *Introductory Readings in Geographic Information Systems*, eds. Donna Peuquet and Duane Marble (London: Taylor & Francis, 1990), 15–27: 17.

Woodward, this was the first *digital* graphic representation facilitating a spatial understanding of the human world.

Just as GIS specialists like Tomlinson were developing the technical power of new information systems, thinkers like Foucault, Lefebvre and Jameson were detecting – although perhaps understandably not fully grasping – a transformation in the mapping of social space using computing technology. It is a development that is now ubiquitous. As the paper map gradually disappears and gives way to online geospatial mapping applications, digital maps are at the forefront of our everyday lives, and these are doing far more than just getting us from A to B. From cracking the human genome and visualising capital flows, understanding the brain and an ever-expanding universe, to how we manage Big Data or our online searches to find the nearest takeaway, maps are now central to how we process and organise modern life. Geospatial applications like Google Maps and the same company's online search returns over 30 per cent of searches containing some form of geographical content. Such digital online applications have led to the emergence of 'neocartography', defined as the creation of maps outside the professional cartographic community. Today, in our globalised digital world, anyone can be a mapmaker, and the future looks less like a text to decode than a map that guides us through what appears to be a simultaneously shrinking and infinitely expanding digital global world.

If mapping has become a default activity for so many spheres of life, what kind of maps should we use, and who will make them? Nearly all digital geospatial applications and neocartography involve the reproduction of a graphic two-dimensional (2D) map, whether the medium be print on paper or pixels on a display screen. Yet many of these online maps act as little more than directional tools or as adjuncts to online search and its monetisation. Artists have responded by incorporating maps into their works but usually

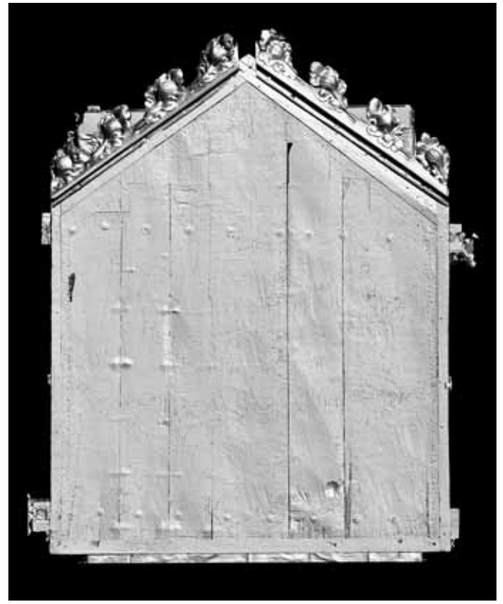
THIS PAGE

Render of the 3D relief of the Hereford Mappa Mundi.

Render of the Hereford Mappa Mundi with colour registered to 3D data.

OPPOSITE

Render of the backboard (c. 1300) of the Hereford Mappa Mundi.



on a purely iconographic basis. But the development of digital three-dimensional (3D) data capture and reproduction of the kind pioneered by companies like Factum Arte offers more significant possibilities for mapping everything from extremely small objects – like the surface of a painting – to the vastness of the globe on which we live.

The laser scanning of an object's surface and its reproduction can be achieved through various methods. They can include Fused Filament Fabrication (FFF), where printers fabricate 3D models in single or multiple pieces; Stereolithography 3D printing (SLA or 'resin printing'), where the form is created in layers through the action of UV lasers converting resin into solid objects; and Elevated Printing Technology, which employs flat-bed printers to layer ink onto a surface to produce a high-resolution 3D form. The method chosen varies depending on the object to be reproduced and the level of definition required. The surface of the object is digitally 'mapped' via scanning then uploaded to computer files before being reproduced in three dimensions in an act of topographical modelling that mimics the act of the mapmaker inscribing the surface of his or her medium.

Factum's practice is therefore embedded within mapping techniques, even though the outcomes are not necessarily cartographic. However, their projects dealing directly with premodern map artefacts offer an insight into their wider ethos of data capture and reproduction. In recent years Factum has worked on the reproduction of various medieval maps from Christian and Islamic culture. In January 2013, Factum was commissioned by the Mappa Mundi Trust of Hereford Cathedral to carry out the first high-resolution 3D scan of the so-called Hereford Mappa Mundi, one of the greatest surviving world maps from the medieval period, dated c. 1300. Using a Lucida 3D Scanner, Factum's team recorded the surface of the map and then used the data to mill it on a panel of polyurethane resin. The subsequent mould was then used to create a plaster cast of the map. This cast shows the map as a white surface in which the colour has been virtually removed, so the landscape of the medieval vellum can be experienced as a 3D object, with every wrinkle, scratch, patch and pouncing mark touched and felt.

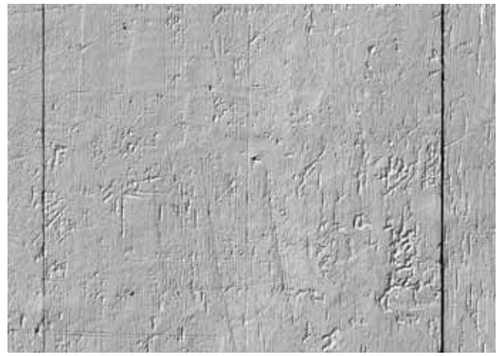
The resulting object both is and is not the Hereford Mappa Mundi. It is a faithful recording of the surface of the map, yet its three-dimensionality enables us to 'see' the map in new ways. It becomes clear that the map was always a three-dimensional object, rather than the two-dimensional image we usually see reproduced in books. We are also reminded that the map was created out of a three-dimensional calfskin, with all its surface variations. It is an undulating, rippling skin, across which the medieval mapmakers created rivers and continents, working with and against the creases, scars and folds of the animal's flayed body. It is the world made (from) flesh. When the map was first unveiled at the Hay Festival in June 2013, the audience response was remarkable. People rushed to touch the surface of the Factum map in a strikingly secular version of its original usage within Hereford Cathedral as an image of the world made by God.

There is another tantalising outcome to using such methods for digitally mapping the surface of a map. The facsimile shows that a compass was used in outlining Jerusalem and Crete. If digital investigation can match the holes made by the compass points on the map with those made on the backboard, then it can be proven that the map was made in Hereford, challenging generations of scholarly belief that it was first made in Lincoln before being transferred to Hereford Cathedral.

A modern map is usually regarded as a 2D abstraction of 3D topographical data. Factum's digital mapping methods effectively invert this process and recreate a 3D artefact from the 2D map, yet in the process reveal the practice that went into the original transformation from 3D to 2D. Nor is this transformative process confined to the Hereford Mappa Mundi. In 2017 Factum was invited by the Bodleian Library in Oxford to scan one of their most precious cartographic objects: the Muslim mapmaker al-Sharif al-Idrisi's geographical compilation with maps entitled the *Kitāb nuzhat al-mushtāq fī ikhtirāq al-āfāq*, which translates as the *Entertainment for He Who Longs to Travel the World*. The text was completed in Sicily in 1154 for its Norman ruler King Roger II. The original no longer exists but there are several surviving manuscript copies, including the one held in the Bodleian, which was copied in Constantinople in 1553. Idrisi's vast text also contains 70 regional maps which, if amalgamated (something Idrisi never proposed), would create the mental geography of the world according to this remarkable 12th-century mapmaker. In scanning all 70 maps, Factum were able to digitally stitch them together to create a composite world map of staggering beauty and detail. The resulting map was displayed for the first time alongside the 1553 book at the Bodleian Library's exhibition *Talking Maps* (July 2019 – March 2020).[5]

Displaying such a map offered a new perspective on Idrisi's world picture. Yet Factum's 3D replication methods were able to go even further. In his *Entertainment* Idrisi describes a subsequent commission from King Roger:

> A disk should be produced in pure silver of a large extent and of 400 Roman ratls in weight, each ratl of 112 dirhams and when it was ready he had engraved on it a map of the seven climates and their lands and regions, their shorelines and hinterlands, gulfs and seas, watercourses and places of rivers, their inhabited and uninhabited parts, what [distances] were between each locality there, either along frequented roads or in determined miles or authenticated measurements and known harbours according to the version appearing on the drawing board.[6]



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Detail of the render of the backboard showing the point made by the compass when the city of Jerusalem was marked onto the map above.

Detail of the exaggerated relief surface of the re-created Mappa Mundi without colour.

OPPOSITE

María Carmen Pascual working on a re-creation of the map with an exaggerated surface relief, 2018.

5 Jerry Brotton and Nick Millea, curators, *Talking Maps*, Bodleian Library, Oxford (5 July 2019 – 8 March 2020).
6 Quoted in Maqbul Ahmed, 'Cartography of Al-Sharif Al-Idrisi', in *The History of Cartography*, eds. Harley and Woodward, vol. 2 bk 1: *Cartography in the Traditional Islamic and South Asian Societies* (Chicago: Chicago University Press, 1992), 156–73: 159.

Having captured the topographical data in Idrisi's text that must have been used to create the silver disc, Factum were able to reproduce it based on the original specification. The map was never seen and was presumably melted down for its weight in silver at some time after King Roger's death in 1154. The result is a beautiful world map made in relief, but what is its status? Is it a copy of a lost original that was never described? Or a cartographic reimagining of a mental geography that enables us to see the world as Idrisi and Roger did in 1154? Both the philosophical and geographical ramifications of this digital act of remapping a lost map remain in the domain of subsequent research that will undoubtedly flow from this unique digital mediation between past and present.

The processes used by Factum can go even further. As well as bringing objects like Idrisi's silver disc back to life from the distant past, it is now possible to remap our globalised world with astonishing results. For several years Factum have been projecting a new 3D map of the world with the oceans' water removed, using a rectangular projection and bathymetric data, challenging us to see the world around us in shocking new light. Using the title and practice of 'Terra-forming', the resulting model suggests a profound reconsideration of how we imagine the globe as both a subject and an object.[7] Whereas globalisation as a critical and economic concept imagines a fantasy of the globe upon which we live as a smooth surface across which capital moves unimpeded by geography, the 'Terra-forming' model presents us with a very different image of how we map our world.

'Terra-forming' also stretches the possibilities of a map to breaking point in making its environmental point: by slowly flooding the map over many hours and days until reaching current sea levels, the world can then be slowly 'drowned' as a statement of the current fears surrounding climate change. Nevertheless, to paraphrase Harley and Woodward, Factum's endeavour is to facilitate a spatial understanding of processes or events in the human world. Their practice suggests that the future looks less like a text and more like a map.

7 Jerry Brotton and Adam Lowe, 'Re-visioning the World: Mapping the Lithosphere', in *Aesthetics of Universal Knowledge*, eds. Pasquale Gagliardi, Simon Schaffer and John Tresch (Cham: Palgrave Macmillan, 2017), 31–51.

THE WAY WE SEE THE WORLD

Adam Lowe

Adapted from a text published in *Modelling Time. The Permanent Collection 1925–2014*, eds. Mari Lending and Mari Hvattum (Oslo: Torpedo Press, 2014)

Adam Lowe is the Director of Factum Arte and the founder of Factum Foundation for Digital Technology in Conservation.

Wilson's Cloud Chamber, designed by Charles Wilson while working on the summit of Ben Nevis in 1894, may have failed to predict the weather but after he joined the team at the Cavendish Laboratories in Cambridge the following year, his model did provide Lord Rutherford with new insights into the complexity of nuclear physics. Physical models have often yielded surprising insights.

It is hoped that Factum Arte's planned model of the surface of our globe without water will find many applications and provoke a range of conversations. Mapping the surface of the lithosphere requires a combination of topographic and bathymetric data. It has great importance not only for territorial disputes focused on the Arctic and Antarctic, but also for understanding the dynamic nature of our relationship with water. As we enter the Anthropocene epoch (or era, depending on how long it is likely to last), this relationship and its constantly changing parameters should be a reason to pause before we go down the route of geo-engineering. The relationships between the lithosphere, biosphere, atmosphere and stratosphere are delicate, dynamic, inter-related and beyond the understanding of the ethnosphere.

The model of the surface of the earth has been assembled from publicly available data. It is intended to be made on a vast scale to be in dialogue with the model built in 1851 in Leicester Square by James Wylde, which had a diameter of 18.9 m, and the proposal by Élisée Reclus for the World Expo of 1900, which was intended to be 160 m in diameter and to contain a second revolving globe 127.5 m in diameter. Reclus' project was never realised, but it continues to influence generations of imaginative thinkers.

The first three-dimensional physical tests were completed in Madrid in 2013. An equi-rectangular projection was carved into a tonally layered block of plaster measuring 50 x 100 cm. The highest points are white. They are 8 cm above the darkest points that represent depth. In this model, a terra-centric projection, north is no longer at the top. The globe was rotated before being projected onto a rectangle so that areas of water – rather than the two polar icecaps – are stretched to infinity at top and bottom. The relief of the surface has been exaggerated by a factor of 100 in order to draw attention to the relief on the surface of the planet. When represented at this scale with no exaggeration, the surface would be as smooth as a billiard ball.

A 2 x 4 m version was shown in the exhibition *Anthropocène Monument*, curated by Bruno Latour for Les Abattoirs in Toulouse in 2014. Since then, the data has been updated as it becomes available and a large-scale version is now planned. It does not propose simply to represent our environment: rather, it insists on the processes through which dynamic environment is shaped and altered.

The historian of science Simon Schaffer has written that 'the concept of the "sublime" was invented to make sense of things beyond our comprehension. Vast things and

OPPOSITE

The first map of the lithosphere. Willem Goeree, *Voor-Bereidselen Tot de Bybelsche Wysheid en Gebruik der Heilige…*, Amsterdam, 1690.

THIS PAGE

The 2 x 4 m 3D relief projection of the world shown as part of the exhibition *Anthropocène Monument* in Les Abattoirs, Toulouse, 2014.

OPPOSITE

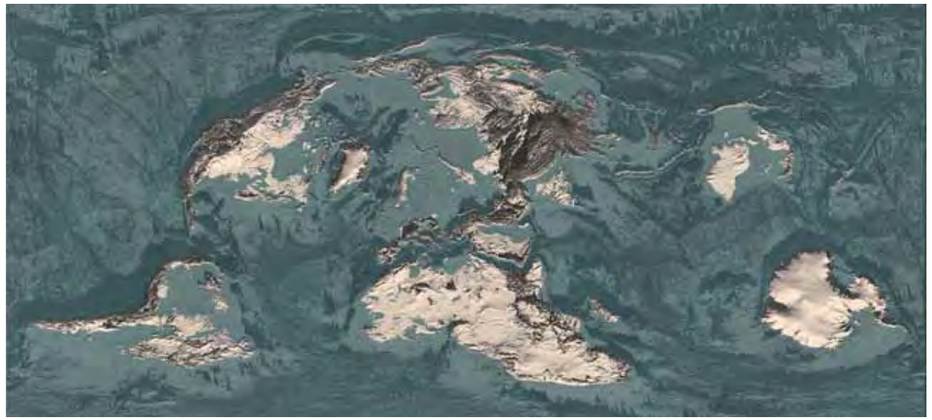
The earth without water.

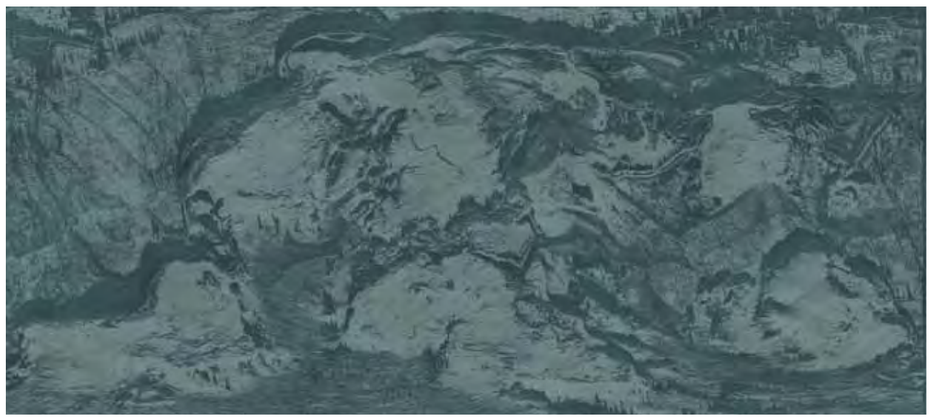
Partially submerged earth.

The earth submerged.

natural phenomena are favoured subjects; not only floods, storms, eruptions, chasms and cities but also over-population, global warming and climate change. These things can freeze with fear or be a prompt to action. The decision to take charge and act is constantly frustrated because of a massive failure of vision, of aesthetics'. The aim of a physical model of the earth's surface cast into cement or carved into stone is to give the aesthetic voice a role in the discussion about climate change. The equi-rectangular projection will be slowly flooded with water. The process will be indiscriminate and uniform, with the water being pumped in until the top of Mount Everest has been covered. While this is a physical impossibility in the real world, on a scaled model it acts as a poetic statement. The watery surface will act as a 'screen' onto which dynamic maps of temperature, gulf streams, radioactivity, salinity, political boundaries, light pollution, and other phenomena can be projected. The physical relief map will become an animated event that can be updated, experienced, discussed and posted or shared on social media. The model makes the data more coherent and vice versa.

Changing the projection used to represent the surface of the spherical planet onto a flat plane changes the way we perceive the planet. It provides a new perspective, a new point of view.





RE-CREATING THE LOST SILVER MAP OF AL-IDRISI

Elizabeth Mitchell

Elizabeth Mitchell has a doctorate in Greco-Roman archaeology from Harvard University. She writes, edits, and works on recording projects for Factum Foundation.

The map of the world completed by the Islamic cartographer al-Idrisi in 1153 was a masterpiece of mapping which remained the most technically sophisticated world map for three centuries after its production. Drawing on several centuries of Greco-Roman and Islamic cartographic research, al-Idrisi produced both a book of 70 maps covering the surface of the known world, and a single, round map engraved onto a silver disk and set into a wooden table, with Mecca at its centre.

It was a map made for a culturally hybrid – and highly volatile – Mediterranean. Al-Idrisi's patron was the Norman king Roger II, whose father and uncle had conquered the Arab Emirate of Sicily in the 11th century and who ruled from Palermo over a culturally and linguistically diverse population: Roger commissioned Arab artisans to produce art and architecture for the court at Palermo, and many Arab bureaucratic structures remained in place. Perhaps because of its large Islamic population, Sicily held back while other European powers were embarking on the failed Second Crusade in 1147–49 – but Roger's powerful navy was less forgiving of other Mediterranean competitors, engaging in campaigns of conquest and ransack on the Tunisian and Greek coastlines as well as on Malta and in southern Italy. While Mecca may have been at the centre of al-Idrisi's map, the Mediterranean looms large, with Sicily an outsized triangle at its centre.

The silver disk is now lost, and the book, the *Entertainment for He Who Longs to Travel the World* (*Nuzhat al-mushtāq fi'khtirāq al-afāq*; also known as the *Book of Roger*), survives only through later copies. But in a groundbreaking collaboration with the Bodleian Library, Jerry Brotton, and Daniel Crouch Rare Books, Factum Foundation has undertaken to re-create al-Idrisi's fabled silver map. Neither facsimile nor copy, this re-creation, which is 2 m in diameter, nonetheless combines painstaking historical research with advanced digital techniques and the highest levels of craftsmanship, paying tribute to the lost original and offering yet another layer to add to the complexity of its transmission.

The process began with the high-resolution photographic recording of a 16th-century copy of the *Entertainment* held by Oxford's Bodleian Library. The 70 maps from the *Entertainment* were stitched together digitally, and discrepancies where one page meets another were adjusted to create a continuous rectangular map of the world. This was then distorted into circular shape, keeping Mecca at the centre, and converted to a vectorised file – essentially a line drawing. While some of these processes could be automised, this was an endeavour that relied heavily on time-consuming human skill – as for example with the hundreds of Arabic place names, which had to be extracted from the composite rectangle and re-placed individually on the final circular image in order to avoid distortion.

Where al-Idrisi's map would have been engraved by hand, the re-creation used CNC milling machines to engrave the contours of cities and coastlines onto the silver surface. Far from representing a de-skilling of the engraving process, however, Factum

OPPOSITE

Engraving the silver map of al-Idrisi.

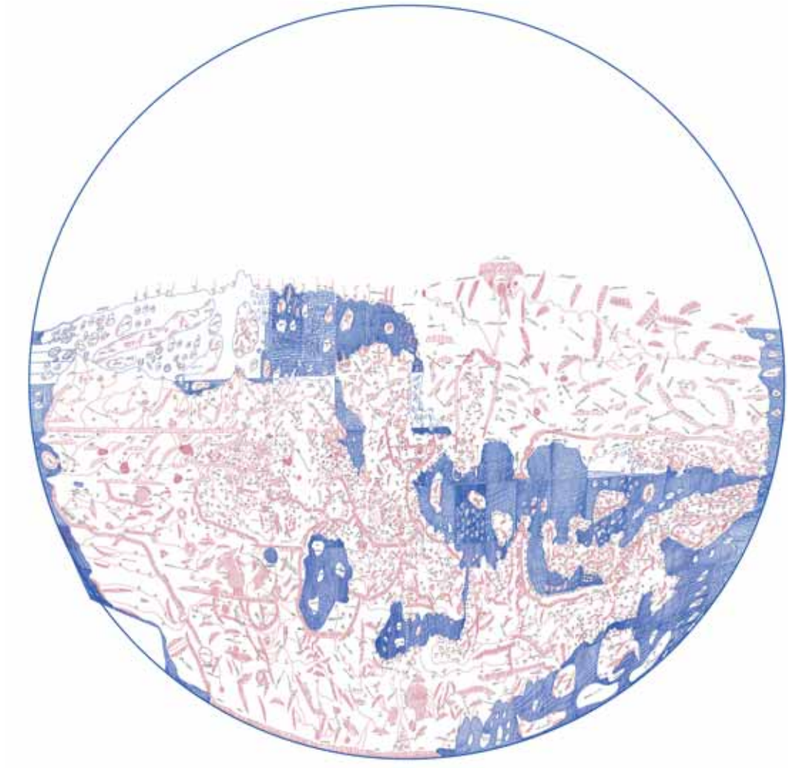
THIS PAGE

The composite map was transformed into a vectorised image, allowing it to be engraved using CNC milling.

OPPOSITE

Casado vectorising the map in preparation for engraving.

Ms. Pococke 375, a representation of al-Idrisi's world map made in the 1550s, now in the Bodleian Library, Oxford.



Foundation's use of these machines regularly pushes them to previously unimaginable limits. In this instance, in order to replicate as closely as possible the hand-engraving process, the usual drill was replaced with a spring-loaded tool able to cut without rotating, which applies a similar pressure to that made in hand-engraving. This allows for the creation of remarkably precise details through the reworking of the same surface multiple times in finer and finer definition. The finished plates, eight in total, were then joined together by a silversmith and polished.

The re-created map of al-Idrisi allows the traveller of the 21st century to undertake an unprecedented journey: both through the landscape of the 12th-century geographical imagination, and across the shining surface of advanced mapping and making technologies. One map has already been given to the Bodleian Library, where it has been displayed as part of the exhibition *Talking Maps*, and the intention is to donate a further copy to the city of Palermo, 'returning' this unique artwork to the place where its ancestor was once beaten and engraved from a disk of pure silver.

RECORDING AN OTTOMAN-VENETIAN WORLD MAP

Guendalina Damone

Guendalina Damone is conducting graduate work in the Conservation of Historical and Artistic Heritage at the University of Udine. She has led the Factum Foundation office in Milan since 2014, and the Foundation's laboratory at the ARCHiVe digitisation centre in Venice since 2018.

The Ottoman-Venetian heart-shaped map of the world now preserved in the Biblioteca Marciana in Venice was found in 1795 in the Criminal Archive of the Council of Ten, in the Doges' Palace in Venice. Dating to the second half of the 16th century, it has traditionally been attributed to the Tunisian Hajji Ahmed, although recent studies have suggested that it was a multi-author project conceived in Venice in 1559–69. The map carries text in Ottoman Turkish and must be understood within the context of commercial relations between the Republic of Venice and the Ottoman Empire; in that period Constantinople was making frequent cartographic requests of Venice, and this map was probably designed for the Ottoman market.

The object preserved by the Biblioteca Marciana is the map's matrix, comprising six engraved wooden blocks measuring 106 x 110 cm and two woodblock prints made from the matrix at the end of the 18th century measuring 111 x 113.5 cm. The matrix shows a cordiform earth (a projection in the form of a heart, a configuration common at the time), with place names written in Arabic letters and a 292-line text in Ottoman Turkish to left and right. The text is divided into five sections: prologue, introduction, description of the continents, descriptions of the twelve main provinces of the world and of the seven great lords, and epilogue. In the lower part of the map are an armillary sphere and two celestial spheres – distinctively European subjects of representation, as Abbot Assemani has remarked, which are found at the same time period in the work of Albrecht Dürer among others. Map, text, and spheres are framed by a string of floral motifs, broken only at the top by the title, 'Kemâlîyle naqš olunmıš jümle jihân nümûnesi', which translates as 'Perfect and complete engraving and description of the whole world'.

In February 2019, the Factum Foundation team collaborated with two students from IUAV University of Venice's Digital Architecture masters programme, Mario Costa and Fabio Martinello, to record the map. The recording was part of an initiative led by ARCHiVe (Analysis and Recording of Cultural Heritage in Venice), and was framed as a comparative study designed to assess the merits of three recording techniques: photogrammetry, laser scanning, and the Lucida 3D Scanner.

The photogrammetric survey was conducted using a Nikon D800 reflex with a 50mm lens, with the data processing employing the Agisoft Metashape Pro Software. A Range 7 triangulation laser scanner, employing both a telephoto lens and a wide angle lens (precision ± 40 microns), was then used to re-record the map. Alignment for the laser scanner was performed using Geomagic Studio software. Finally, the map was recorded with the Lucida 3D Scanner, which is designed for the acquisition of 3D information from objects with an almost flat surface, such as paintings or bas-reliefs. At the end of the investigation, a section (10 x 10 cm) of the data collected from the different systems was printed in 3D. The information acquired through the Lucida Scanner was the closest

OPPOSITE

The wooden matrices of the Ottoman-Venetian map.

THIS PAGE

The re-materialised matrices were used to create a new print of the map.

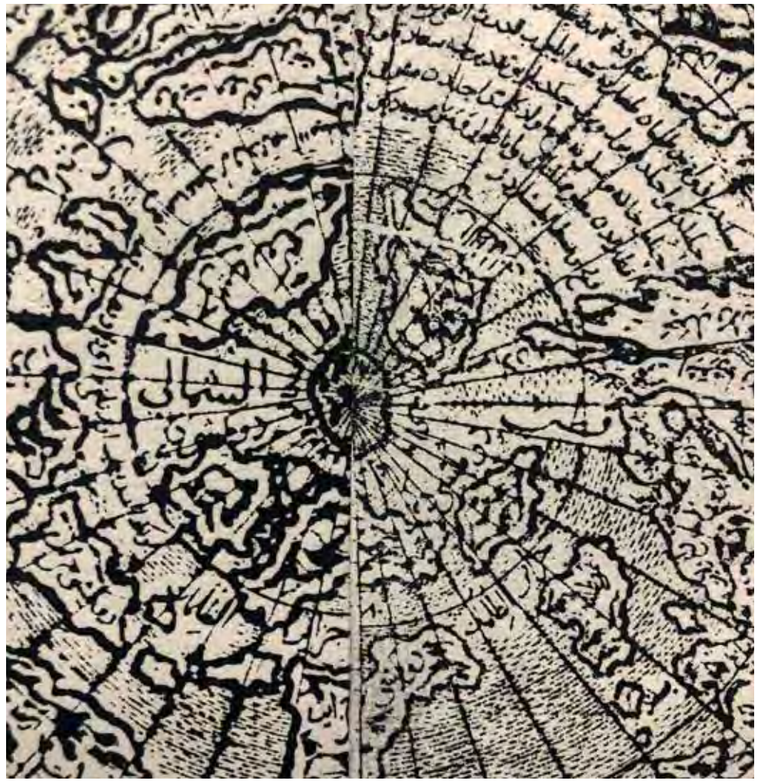
OPPOSITE

Mike Ward printing from the routed facsimiles of the matrices.

Detail of a print from one of the rematerialised matrices.

to the surface of the original matrix. The correspondence was so close that the data could be CNC routed into panels and used to remake a printed image of the map.

Should the Biblioteca Marciana decide to, it will now be possible to use the scan data as a base for digital restoration. Factum Foundation is a pioneer in this sector, working in close contact with universities, technical experts and art historians to develop and implement strategies for restoring objects in virtual space. The blocks that make up the matrix of the Ottoman-Venetian map have deteriorated considerably since they were first made, and there are several gaps in the map; using the scan data and the existing maps, it would be possible to propose restoration options for several of these gaps, leading to a more complete 3D model that could then be rematerialised and used to print new, 'restored' maps, and allowing conservators to identify the most appropriate actions to take in order to conserve the original object.



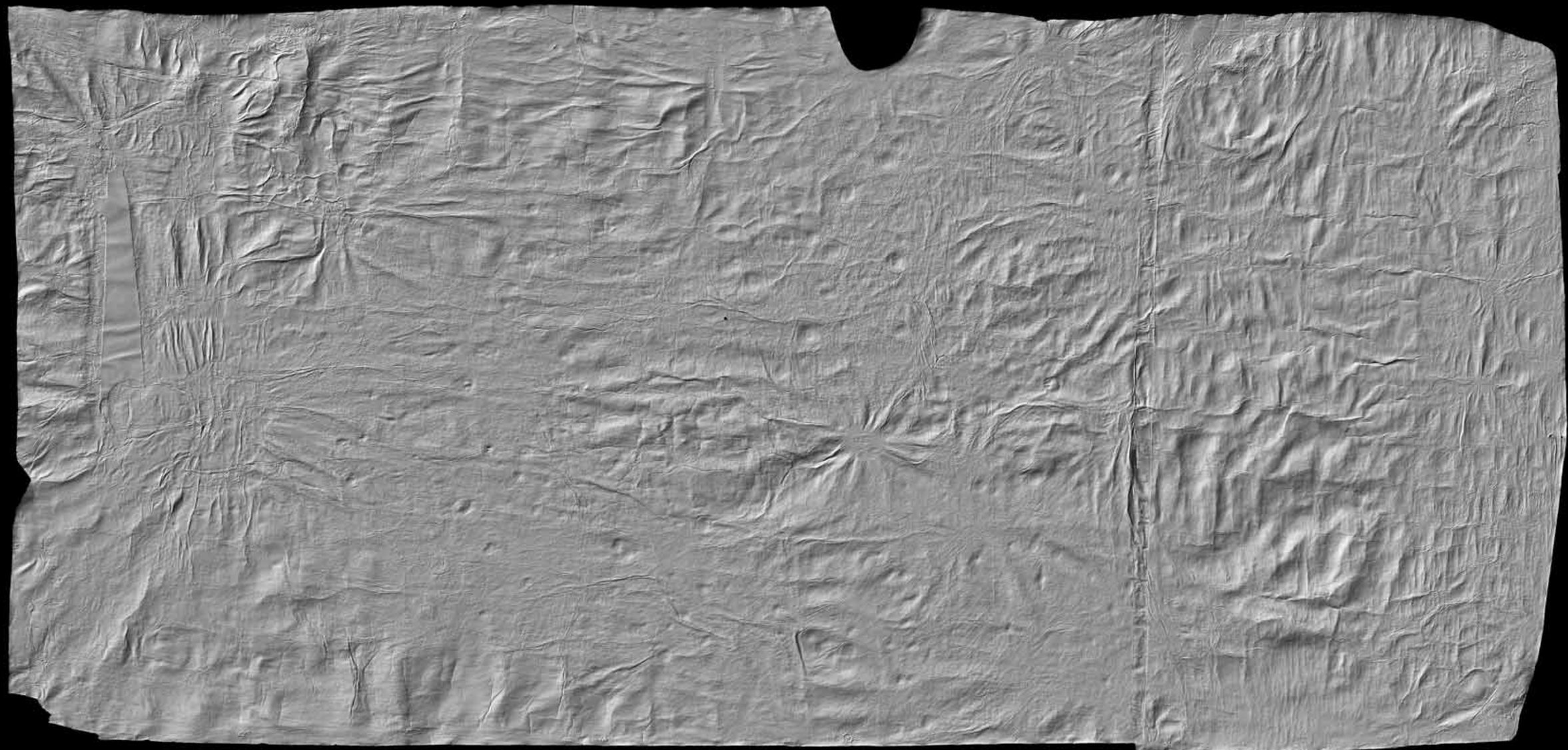
FOLLOWING PAGES

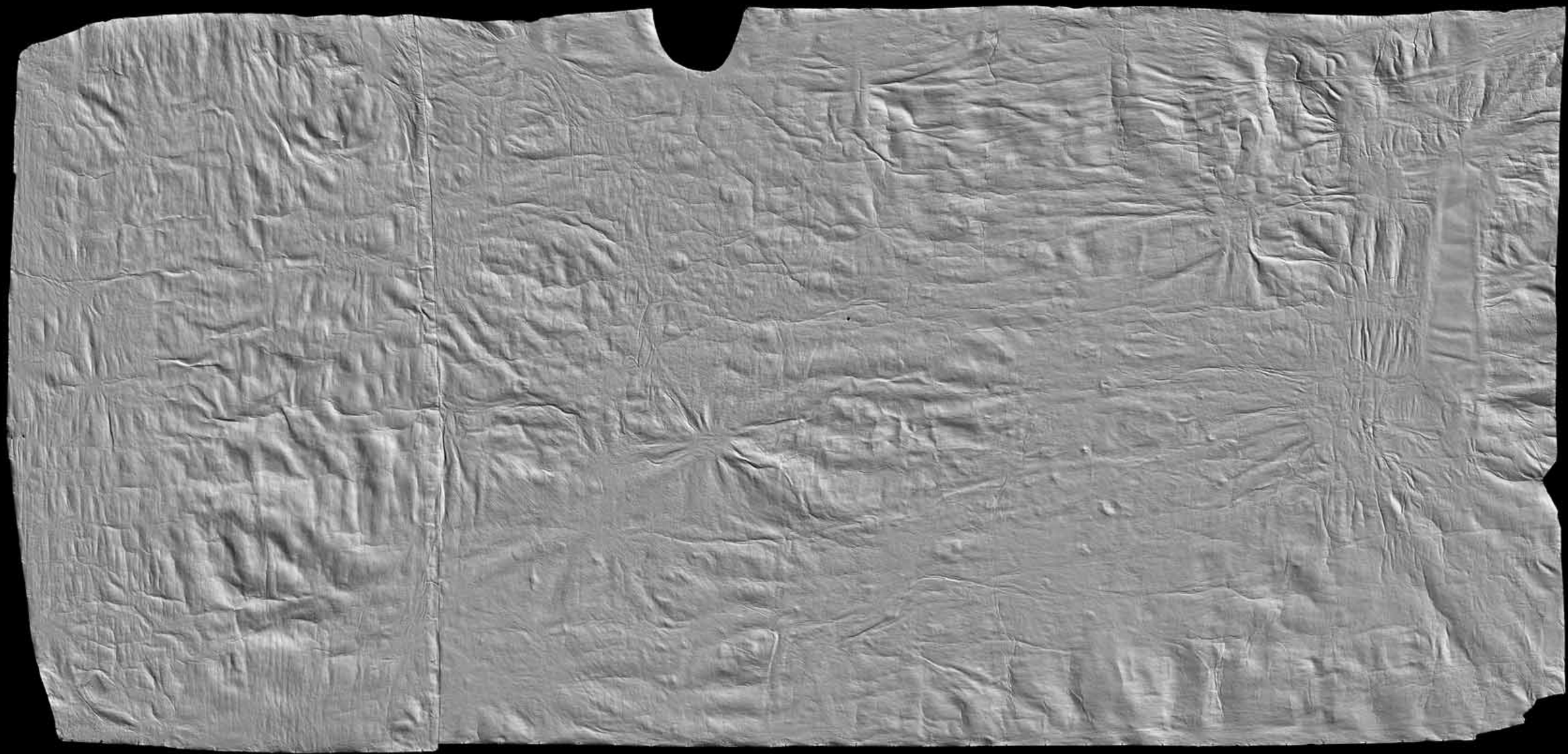
Render of the Gough Map with colour and 3D registered together.

Colour data for the back of the map.

Render of the 3D data for the front of the map.

Render of the 3D data for the back of the map.





THE GOUGH MAP. REVEALING FUNCTION THROUGH CARTOGRAPHY

Catherine Delano-Smith and Damien Bove

Catherine Delano-Smith, formerly reader in Historical Geography, University of Nottingham, is senior research fellow at the Institute of Historical Research, School of Advanced Studies, University of London. She has written extensively on early maps and mapping and is the editor of *Imago Mundi. The International Journal for the History of Cartography*. She is also currently the lead academic for the three-year research project 'Understanding the medieval Gough Map through physics, chemistry and history'.

Damien Bove is the research assistant for the project 'Understanding the medieval Gough Map through physics, chemistry and history'. He is also a freelance researcher and the picture editor for *Imago Mundi*.

OPPOSITE

Recording the Gough Map in the Bodleian Library, Oxford, 2014.

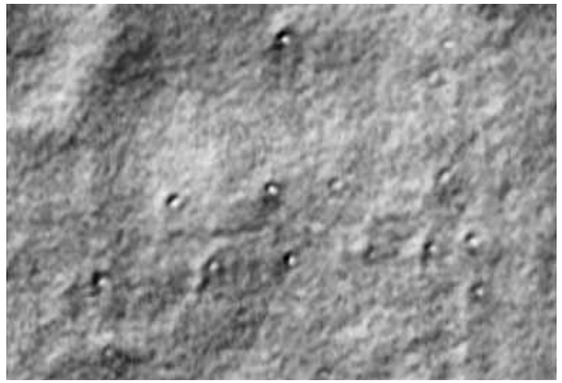
The Gough Map of Britain (c. 1400), bequeathed to the Bodleian Library by Richard Gough in 1809 (Gough Gen. Top. 16), was drawn on two pieces of parchment stitched together to make one large sheet (115 × 56 cm).[1] The complexity of the cartographical image, which is dominated by some 660 places portrayed pictorially, presents a challenge to historians seeking to discover the physical processes of compilation and the reasons for the map. In 2015, in the course of two related research projects, the latter supported by the Leverhulme Trust (RPG-2019-070), Factum Arte undertook 3D scans of the document, recto and verso.[2] The objective was to record the total distribution of the pinholes scattered about the map (long known to be present but never studied) and explain their origin and function, as well as to discover any other markings not discernible by the naked eye.[3]

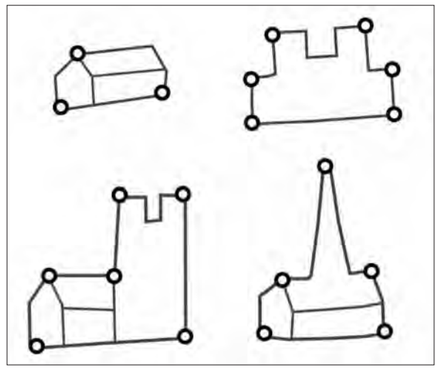
The outcome exceeded expectations. The 3D scan not only allowed the plotting of a more or less complete distribution of the pricked holes, but also revealed a number of unsuspected scored outlines, both features connected with the settlement signs and some regional labels. The mismatch between the pricked outline of the sign, some rubrication and the final inked lines testify to an *ad hoc* sequence of alteration and amendment and confirm the use of the map specifically for consultation. No less significant was the discovery that the pinholes are absent from one part of the map (East Anglia and Kent).

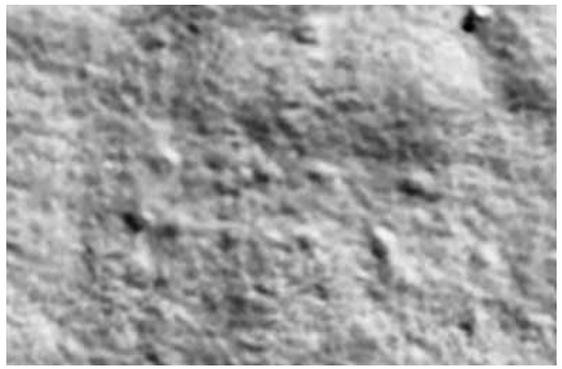
Evidence from the 3D scan points to the use of a pin in copying features *from* an unknown exemplar *onto* the new, appropriately-sized, parchment; as far as can be seen from the verso, almost no hole has penetrated the sheepskin and only a tiny bump, revealed by the 3D scan, betrays the pricking.[4] This is a key discovery, explaining the pinholes, documenting a so-far unparalleled map-making process, directing attention to the origins of the Gough Map, and highlighting to an extraordinary degree the way the map was used and repeatedly amended.

On some occasions the mismatch of pinholes and inked lines can be ascribed to the need to position the drawn sign more appropriately (not in the middle of a river, for instance, or because of a blemish on the skin, revealed only by the 3D scan). Elsewhere it hints at changed local circumstances (as when a towered sign is indicated by the pinholes, but only the adjacent small cottage element was inked). The lack of any pricking at all in

1 Nick Millea, *The Gough Map: The Earliest Road Map of Great Britain?* (Oxford: Bodleian Library, 2007).
2 Catherine Delano-Smith et al., 'New Light on the Medieval Gough Map of Britain', *Imago Mundi. The International Journal for the History of Cartography*, no. 69, 1 (2017): 1–36.
3 W. B. Sanders, 'Map of England and Scotland (author unknown) preserved in the Bodleian Library, probable date, about 1300', in *The Thirty-Second Report of the Deputy Keeper of Public Records*, no. 1 (Southampton, Ordnance Survey; London, HMSO, 1871).
4 The removal of the glued backing of the map, and extensive patching undertaken as part of conservation somewhat confuses what can be seen.







OPPOSITE, CLOCKWISE FROM TOP LEFT

Detail from the Gough Map showing the pictorial sign for Hull, Yorkshire. Bodleian Library, Oxford, MS Gough Gen. Top. 16. Reproduced with the permission of the Bodleian Library, Oxford.

Details from the 3D scan of the Gough Map showing (top) the pinholes marking out the shape of the pictorial sign for Hull, Yorkshire, and (bottom) the bumps on the verso made by the pins. Bodleian Library, Oxford, MS Gough Gen. Top. 16. Reproduced with the permission of the Bodleian Library, Oxford.

General distribution of pinholes on the Gough Map. The lack of any pricking in East Anglia and Kent clearly anticipated the need to reconfigure the coastline of southeast England according to new information. Geographical features in this part of England had to be drawn directly onto the parchment instead of being pricked off from a template. The vertical line crossing the map near its centre corresponds to Hadrian's Wall.

Standard groupings of pinholes on the Gough Map showing how they fit the pictorial town signs. D. Bove.

FOLLOWING PAGES

Render of the surface of the Illés Map, a 1:500 scale model of Jerusalem made between 1864 and 1873 by Stephan Illés, now on permanent loan from the Maison de la Réformation SA in Geneva to the Tower of David Museum in Jerusalem.

Panoramic photograph of Giovanni da Modena's *Last Judgement* in the Basilica of San Petronio before perspectival correction.

LiDAR scan of the interior of the Pantheon in Rome, 2019.

East Anglia and Kent, however, clearly anticipated the need to reconfigure the coastline of southeast England according to new information.[5] The hitherto unseen grooves scored around some of the regional labels are not always associated with pinholes and seem to have been a different way of indicating the outline of the label that was later to be inked.

The clerks in the royal household conjectured to have been responsible for the Gough Map, working on it intermittently, cannot be thought of as map-makers. They appear to have been working for their own purposes, probably in connection with domestic administration, without established map-making techniques. Their prickings and scorings, revealed so remarkably by the 3D image, reflect their struggles and their experiments.

5 By the early 14th century, Mediterranean traders and navigators were arriving in London from the Bay of Biscay and the Channel with their charts; 'New light' (see note 2), p. 18 and Fig. 7.

CHAPTER 5

ACCESS AND DISPLAY

THROUGH THE LOOKING GLASS. TRANSPORTIVE ARCHITECTURE

Charlotte Skene Catling

Charlotte Skene Catling is an architect. With her practice, Skene Catling de la Peña, she designed the exhibitions *Madame de Pompadour in the Frame* at Waddesdon Manor and *Scanning Seti: The Regeneration of a Pharaonic Tomb* at the Antikenmuseum, Basel, among other collaborations with Adam Lowe.

The exhibition *Madame de Pompadour in the Frame* opened in May 2019. It was originally scheduled to run for four months but has now been extended to May 2020.

It is strange to dream, and to have mirrors
Where the commonplace, worn-out repertory
Of every day may include the illusory
Profound globe that reflections scheme.

Jorge Luis Borges, 'Mirrors', in *Dreamtigers*, trans. Mildred Boyer and Harold Morland [1960] (Austin: University of Texas Press, 1964), 60–61.

The biography of a painting can be almost as complex as that of its subject. The exhibition *Madame de Pompadour in the Frame* was built around a facsimile by Factum Foundation of François Boucher's famous 1756 portrait of the all-powerful, Enlightenment *maitresse-en-titre* of Louis XV. The initial idea was to replicate Boucher's portrait, reunite it with the frame it once occupied and to display them together. But the idea grew… A smaller Boucher oil sketch of Madame de Pompadour in an elaborate 18th-century gilded frame remains at Waddesdon. By Factum also recording and replicating this sketch, there was the rare possibility to display an original and a facsimile next to one another, challenging visitors to determine which was which. Then it became important for the show to explain what this means and why it matters. This is a description of the exhibition, of the intention behind the design, and some reflections that emerged during the process.

THE MIGRATION OF THE OBJECT

It remains a mystery how, or why, Boucher's portrait was separated from its frame – no-one today knows. It was painted while Madame de Pompadour was living at Versailles. After her death, the vast quantity of her possessions were split up and sold by her brother and soon after, the royal collections were dispersed as the French Revolution unfolded. By the late 19th century, the Pompadour portrait had travelled to London, where it belonged to Baron Ferdinand de Rothschild as part of his large accumulation of Ancien Régime artworks. Around the time Ferdinand acquired the portrait, it was reframed. When he died in 1898, he left the portrait to his brother Nathaniel and although the canvas eventually found its way to Germany, the elaborate 18th-century frame, with its 19th-century cartouche and decorations that mimic the flowers on Pompadour's dress, was kept. Today, the painting belongs to the HypoVereinsbank but is on permanent loan to the Alte Pinakothek in Munich, where it is one of the most important in their collection.

The painting depicts Madame de Pompadour reclining on a striped chaise and embroidered satin cushions, framed by curtains and swags of gold silk damask. The vast mirror behind her extends outside the frame of the painting. It reflects the back of her

PREVIOUS PAGE

A facsimile of Leonardo da Vinci's *Last Supper* displayed as part of an installation by Peter Greenaway, Park Avenue Armory, New York, 2010.

OPPOSITE

Charles-Germain de Saint-Aubin, *La verité Surmonte L'Autorité* (*Truth Overcomes Authority*), 1757. Waddesdon (National Trust), Bequest of James de Rothschild, 1957. Photo Waddesdon Image Library, Bodleian Imaging Services.

head and the bow at the nape of her neck, bookcases, and the putto of an ornate clock, and it allows a view into a shadowy place beyond. Pompadour – a pale pink and white bust, forearms and hands, and a pair of tiny, slippered feet – emerges like sculpted porcelain from a frothy sea of turquoise taffeta, white lace, pearls, pink roses and a corset of pink silk ribbons and bows. Pompadour used portraits to communicate with the King as well as to shape a public perception of herself: here the image is of beauty and purity, framed in sensuality and balanced with intellect, kindness and devotion. Boucher was a favourite collaborator. She holds an open book in her lap. Surrounding her are symbols of biographical detail: a writing desk with a quill resting in an inkstand, a half-written letter, her seal and wax, a patient spaniel sitting loyally at her feet, a leather-bound book from her own printing press with the stamp markings of her arms, loose manuscripts and engravings, rolls of architectural drawings and a pair of roses crossed with engraving tools. She gazes affectionately beyond the edge of the painting – one assumes towards the King, or at least the thought of him.

PAST, PRESENT AND FUTURE

Madame de Pompadour's Rococo portrait is part of the story of Versailles but also of the Rothschild's family past and the Alte Pinakothek's present. In each of these contexts, it has a very different meaning. Pompadour might be surprised to find a facsimile of herself at Waddesdon Manor, a house commissioned by Ferdinand de Rothschild that looks like a Loire Valley château conjured into the English countryside. When her portrait was painted, France was at war with Britain. Facsimiles allow objects to be in more than one place at once – to travel back to former contexts or forward to new ones. A facsimile has reunited Boucher's portrait with the 18th-century frame that ended up at Waddesdon in an act that questions the relationship between originals and facsimiles, technology and art, and the way we value things and move them from one place to another. It demonstrates the role digital recording and facsimile-making can play in preserving and disseminating cultural heritage. From this, questions proliferate and as they multiply, culture comes vibrantly to life as a primary form of communication. Madame de Pompadour was an Enlightenment inspiration. Back in her frame at Waddesdon, she becomes part of the discourse of today.

In 2018, the Alte Pinakothek gave Factum Foundation permission to digitally record Boucher's portrait in high resolution. An agreement was made according to the protocol Factum has developed around its recording and output technologies, whereby the Alte Pinakothek gains the data in colour and 3D and retains full control of the copyright for all current and future commercial applications. In return, they allow Waddesdon to make one exact copy of the painting.

The Exhibition Room in the North Passage on the first floor of Waddesdon Manor is a room of 5 x 6 m with high ceilings and walls dressed in a deep red damask, suggesting the high fashion of Victorian mourning. The light that enters through two tall windows is immediately swallowed into the burgundy gloam before it can reach the opposite wall. A dark red carpet covers the floor. A narrow corridor off the end of this space – 8.5 m long by 1.5 m wide forms a tail that leads to a small, bright room with pale walls of glass-fronted cabinets filled with Sèvres porcelain: figures of flirting shepherdesses and table settings in brilliant blues, pinks and golds. 'Rose Pompadour' was the pink ground invented by Sèvres in 1757.

The facsimile of Boucher's *Madame de Pompadour* (1756) displayed at Waddesdon Manor. It was scanned from an original in the Alte Pinakothek, Munich, where it is on permanent loan from the HypoVereinsbank, Member of UniCredit.

PORTALS

A painting can be a portal that leads far beyond the visible contents of a picture. The composition, the language, and the symbolic objects of Boucher's portrait are all layers of a complex narrative. Although the intention was not to focus on the character of Madame de Pompadour, the biography of the painting revealed aspects of her own extraordinary life that have relevance today. The aim of the facsimile and the exhibition design was to amplify the multiple narratives of the painting to produce a space that throws the portal further open and draws the viewer through. It was decided to block the two windows directly opposite the entrance and effectively split the space into two: the long exit corridor was extended into an even longer strip using a theatrical gauze, and the main room was turned into a 5 x 5 m square. On entering the exhibition, the eye is immediately drawn to Madame de Pompadour in her frame on the end wall, making her the literal centrepiece of the show as well as its subject. The dividing frame of gauze was digitally printed with elements of the damask cloth from her portrait and focuses attention onto the facsimile of the painting and its frame. The walls of the long strip were painted the same mole grey as in the portrait's mirror reflection, with the effect of extending the painting beyond its frame and into real space. The gauze conceals the door to the exit corridor, so allowing an element of discovery and successive experiences.

FRAMES WITHIN FRAMES

The main room was painted the pale rose of Madame de Pompadour's skin, and a carpet of the same fleshy colour replaced the deep red one. The walls were divided by strips of bevelled mirror framing the Rococo panels of Boucher's *Nouveaux morceaux pour des paravents* (*New works for screens*) designed between 1730 and 1740 and

depicting the *Triomphe de Pomone* (1740), *Triomphe de Priape* (1737), *Rocaille* (1730s), *Hommage champètre* (1740) and *Léda* (1740). Following the Siamese Ambassador's visit to Versailles in 1686, Chinese screens became very fashionable in France. Diderot and d'Alembert's *Encyclopédie* includes examples, and *Chinoiserie* was absorbed into the Rococo style.

In Boucher's screens, architecture is overtaken by an aesthetic of constantly shifting movement; materials become indistinguishable from one another as they dissolve from picture frame to plant tendril, spiky coral branch, waves, waterfalls, vines and ribbons. The viewer is pulled through successive openings, impossible perspectives, abstractions and layers of illusory depth. The role played by frames within these Rococo fantasies is at once paramount and elusive: they distract as much as they focus. Erotic scenes of mythological and pastoral love undulate among broken statues and pediments; time is compressed into a single, restless moment that unites relic, reproduction, and the possibility of renewal. Responding to Factum's interest in art and illusion, originality and authenticity, as well as the 18th-century approach to the role of the copy, the screens also play with the way a subject can be expressed in different materials. Boucher's panels began as drawings that were turned into engravings, probably designed to be painted on paper mounted to canvas or woven as tapestries. Here they have been digitally printed onto pale pink, padded silk, fixed to boards and wall mounted. Similarly, Pompadour's print engravings reproduce drawings by Boucher, themselves reworkings of carnelians carved by court gemstone engraver Jacques Guay. In the 18th century, skilled translations between different media were highly regarded. Boucher includes a putto engraved by Pompadour in his portrait, represented through a fourth medium – oil paint. Factum's facsimile becomes a fifth, made by printing pigment onto gesso.

THIS PAGE

View of the exhibition showing the Lucida Scanner and Rococo wall panels with mirrored surrounds.

OPPOSITE

Cabinet containing production artefacts from previous projects.

WORM-EATEN

To fit the proportions of the room, Boucher's compositions have been extended at their base by the addition of five different framed panels of 'digital vermiculated rustication'. These panels were developed with Adam Lowe and were 3D-modelled by Irene Gaumé at Factum, eventually to be CNC routed into stone. Boucher's panels merge the mythological past and pastoral idyll reclaimed by nature, only to be reborn again. Similarly, rustication is the symbolic, sculpted transition from raw material to rarified architectural composition, animated by shadow. The routed patterns are based on rock and crystal forms, petrified underwater creatures or their fossilised remains. This vermiculated or 'worm-eaten' rustication is masonry as 'Memento Mori', a 21st-century architectural Vanitas, speaking of life, death, dirt and time.

GALERIES DES GLACES

The mirrored frames create yet more layers of infinitely extended space and make the edges of the room dissolve. Through these mirrors, Madame de Pompadour is omnipresent – visible on every wall. As visitors move through the dimly lit space, Pompadour's opaline face flickers in and out of view and she can be caught gazing at multiples of her own reflected image in a series of confrontations between original and facsimile. Bevelled edges add further kaleidoscopic multiplications, extending and partly abstracting Boucher's palette of turquoise, fleshy rose, mole grey and muted gold. The mirrors are a reference to the Galerie des Glaces (Hall of Mirrors) at Versailles where, on the night of 24 February 1745, at the masked Bal des Ifs (Yew Tree Ball), King Louis XV first declared himself to Jeanne-Antoinette Poisson. She was disguised as Diana the Huntress. The King was disguised as a tree, accompanied by a small forest of courtiers.

LAITERIE D'AGRÉMENT

Jeanne-Antoinette Poisson was not born an aristocrat. She took the title of Marquise de Pompadour after moving to Versailles. She exemplified the Age of Reason: a friend of Voltaire and Montesquieu, she was initially a supporter of Diderot and his *Encyclopédie* despite the disapproval of the Church and the King. She wielded enormous political influence and was involved in negotiations that led to the first Treaty of Versailles in 1756. Pompadour was an opera singer as well as an accomplished artist, print and gem engraver, champion of the Rococo style and great patron of the arts. She would distract and entertain the King with architecture, his favourite pastime. From Crecy to Bellevue, Fontainebleau and Elysée, together they bought, built and refurbished chateaux, theatres, hermitages and *petits appartements*, killing time and a large chunk of the Kingdom's taxes. The aristocratic mania for milk and rural life, or a rarefied simulacrum of it, led to a whole genre of architectural contrivance: the *laiterie d'agrément* or pleasure dairy, little temples to health and the 'simple life'. The King's favourite architect, Ange-Jaques Gabriel, built the Nouvelle Ménagerie for Pompadour in the gardens at Trianon in 1749 with an elegant *laiterie*, ornamental cowsheds, aviaries and henhouses. Art and life merged. Pompadour could commission and co-design the architectural set while playing the role of decorative milkmaid.

LES TREMBLEUSES

Bone china is a soft-paste porcelain made with clay and the ash of cattle bones. In Limoges producers found a large kaolin deposit and began making an imitation soft-paste, mixing the white clay with powdered glass to dazzling effect and widespread yearning. Pompadour is remembered for her role in creating the porcelain factory at Sèvres. It was said that to charm the King into supporting her enterprise, she commissioned Sèvres to make her a garden. Louis' delight became enchantment when he tried to pick a flower only to discover it was made of brilliant porcelain. By 1753, Sèvres was a Royal factory.

Pompadour's frequent illnesses, together with her desires for 'health for within' and to overcome her frigidity, led her to drink a lot of milk. In 18th-century medical discourse, milk, a symbol of pastoral purity and feminine innocence, was put forward as a wholesome health cure for the elite ailments of the urban upper class. Diderot's *Encyclopédie* included Gabriel François Venel's essay 'Lait' as part of a new secular Enlightenment morality. Delicate porcelain *gobelets à lait* (milk goblets) were developed by Sèvres to hold the milk-cure for the anxious, the depressed and eventually, the oversexed, and to prevent 'insane love'. These vessels, some deeply recessed into the socket of their saucers to prevent the quivering hands of delicate owners spilling the contents, became known as *trembleuses*: exquisite emblems of rarefied temperaments. Pompadour chose *trembleuses* in blue and white porcelain for her pleasure dairy at Compiègne and her apartments at Versailles and Paris.

Years later in 1787, four porcelain *bol-seins* or *jatte-tetons* (breast cups or nipple bowls) were made by Sèvres for Marie Antoinette's dairy at Rambouillet based on an Etruscan design. Rumoured to have been cast from her royal breast, the thought of the process gave a voyeuristic frisson. Each was delicately painted to mimic flushed living flesh, its erect nipple a deeper shade of pink. To drink, the milk-filled breast is lifted from its tripod base where it rests on the curved horns of three goats. With her *bol-seins*, Marie Antoinette's Hameau somehow failed to project innocence: as the Revolution approached, her pleasure dairies became infamous as rendezvous for degenerate, incestuous sex. They were part of the end, both for her and the Ancien Régime.

Colour tests for the facsimile of the Munich portrait.

TWIN SKETCHES

Mounted on two panels in the main room, the smaller, more spontaneous and intimate Boucher oil sketch of Madame de Pompadour hangs in its original 18th-century frame alongside its twin – a perfect facsimile – challenging the visitor to tell one from the other. The challenge means that viewers spend much longer looking than they normally would. They also tend to look in a different way, beyond the subject of the picture and to the technique; they see the brushstrokes and gain an understanding of how the painting was made as well as what is depicted, and they puzzle over the ornate, hand-gilded frames. They go deeper into the picture, almost as if seeing it 'inside out'. The way that recording and rematerialising gives access to a deeper understanding of an artwork as a process is one of the core tenets of Factum's work. The labels are covered, and visitors are invited to vote for which they believe is the original. Since the opening of the exhibition, the results have been surprisingly equal, suggesting the visual gap between original and facsimile has been closed.

Directly opposite the oil sketch and facsimile are two prints of the main painting. One is divided by a net of scarlet lines into a matrix of puzzle-shaped pieces; it is an artefact of composite photography where multiple images taken methodically must then

be reunited to recreate a three-dimensional object. The other, a more abstract black and white image where the composition of the painting can just be made out, is a 'mask', used to ensure that the multiple photographs all have the same qualities. Both are compelling and look like 21st-century artworks reinterpreting Boucher's portrait.

TECHNE CASES

Beneath the composite and mask, four perspex cases contain a collection of objects that also relate to the facsimile-making process; these include greyscales, surface textures and images at different resolutions. Beautiful in their own right, they demonstrate the physical materiality and craft involved in making a perfect recreation. The first case focuses on tone, relief and the relationship between image and form through a Woodburytype print. A CNC milled relief plate, when filled with pigmented gelatin, is able to turn depth back into a continuous tone image. In the second case, to demonstrate elevated printing, a detail of the small Boucher oil sketch was made in increasingly exaggerated surface relief, partly with colour and partly without. A third case is dedicated to digital 'noise', demonstrating the critical balance between information and noise in the process of data gathering (recording an image) and output (making a facsimile). This is illustrated through interference patterns that look like geometric notations of the music of the spheres. Finally, a collection of greyscales illustrates an essential part of Factum's process that underlies both 3D scanning and low-relief output.

FANS

Text in exhibitions is generally dictated by size, legibility, the limits to what can be easily absorbed and the speed at which people are encouraged to move through. Word count tends to be limited. But in this relatively tiny show, the text amounted to nearly 3,000 words. Hand-held information paddles followed an 18th-century Chinese fan design, the original printed with a popular lyric and used for coquettishly hiding behind at Court. Visitors lingered much longer than expected and guards noticed that they talked and interacted more than usual. Objects seem to come alive when they're shared and discussed. It was important to include places to sit; four emerald mohair velvet seats allowed visitors to stop, look, talk, read and rest.

A Lucida Scanner was set up near the entrance to the room to record various paintings in the Waddesdon collection over the course of the exhibition. The paintings are supported on an historic easel, emphasising the juxtaposition of past and present. The person scanning sits at a small desk, processing images on a laptop in real time.

THE LONG CORRIDOR

Behind the gauze that frames the portrait, visitors discover, to the right, a case that contains Charles-Germain de Saint-Aubin's *Livre de Caricatures tant de bonnes que mauvaises* (*The Book of Caricatures – both good and bad*), known in his family as the 'Livre des culs' or 'Book of Arses'. The King's embroiderer, Saint-Aubin amused himself by ridiculing the Court in exquisite – and often obscene – watercoloured drawings.. The book is open to a page on which a diabolic satyr examines Boucher's portrait of Madame de Pompadour at the 1757 Salon, with the caption, 'La verité Surmonte L'Autorité'.

To the left is the exit corridor with six full-height cases containing a collection of objects from the Factum studio. They make up an extraordinary 'Cabinet of Curiosities' related to the process of recording and making, 'input and output'. The first case contains test and reject prints of the Boucher portrait, mounted with a raking light to reveal the relief surface of the canvas. Colour sticks show the method used to perfectly match the facsimile to the original.

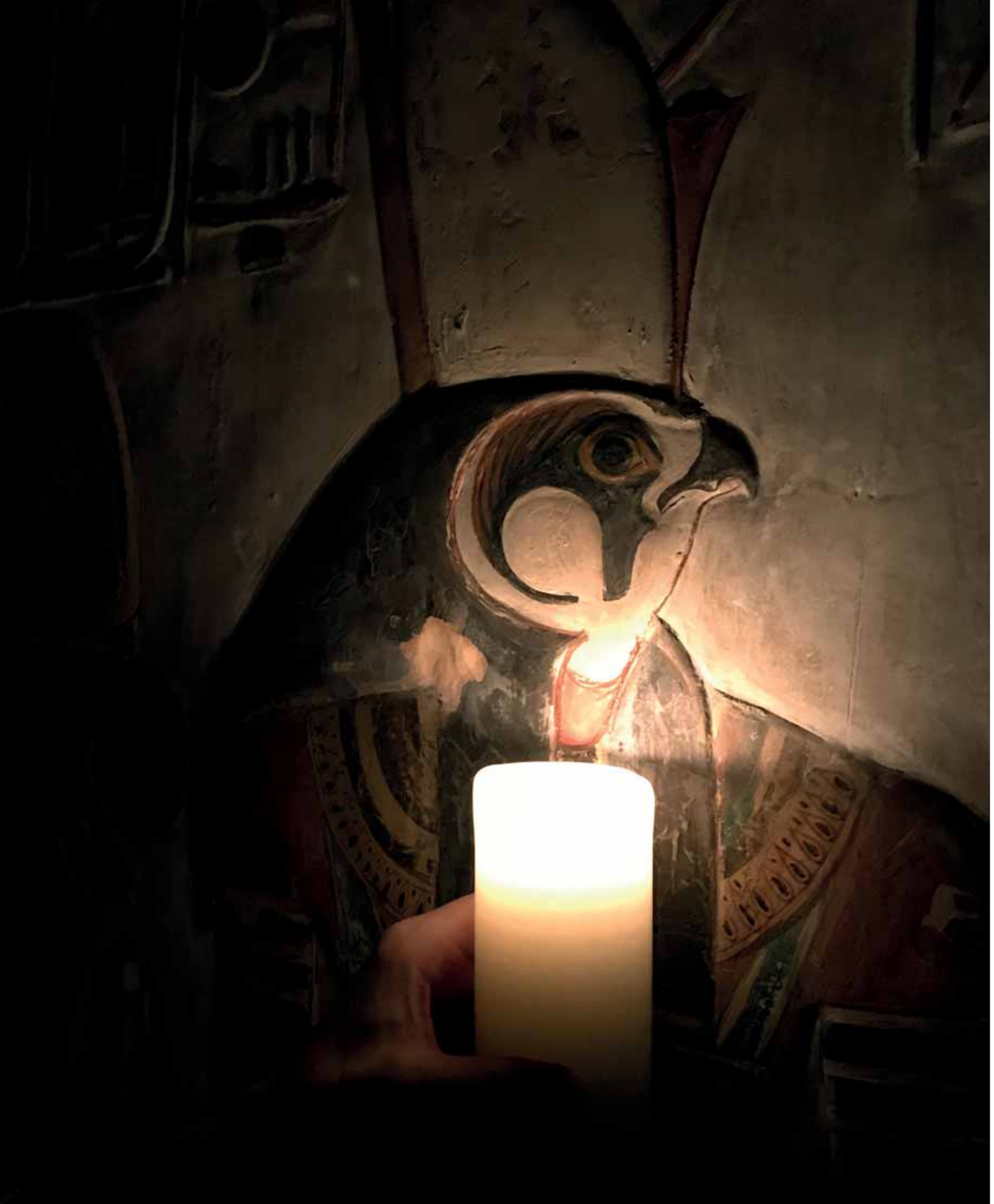
The 'curiosities' consist of: a demonstration of resolution in 3D scanning showing a blurred vs. sharp form; an emerald-green depth map; a 3D-printed colour facsimile of the skull of an extinct bald ibis; a section of al-Idrisi's world map engraved in silver; a detail of the surface of Seti I's sarcophagus in alabaster; a cluster of printed stones and Meissen porcelain panels from the facsimile of the Table of Teschen; the head of Ashurnasirpal II from the throne room in Nimrud; geometric solids designed by Wenzel Jamnitzer; reduced scale 3D prints from the façade of San Petronio; a facsimile of the helmet of Jaime I; facsimiles of paintings from the *Politico Griffoni*; details from the Hereford Mappa Mundi; colour notes produced in the Louvre while making Veronese's *Wedding at Cana*; an assortment of tests both digital and physical; a fragment of a routed test for a tombstone from Kala Koreysh; a CNC milled panel of Vermiculated Rustication in Limestone. Films on wall monitors show the making of objects designed by Piranesi, an animation of Piranesi's *Carceri* and a Lidar-scanned film of Factum's Madrid studios revealing their production processes.

CYCLES OF REBIRTH

From Waddesdon Manor – an escaped château – to the writhing Rococo fantasies of Boucher's parallel universe; from the reflected room in Pompadour's portrait to the dissolved and multiplied space of the exhibition, these are all 'transportive architectures', designed as portals into the imagination.

Facsimiles mean that exhibitions no longer need to depend on loans or the movement of valuable, fixed or fragile things from one place to another. *Scanning Seti: The Regeneration of a Pharaonic Tomb* at the Antikenmuseum, Basel in 2017 was an earlier collaboration with Factum that also engaged with an historic character. Seti I is much further away in time than Madame de Pompadour, but by using facsimiles and design, within a labyrinthine space, many complex stories were unfolded including the ultimate – that which leads from life to death. At the core of the exhibition was the journey through the underworld, the symbolic transformation over 12 hours from death to rebirth. Cycles of rebirth are the tomb's narrative and Factum's virtuosity.

Through the looking glass or through the wormhole, these exhibitions aim to create a passage through space and time where art becomes alive again.



OPPOSITE

Holding a candle to the head of Horus in the re-creation of the Hall of Beauties as seen by Belzoni in 1817.

VERUM FACTUM ARTE: *SCANNING SETI* AND THE AFTERLIFE OF A PHARAONIC TOMB

Bryan Markovitz

Bryan Markovitz is an artist, museum designer, and academic. His research focuses on cultural reproduction, the overlay of performance and materiality, and the experimental systems of archaeologists and conservation scientists.

Even the most fecund of methods may eventually become sterile without the fertilizing stimulus of new problems to solve.

Gaston Bachelard, *The New Scientific Spirit*, trans. Arthur Goldhammer (Boston: Beacon Press, 1984), 13.

The *Scanning Seti* exhibition at Basel's Antikenmuseum begins like many other exhibitions of Egyptian antiquity – in an orientation room filled with expository text.[1] Here, the story of the 1817 European discovery of the New Kingdom tomb of Pharaoh Seti I is told on graphic panels with supporting images from historical volumes. These are nested within wall murals made from 19th-century watercolors of the Theban hills. Romantic palm trees arch over a famous portrait of *Scanning Seti*'s main antagonist, Giovanni Battista Belzoni, sporting a turban. Belzoni was the Italian engineer and theatrical showman who found Seti I's tomb during a stop-gap expedition for Egyptian antiquities after his water-pump enterprise failed to impress Muhammad Ali, the Ottoman governor who sought to modernize Egypt. To complete the Orientalist tone of the room, a Turkish carpet on the parquet floor muffles the sound of visitor footsteps, giving one the feeling of being in the salon of some esoteric Egyptological society.

Many scholars have written about Egyptomania and its relationship to the formation of modern Western museums. The West's longstanding fascination with Egyptian antiquities is just one of a variety of elements that transformed Egypt into a colonial territory, along with cotton exports, new trade routes, tourism, and the formation of academic disciplines like archaeology and Egyptology. The valuation of Egypt as a source of both natural resources and cultural heritage remains a fraught business in our postcolonial age. Knowledge about Ancient Egypt is driven by a passion for new evidence, thanks to the CT scanning and genetic sequencing of mummies, as well as the digitization and scientific conservation of sites and artifacts. The Egyptian state itself plays dual positions, simultaneously asserting its sovereign rights over the material culture of Ancient Egypt, while leveraging global resources to preserve and showcase that culture on the grounds that it is a source of humanity's shared heritage.[2]

In this age of global tourism, displays of Ancient Egyptian artifacts still evoke the mystery and Gothic overtones that Europeans placed on early exhibitions, like the one

1 Curatorial essays accompanied the narrative in the exhibition catalog, *Scanning Sethos: Die Wiedergeburt Eines Pharaonengrabes*, Antikenmuseum Basel and Sammlung Ludwig, Basel, 29 October 2017 – 6 May 2018.

2 For more on this complicated relationship see Christina Riggs, 'Ancient Egypt in the Museum: Concepts and Constructions', in *A Companion to Ancient Egypt*, Volume 2, ed. Alan B. Lloyd (Oxford: Wiley-Blackwell, 2010).

that Belzoni mounted in London's Egyptian Hall in 1821.[3] Unapologetically, Factum Arte, the aesthetic curators of *Scanning Seti*, draw upon similar dramatic effects to set the rest of the exhibition apart from its didactic opening scene. Past the carpeted salon, visitors are lured into darkness by the foreboding presence of a stone-like block with a model of Seti I's tomb carved into its core. Split down the center, with one half of the tomb appearing on each side, the model is a perfect miniature of the burial complex's corridors and rooms.[4] Centered on the wall between the model's two sides is a monitor showing a 3D fly-through of the tomb that Factum Arte created. As the sacred burial space appears simultaneously from these dual perspectives – here as dollhouse, there as bird's-eye view – one begins to sense that Factum Arte is setting up a distinct mise-en-scène of surrogates and doubles.

Far in the corner, a photograph of Seti I's unwrapped mummified face hangs without explanation. His closed eyes refuse our gaze. He is captive, yet inscrutable. This inclusion of photographic evidence is clearly a desecration of the deity-king's formerly wrapped body. However, the neutral purse of his desiccated lips suggests that the Pharaoh is indifferent, having already left the chaos of the world for the orderly sky. One need only look to Ancient Egypt's Myth of the Heavenly Cow, which covers the walls of Seti I's tomb, to understand that the Pharaoh's cosmos was organized by the sun god to contain human conflict on Earth, so that order could reign at other celestial registers. The myth establishes the origin of kings as earthly mediators between layers of the visible and invisible, human and divine.[5] Moreover, the myth's presence within Seti I's tomb instantiates the Pharaoh's transformation into a god of the afterlife. The photographic evidence of his unwrapped corpse says more about our world than his. It is an indication that we, the spectators, are the reflexive focus of this show, not the Pharaoh. What we choose to see, or not see, is the issue at hand.

Adjacent to Seti I's portrait is a discreet hole in the wall – a portal cut at a deep angle. Looking through it, one sees an image of Seti I on a distant surface surrounded by the gods that he joined in the afterlife. I watch other museum visitors to see who notices this view, hidden in plain sight. Most pass by without notice, reminding me that some scholars believe the Ancient Egyptians kept the presence of the dead in daily life through similarly subtle acts of revealing and concealing. While one cannot say that it is in the power of Factum Arte to re-perform this magic, it is nevertheless a way of understanding Ancient Egypt through its manner of operation. The divine is rendered present in surrogate form, and the more surrogates there are, the stronger their presence.[6] Indeed, no less than four versions of Seti I and his tomb are registered by Factum Arte in this dark opening scene.[7]

Registration – certifying the transfer of one thing to another – is an essential idea in Factum Arte's work, where the facsimile must be precisely aligned with the contours of its disfigured or absent referent. What is seen immediately registers what is unseen,

3 A detailed account of the exhibition and its archival remains is provided by Susan M. Pearce, 'Giovanni Battista Belzoni's Exhibition of the Reconstructed Tomb of Pharaoh Seti I in 1821', *Journal of the History of Collections* 12, no. 1 (2000): 109–25.

4 Factum Arte's model is a nod to the one made by Belzoni for his exhibition. See ibid., 114.

5 For a more complete account, see Nadine Guilhou, 'Myth of the Heavenly Cow', in *UCLA Encyclopedia of Egyptology*, ed. Jacco Dieleman and Willeke Wendrich (Los Angeles: University of California Digital Library, 2010).

6 Alan B. Lloyd offers a distinctly performative understanding of Ancient Egyptian mimesis. His interpretation emphasizes the way that an act of reproduction instantiates the thing copied as a new entity in reality. See *Ancient Egypt: State and Society* (London: Oxford University Press, 2014): 257–61.

7 Adam Lowe's writing suggests that he is indeed making invocations at the borderline between our time and the time of the pharaohs: 'Walking the thin line between fact and fetish, image and idol', Lowe writes, 'Fact loses its objective truth, things are never stable'. Adam Lowe, *The Dark Hours of the Sun* (Madrid: Factum Arte, 2006): 15.

3D model of the entire tomb of Seti, with doorway (based on the design used in Belzoni's original exhibition) leading to the re-created Hall of Beauties.

evoking a kind of quantum entanglement, where objects separated in time and space may be united as a whole. As in other experimental systems that mingle science and art, Factum Arte's technology of registration inevitably impresses itself on the people and cultures that it entangles. One might simply call this a play of copies and originals, but there is deeper problem at stake than a simple question of authenticity. The problem is how to change the very foundation of modern historical knowledge by acknowledging more poetic and moral expressions of truth.

Factum Arte presents museum visitors with an opportunity to understand the poetic powers that museum authorities use when they display historical accounts through their curatorial decisions, while also inviting visitors to think about the epistemological obstacles that artisans must overcome (such as museology's policing of fact and fiction) when they set out to reproduce a historical object. By looking at *Scanning Seti* as an experiment in historical recomposition, we see that Factum Arte is embracing a philosophy of history that replaces cause-and-effect narratives with arrangements of things that share intrinsic relationships. The truth of the whole is to be found in the aesthetic reproduction of its parts.

Scanning Seti assumes this philosophy when it proposes that out of bad colonial acts of destruction, something good can emerge in the registration and reconstruction of its remains. This is why Adam Lowe, Factum Arte's founder, invites us to focus on the aesthetic qualities of the reproduction to determine whether it succeeds or fails at invoking a deeper moral truth.[8] This is not the same as suggesting that the museum display can preserve a pharaoh's life after death, or that museum visitors will experience an Ancient Egyptian's

8 A reclaiming of the metahistorical potential of technological reproduction after Walter Benjamin, which Bruno Latour and Adam Lowe call 'The Migration of the Aura, or How to Explore the Original Through Its Facsimiles', in *Switching Codes*, ed. Thomas Bartscherer (Chicago: University of Chicago Press, 2011).

THIS PAGE

The Hall of Beauties re-created following watercolours produced by Alessandro Ricci for Belzoni.

OPPOSITE

Close-up of recreated Hall of Beauties.

feeling of spiritual power.[9] Factum Arte is not attempting to restore a lost religion. Yet, it is trying to breathe life into materiality in the same way that Seti I's high priests and artisans did – at the most detailed level of careful execution. *Scanning Seti* does not ask us to believe in the Pharaoh's divine power any more than it asks us to believe that the copy is the original. Rather, it asks us to see the Ancient Egyptians' religious devotion through the aesthetic and moral quandaries that a precision reproduction presents.

Consider the next act of appearing that occurs when the model room ends with a curtained archway of heavy fabric. The curtain is a facade of the architectural entrance that Belzoni designed for his 1821 reconstruction of the tomb. The effect is well placed, for some spectators appear giddy with pleasure when they pull the curtain back to reveal a stunning replica of the space that Belzoni once called the 'Hall of Beauties'.[10] A wall label indicates that this is not the 'Hall of Beauties' that one sees in the original tomb today, but an idealized version that Factum Arte made to imagine what Belzoni might have seen before he and others did so much to damage to the tomb. On all sides of the small room are richly painted images of Seti I as he is greeted by his family of gods. The images multiply the king in a continuous repetition of encounters, each glowing warmly with the color of life after death. Overhead, a deep blue ceiling painted with a grid of repeating five-point stars becomes the night sky – supplemented by modern LED track lighting at the base of each long wall. A collection of flickering LED candles are scattered indiscriminately on the floor. Like me, other visitors may not initially understand how the 'Hall of Beauties' fits into the overall scheme of the tomb. Fewer visitors may know

9 This idea is suggested by Dietrich Wildung in 'What Visitors Want to See', *Museum International* 47, no. 2 (1995): 4–8. Christina Riggs critiques such claims, as well as the stereotypes found in the 'museum-as-tomb' trope in *Unwrapping Ancient Egypt* (London: Bloomsbury Publishing, 2014): 213–15.

10 The 'Hall of Beauties' is one of the two rooms that Belzoni produced as a full-scale replica in his London exhibition, which was considered at the time an objective way of presenting real artifactual evidence (see Pearce, 'Giovanni Battista Belzoni's Exhibition': 117). Factum Arte mirrors Belzoni's actions by reproducing the same two rooms for their *Scanning Seti* exhibition.

that this is a fantasy of a lost past reality. The layering of real and imagined surfaces forces one to recognize that there is more than one version of the story on display, making *Scanning Seti* feel at times like a game of hide-and-seek.

Beyond the reconstructed room, a dark gallery presents a series of framed drawings made by Belzoni and his team during the first months that Belzoni spent at the site. They render the tomb's walls in pencil, ink, and watercolor. Between 1817 and 1859, the exhibition tells us that the tomb was visited and plundered by a whole host of expeditions. Accompanying the gallery of drawings is a room full of stone fragments extracted from the tomb by Belzoni and others, now deposited in museums around the world. The display supports Factum Arte's advocacy of preservation through reproduction as an ideal way to reassemble the scattered remains.

This drive to preserve history as a commercial salvage operation is not without precedent. Despite Factum Arte's impassioned call to save Seti I's tomb from past injustices of colonial plunder, the facsimile is nevertheless made over in Basel as cultural capital whose caché is heightened by the level of social interaction it affords. You can step into the tomb, post a few images of it on Instagram, and feel good knowing that the original is protected by the experts. It is a subtle reworking of the same narrative that drives many archaeological projects today. Salvage and circulation also drove modern Egypt's first president, Gamal Abdel Nasser, to disassemble and ship a handful of Ancient Egyptian temples to international cities like New York and Madrid. In exchange, Nasser's modernizing Egyptian state received the funding and expertise needed to save the great temple of Abu Simbel by moving it out of the Nubian flood plain caused by the construction of the Aswan High Dam.[11] Whether one approves or not of saving world heritage sites through the free flood of data is a pressing issue, especially when many borders are closed for asylum-seeking refugees.

11 For more on the long shadow of international development and salvage archaeology see Lynn Meskell, *A Future in Ruins* (London: Oxford University Press, 2018).

Antiquarian study containing artefacts from the facsimile-making process, and facsimiles including replicas of the lid fragments from Seti I's sarcophagus.

The next gallery extends colonialism's tragic plot by merging the story of the tomb's destruction with actual reenactments of the crime. At first glance, visitors might misinterpret this display as a demonstration of Factum Arte's own artistic processes, but closer scrutiny reveals that one is seeing an indictment of past abuses presented as demonstrations in a forensic laboratory. A second facsimile of a wall from the 'Hall of Beauties' is also present. This time, it is not shown as an ideal ancient past, but as a scene of more recent crime. Blood-red wax is splattered down the side of Seti's body from the neck, where a wax impression was taken of his face. Dripped plaster pools on the floor in front of another version of the Pharaoh, his body covered with cracks and holes from souvenir extraction. The wall functions as a demonstration for a casting technique known as 'squeezing'. Well before laser scanning and photogrammetry, squeeze casting was a popular way to record the relief of a surface for reproduction. Most of the replicas in Belzoni's exhibition were produced this way, and the wall shows three examples of squeeze casting materials: wax and vegetable fiber, plaster, and wet paper. Each technique creates a different kind of impression, with a discernibly different damaging effect. A screen next to the wall also displays a documentary video of the squeeze-making process as it was performed at the Factum Arte studio.

Turning away, I am faced with a reconstruction of the wall relief of the Myth of the Heavenly Cow. Here, a facsimile of the relief is presented as it is today – covered in wax from multiple squeezes, blackened from soot and impurities, and loaded with graffiti from two centuries of tourist abuse. As I stand before the wall, scrutinizing its marks, I notice that it starts to change. The surface brightens and my shadow appears on the surface. Very gradually, a projection from behind me grows brighter and whiter, filling the faded and soiled relief with intense luminosity. After a brief pause, the image transforms again, as the figures of the cow and the hieroglyphs are restored with vibrant blacks, blues, red, ochre, and yellow sepia. I realize that Salt's watercolor has been used as a compensation image and mapped onto the facsimile's surface.

Beyond the squeeze room, the exhibition grows more labyrinthine. There is a space arranged like an antiquarian's office, evoking the home of Sir John Soane, who purchased Seti I's alabaster sarcophagus from Belzoni's agent in 1824. Soane designed a special sepulchral chamber for it, where the sarcophagus is now permanently displayed. The office contains flashes of humor. A small *memento mori* cutout of Seti I's mummy is propped up behind a desk lamp. Tongue-in-cheek images evoking Britain's golden age of collecting hang on the walls.

The adjoining room contains the life-size facsimile that Factum Arte has painstakingly produced of the sarcophagus itself. Here the facsimile reproduces in detail the sarcophagus's many inscriptions, figures, and historical scars. Texts along the sides of the room depict the complete Book of Gates. Occasionally, a visitor will lean over to scrutinize the wall and inadvertently find themselves bumping into the facsimile sarcophagus behind them. Some appear startled by the inadvertent taboo of touching the 'artifact', while others seem more surprised by the sensation of bumping into something that has the appearance of heavy stone, but sounds light and hollow. This happens to one man who gives the object a good knock with his knuckles to demonstrate its hollow resonance to a friend. 'See?' he says, 'Plastic!' His friend then grasps the ridge of the sarcophagus where the lid once rested. Without concern, he holds and caresses its surface. It is a brazen defiance of museum decorum, ironically situated at the very spot on the sarcophagus where Belzoni carved his name.

Adjacent to the sarcophagus is a small gallery of artifacts presented in a more traditional exhibition format, clearly a zone managed by the Antikenmuseum's curatorial staff. These original objects are displayed in protective glass cases with an array of explanatory wall labels. At the end of the gallery, one realizes that it also contains a surprise. A facsimile wall of a pillar in the tomb's Hall E is placed at the threshold. It depicts Seti I with Horus, standing before Osiris, and Hathor.[12] Turning around, I recognize a hole in the adjacent wall. I lean over and look through. Peering back is a pair of eyes from someone back in the model room, and I find myself caught up again in the exhibition's play of appearances.

Around the corner, a much larger gallery is divided into two sections. To the left is a large grid of framed black and white photographs that Harry Burton took of the tomb for the Metropolitan Museum of Art between 1921 and 1928. The photographs coincided with inspections of the tomb conducted by Howard Carter after large portions of the ceiling, rear wall, and middle pillar of the burial chamber collapsed in 1901–02. Carter embarked on a year-long restoration of the space by reinforcing walls and archways with brick, and installing electric lighting to prevent further smoke damage from the use of torches. The rubble from the collapsed sections of the tomb was collected and thrown into a spoil heap near the tomb of Ramesses X, which the University of Basel has been excavating since 1999. In the center of the gallery are two distinctly different kinds of reconstructions of destroyed pillars, which were produced by the University, along with photographs and descriptions from other nearby excavations in the Valley of the Kings. While informative, and a welcome nod to interdisciplinary collaboration, the academic contribution to the exhibition feels incomplete, if not marginalized, because of the stark contrast with Factum Arte's larger aesthetic project.

12 In the middle of this 'family portrait' is a small square section of enhanced coloration that was made on the original relief as a restoration test by the American Research Center in Europe. The restoration has now been replicated as well.

This is made most apparent by the other end of the gallery – the largest area of the exhibition, which immerses the visitor in Factum Arte's studio practice. Several objects and media here attest to the different technologies that have evolved over many years of the company's experimental practice. One of the most important of these is the Lucida Scanner, a dual cameral and laser scanning system that Factum Arte custom built for the reproduction of large-scale art and artifacts. *Scanning Seti*'s most bespoke tool appears as a black box of perfected technology, but its real history is one of intense trial and error to achieve maximum fidelity. Lucida now functions in more of a supplementary role, buttressed by recent advances in photogrammetry and the need for speed when scanning and rendering a file.

A two-channel video loop projected on the largest wall of the gallery presents in wordless documentary format the dual aspects of fabricating and printing that make up Factum Arte's present-day process for replicating sections of the tomb. The video on the left shows two different machine techniques used for producing the wall reliefs prior to their painting. The process for registering the surface images on the relief is documented in the second video. Artisans are shown manufacturing an ultra-thin, semi-elastic material, or 'skin', which is then printed using a custom-made inkjet printer. After printing, the 'skins' are applied to the surface of the relief in an elaborate and careful process. Together, both videos dramatically demonstrate the complex interplay of computerized machines and human artists. While one screen displays a close-up of a very precise milling machine at work, the other screen presents two artists literally climbing onto a table to smooth out the creases on a freshly applied 'skin' with the full weight of their bodies.

The room gives visitors a peek into Factum Arte's process over the past two decades, which is in a constant state of evolution, pushing at the constraints of time, money, and technology. Every moment of transformation produces new anomalies in their experimental effort to register a perfect double. Thus, every moment of imitation is also one of radical novelty. As *Scanning Seti* reveals, the art and science of reproduction is always subject to dramatic plays of difference. Materials present obstacles to the reproductive process, and their appearance creates subtle shifts in the subjective aim of an act of remaking. Original and copy inevitably diverge along their own drifting historical trajectories.

A single doorway to a long and narrow hallway leads to the final gallery of the exhibition. Along the way, one encounters a small screening room where videos about Factum Arte play on a continuous loop. Most of these contain Adam Lowe, speaking in one way or another about his ideal museum visitor, who willingly adopts the 'new contract' that Factum Arte proposes, in which the original artifact is hidden away and preserved in exchange for a facsimile that takes over its public duties. As Lowe points out, Seti I's tomb was never meant to be seen, yet it is the digital copy that may make it possible for countless generations of people to scrutinize it in ways that the Ancient Egyptians never intended.

THIS PAGE

Display showing the effects of squeezing (casting) the painted relief surfaces.

The facsimile of Seti I's sarcophagus made using elevated printing technology.

OPPOSITE

Close-up of a test for the digital restoration of the sarcophagus of Seti I, showing the goddess Nut, with the blue infill which is no longer present on the original.

The possibility that an ever-more perfect copy could be made from the vast trove of data in the future becomes the key to the tomb's transcendence. Like the king, the tomb must be made again and again, comprising a sequence of multiples made possible by the power of 'datareality' that Factum Arte has stored.[13] Expansion of the artifact as a class of repetitions that Factum Arte's artisans and technologists have the skill to mediate is offered as another way for museology to make the past endure as a form of stable knowledge. This suggests that the historicizing work of curation – of investing things with a rarefied aura – is rapidly merging with the art and science of conservation-as-reproduction in Factum's experimental atelier. Factum Arte dispenses with the need for originality at the same time that it doubles-down on the importance of technological fidelity as a poetic expression of truth.

What seems like a contradiction is at the heart of Factum Arte's challenge to established professions that make up the cultural hegemony of museums. Lowe's rhetoric simultaneously draws on the romance of preserving priceless artifacts, while extolling the destruction of museology's sacred cow: originality. Factum Arte's ambivalence toward authority in the museum creates a new kind of artisanal epistemology.[14] Knowledge is repositioned to privilege the ones who have the skills to remake the thing itself.

13 George Kubler was prescient in his observation that the metaphors of modern technology, from transmissions to circuits, seemed most suitable for characterizing the way that artifacts are made to endure across time as open-ended and expanding classes. See *The Shape of Time: Remarks on the History of Things* (New Haven: Yale University Press, 1962): 9, 34. Compare this to Adam Lowe, 'Datareality', *Future Anterior* 12, no. 2 (2015): 72–81.

14 For a history of the role of artisans and similar liminal practitioners in the formation of scientific and historical authority, see Pamela H. Smith, *The Body of the Artisan: Art and Experience in the Scientific Revolution* (Chicago: University of Chicago Press, 2004).

The copy looks the same as the original, but does it act differently? Could Factum Arte not only remake the tomb of Seti I, but also restore the power that is found in the magic of the Pharaoh's high priests? Or is this simply confusing ancient divine secrets with modern technical skills? One thing seems clear. In both cases, what is displayed has the power to conjure a certain kind of truth. Indeed, *Scanning Seti* heightens the power of the facsimile by using multiples to emphasize the contrast between different times in the life of the object, including the trauma inflicted on the artifact, which serves to heighten its aura.[15] One version of the 'Hall of Beauties' highlights the destruction. Nearby, another version reimagines its original perfection. This is quite an omniscient position to occupy over the leveling forces of time. Perhaps this is the ultimate pursuit of Lowe, whom a television reporter once called, 'the man who leads Factum with evangelical fervor'. *Scanning Seti* definitely plays to one of the West's most powerful forms of historical, and religious, emplotment – resurrection.

That's one view. However, I want to propose a more complicated understanding of Lowe's aim. As I have stated, Factum Arte prefigures its mode of display in aesthetic and moral terms. We are invited to decide for ourselves whether the copy is a good surrogate, or whether it fails to register the truth of the artifact's history. Thus, real and copied fragments are reassembled without differentiation in the exhibition to conjure a mythos that lures spectators with feeling rather than dispassionate objectivity. The act of making in Factum Arte's studio shares similarities with Ancient Egyptian practices of cleaning, perfuming, dressing, and feeding a cult statue. Scanning and routing, casting and sculpting, adding and subtracting, layering and passing, rendering and processing… All of these steps are never-ending acts of problem solving, perfecting, and care. They fill the material form with a certain kind of constructivist loving that brings life back to the artifact. Immanence and transcendence and combined.

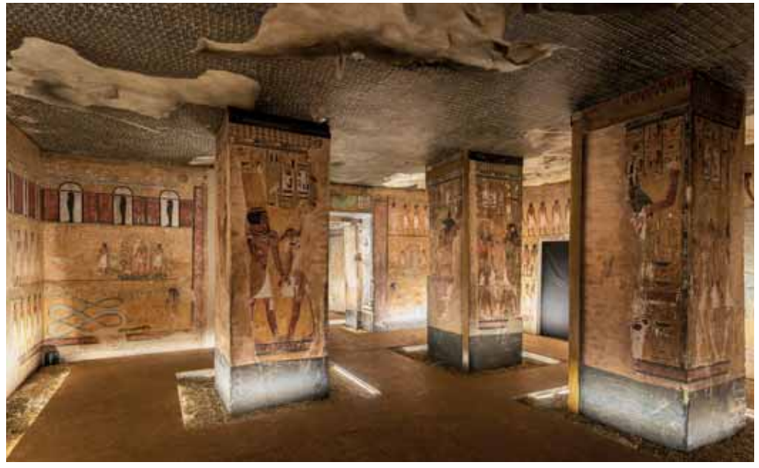
More traditional forms of museum display might simply give visitors a general schema of Ancient Egyptian cosmology in text beside a glass case. Immersive exhibits of infotainment might just embrace the clichés that dramatize Ancient Egypt as obsessed with death. A more critical postcolonial form of display might focus so intently on the West's problematic gaze that the tomb's presence might seem incidental. Factum Arte uses a little of all of these techniques, and none of them fully. Instead, its idiosyncratic obsession lies with reproducing fragments by the micron in pursuit of a more meaningful whole. Something about Factum Arte's approach is expressed in what Hayden White found so distinct about Giambattista Vico's claim that the most true expression of a thing's history comes from dissecting and reassembling its discrete heterogeneous parts.[16] Vico's famous response to the modern Cartesian age was a constructivist mantra: *verum esse ipsum factum*. By reassembling the tomb's billions of small attributes, both physical and performative, Factum Arte lives up to the assertion that what is true is precisely what is made.

I continue along the dim hallway, which opens onto a platform before the final gallery. Here I step into the exhibition's final reproduction of the 'Hall of Beauties'. Unlike the wonder felt with the Belzoni version, or the gruesome horror of the room as a crime

15 Drawing on the work of Michael Taussig and Walter Benjamin, Christina Riggs raises this question about the importance of the public secret in Ancient Egyptian society in *Unwrapping Ancient Egypt*: 190–95.

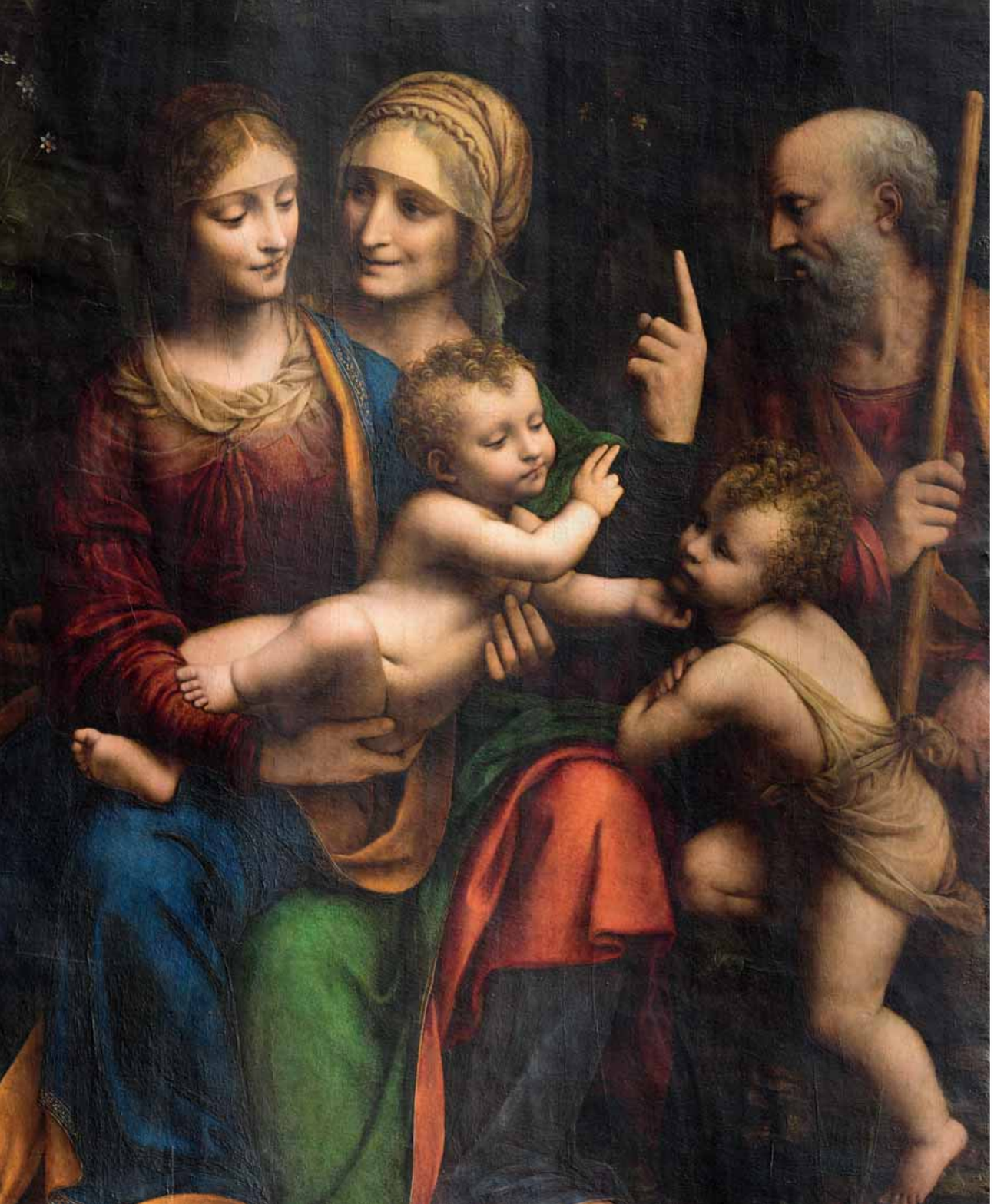
16 Hayden White, *Metahistory: The Historical Imagination in Nineteenth-Century Europe* (Baltimore and London: Johns Hopkins University Press, 1973). For more on Vico's views on the experimental construction of cultural models, see Robert C. Miner, 'Verum-Factum and Practical Wisdom in the Early Writings of Giambattista Vico', *Journal of the History of Ideas* 59, no. 1 (1998): 53–73.

Facsimile of pillared Hall J as it is today.



scene, this space presents the hall in its current condition. The truth is sad. The residue of squeeze castings mingles with extracted stone and cracked surfaces. Part of the ceiling has collapsed, which the facsimile mimics, complete with graffiti made by candle smoke. The display is made all the more honest by the fact that it is a continuation of the same history of desecration that it reproduces, just in a less materially invasive way. A sign on the wall announces that visitors are free to use their cameras, and encourages them to hashtag their photos on social media. Following the crowd, I pull out my smartphone and take a selfie with Seti's half-erased image on the wall, before entering the column-filled hall adjacent to the Pharaoh's burial chamber.

This is where the unfinished replica ends. The floor is lined with raised wooden pathways that creak when you walk, and gaps between the walls and floor are filled with a brown styrofoam-like material that simulates gravel. Embedded in the gravel are a handful of speakers that play a new-age ambient sound reminiscent of Brian Eno's *Music for Airports*. The non-contextual cosmic atmosphere competes with a loud HVAC system that is required to heat the temporary space, protected beneath a tent in a service courtyard of the museum. Around me, visitors pose for photos of themselves standing in front of the tomb's most captivating images. Belzoni would be impressed with the quality of the copy. I walk toward the exit and notice one last panel at the very end of the path. It fills in the final section of surface with one of Harry Burton's black and white images – an unusual registration of one era of documentation with another. I find out later that it is a placeholder for a section of the tomb that could not be scanned before Factum Arte's permit to work in the tomb had expired. The gap in data will remain unfilled until Factum Arte's papers are renewed by the Egyptian Ministry of Antiquities and *Scanning Seti* begins again.



OPPOSITE

Colour data for *The Holy Family with St Anne and St John* by Bernardino Luini, c. 1520–30.

RECORDING AND DISPLAYING BERNARDINO LUINI

Guendalina Damone

Guendalina Damone is conducting graduate work in the Conservation of Historical and Artistic Heritage at the University of Udine. She has led the Factum Foundation office in Milan since 2014, and the Foundation's laboratory at the ARCHiVe digitisation centre in Venice since 2018.

Since the donation of the private collection of its founder, Federico Borromeo, in 1618, the Veneranda Biblioteca Ambrosiana has held an impressive collection of paintings and drawings, known throughout the world for their quality and for the significance of the artists represented. Given the importance of these works to our common cultural heritage, it has been essential to establish a system of studying and monitoring that can underpin their safeguarding and display. Fundamental to this is the documentation of how these works were made and their current conservation state, which can inform their ongoing care as well as public appreciation and understanding.

Since 2016, Factum Foundation has collaborated on an academic initiative led by the Veneranda Biblioteca Ambrosiana[1] to define a new investigative methodology for works of art. This aims to incorporate both art-historical studies and material data into a single integrated analysis, and takes as its case study a collection of paintings and drawings attributed to Bernardino Luini, spanning different periods, techniques, and levels of documentation, together with the relevant published academic studies.

The first phase of the project, which finished in 2017, selected from the collections of the Pinacoteca e Biblioteca Ambrosiana four paintings and a drawing by Bernardino Luini and his workshop. Among these were *The Holy Family with St Anne and St John* and *The Infant Jesus with a Lamb*.[2] A multidisciplinary team, consisting of art historians, restorers, archivists and academics conducted a chemical-physical and historical-artistic investigation to clarify the most relevant issues regarding Luini's work.[3]

As part of this investigation, the Factum Foundation team recorded the works using the Lucida 3D Scanner,[4] and at the end of a long campaign produced a high-resolution web browser for each work, allowing the different datasets – including VIS, UV, IR, XRF, and micro-samples – to be viewed at 1:1 scale in perfect register. The browser allows the display either of a single dataset or of two datasets in parallel. The result offers a unique ID of the artworks and has been provided to experts who will now be able to compare the datasets with unprecedented ease as they work on a comprehensive

1 The project has been financially supported by the Veneranda Biblioteca Ambrosiana, Fondazione Cariplo, Fondazione Gianmaria Buccellati, Alvise di Canossa and Arteria.

2 The works selected from the collection of the Pinacoteca e Biblioteca Ambrosiana are: Bernardino Luini, *The Holy Family with St Anne and St John*, oil on board, 118 x 92 cm (inv. 92); Bernardino Luini, *The Infant Jesus with a Lamb*, tempera and oil on board, 28 x 25 cm (inv. 82); Bernardino Luini, *Tobias and the Angel*, drawing on paper, 40.5 x 45.9 cm (ND cat. no. 21); Bernardino Luini workshop, *Nursing Madonna*, tempera and oil on board, 51 x 41.4 cm (inv. 81); Bernardino Luini workshop, *Noli me tangere*, oil on canvas, 95.5 x 91.5 cm (inv. 776).

3 Together with Factum Foundation, the following institutions participated in the project: Università degli Studi Milano Bicocca, Politecnico di Milano, INO (Consiglio Nazionale delle Ricerche CNR) in Florence. The team of art historians, restorers and archivists included Valeria Villa, Giulio Bora, Edoardo Villata, Pietro Petraroia and Marino Viganò.

4 The Lucida 3D Scanner was designed by artist and engineer Manuel Franquelo with support from Factum Arte and Factum Foundation.

OPPOSITE, CLOCKWISE FROM TOP LEFT

Bernardino Luini, *The Infant Jesus with a Lamb*, c. 1525, colour photography (Cristana Achille and Francesco Fassi, Politecnico di Milano).

3D render using Lucida 3D Scanner (Guendalina Damone and Carlos Bayod, Factum Foundation).

IR 1230 nm (Accesso Molab, CNR-INO; Anna Galli, CNR-IFN; Letizia Bonizzoni, Università degli Studi di Milano).

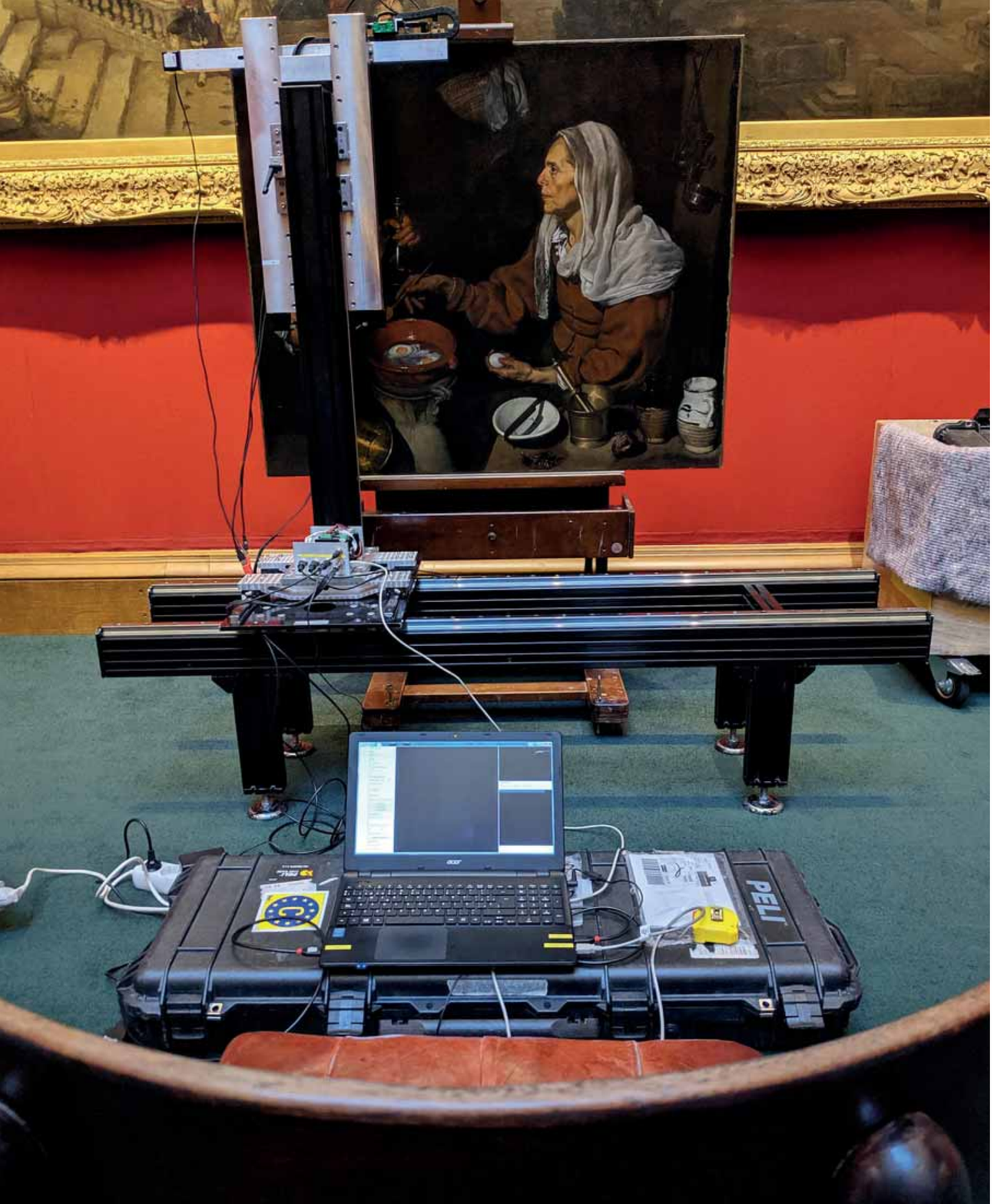
Measured points XRF + FORS (white) + RAMAN (red) (Letizia Bonizzoni, Università degli Studi di Milano; Daniela Comelli, Politecnico di Milano; Anna Galli, CNR-IFN; Marco Gargano, Università degli Studi di Milano; Austin Nevin, CNR-IFN; Gianluca Poldi, Università degli Studi di Bergamo).

X-ray (Marco Gargano, Università degli Studi di Milano).

IR 1705 nm (Accesso Molab, CNR-INO; Anna Galli, CNR-IFN; Letizia Bonizzoni, Università degli Studi di Milano).

study of Luini's work. The initiative has provided a new model for the combination of humanistic and scientific study, bringing together experts from many different fields. Digital datasets supplement biographical studies, archival research, knowledge of artistic techniques, materials and tools, and, in the case of Luini, the body of research on his complex vision of the world and the role of religion in his work. The next phase of the project will be dedicated to the study of a selection of Luini's works preserved in international collections.

The project has two interlinked aims. The first is to establish and test a methodology for research and documentation within the limited scope of the Ambrosiana's collections. This must be able to support judgements of authentication and art historical studies, record the state of conservation of a work, and at the same time increase public appreciation and facilitate understanding in ways that do not compromise the work's safety. The second aim is to expand this initiative to create a systematic conservation methodology which can be employed within museums and collecting institutions more broadly.



OPPOSITE

Old Woman Cooking Eggs was recorded in the National Galleries of Scotland in Edinburgh.

LA CASA NATAL DE VELÁZQUEZ: RE-PRESENTING THE SPANISH GOLDEN AGE

Elizabeth Mitchell

Elizabeth Mitchell has a doctorate in Greco-Roman archaeology from Harvard University. She writes, edits, and works on recording projects for Factum Foundation.

One of the great advantages of facsimiles is their ability to move – to travel 'back' to an object's original location or onward to new ones. Mobility also creates the potential for new juxtapositions, and even new collections, of artworks, allowing them to be restaged outside traditional museum settings in creative new configurations. One such project is the new initiative currently underway at the Casa Natal de Velázquez, where facsimiles are being used to create an unprecedented permanent display of the early works of one of Spain's most revered artists in the context of the city and time at which they were made.

Diego Velázquez spent the first 23 years of his life in Seville, where he was born in a house on what is now Calle Padre Luis María Llop in 1599. Seville was where Velázquez undertook his apprenticeship in painting with Francisco Pacheco, and it was here that he painted his famous *bodegones*, scenes from daily life in which people and objects are often accorded equal prominence.

Today, very few of Velázquez' paintings remain in Seville. But a new initiative is now set to revive the spirit of the city's most famous artist, using facsimiles and displays in multiple media to recreate not only Velázquez' paintings but also the surroundings in which they were produced, all within the 16th-century courtyard house in which he was born. Bought in 2018 by a group led by author and journalist Enrique Bocanegra, the Casa Natal de Velázquez will partially reopen in late 2020. Working together with José Luis Colomer and the Centro de Estudios Europa Hispánica, Factum Foundation will contribute to the project by recording and creating facsimiles of around 10 paintings by Velázquez. The project is thus an innovative new collaboration between a private interpretation centre, two well-respected foundations, and the several public museums that have generously permitted the reproduction of works in their collections; these museums will retain the rights to the recorded data for these works.

On arriving at the house, visitors will travel through a sequence of rooms exploring the domestic and urban backdrop against which Velázquez' talent developed. Each one will contain a facsimile or facsimiles of paintings from the artist's Seville years (1618–22), and will be furnished in the style of the early 17th century, with displays which incorporate objects found in the paintings themselves. Velázquez' early life and education, his training with the artist Francesco Pacheco, and the vibrant character of Seville in the late 16th and early 17th centuries, the apex of Spanish expansion into the Americas, will be among the lenses used to contextualise the artist's early works.

By exhibiting the facsimiles of paintings within domestic environments, the Casa Natal de Velázquez will allow the closed plane of the painting to expand out into the space of the viewer, facilitating a new intimacy with the material world of the paintings' subjects and maker. The facsimiles will include works such as the *Old Woman*

THIS PAGE

Deatils of *Old Woman Cooking Eggs*.

OPPOSITE

Proposed design for one of the rooms in the Casa Natal de Velázquez by Carlos Bayod, including a facsimile of *Old Woman Cooking Eggs*.

Cooking Eggs from the National Gallery of Scotland in Edinburgh, painted when the artist was only 18 or 19 years old. The Foundation will also work with local craftsmen and other specialists to recreate objects seen in the paintings, using traditional woodworking, forging, ceramic and decorative techniques alongside digital recording and rematerialisation technologies.

Paintings on canvas are eminently portable objects, often intended from the start to be moved from one place to another. Later on in his career, for example, as official artist to Philip IV in Madrid, Velázquez and his assistants would paint three separate portraits of the Infanta Maria Teresa to be sent out to potential husbands, all of them outside of Spain. But while there may be no single 'correct' location for Velázquez' early paintings, the creation of facsimiles that can be shown as a group in Seville restores important layers of local meaning to these works, as well as allowing Sevillians and visitors to the city to re-ground its most famous offspring once more on the narrow, twisting street on which he was born.

PROLIFERATION OF OPERA HOUSES, CONCERT HALLS, MUSEUMS & ART GALLERIES: ARE WE BUILDING SEPULCHRES AND MAUSOLEUMS FOR THE FUTURE?

Jasper Parrott

Address given in Yekaterinburg in December 2019 at a symposium to discuss the new opera house designed by Zaha Hadid Architects.

Jasper Parrott is the co-founder of HarrisonParrott Ltd., a creative management company based in London, Munich and Paris. He is credited with pioneering innovative methods of handling the careers of classical musicians. HarrisonParrott's approach (also embracing orchestral and project management) has been influential in the management of artists worldwide.

OPPOSITE

3D render of the Barberini Harp.

Over the last two days it has been very interesting to learn so much from highly respected colleagues who are creators or managers of cultural buildings and who have devoted so much of their lives to the enrichment of cultural life, often in many different cities as their careers have evolved. Nonetheless, perhaps because of the very long perspective that my 55 years of work in music and the arts (as well as my by now ingrained habit of almost continuous travel around the globe over many decades) have given me, I can perhaps make some observations about the challenges I believe we all face today in all of the different areas of our work.

I suppose one could say that the post-World War II system of values and beliefs as incorporated in our music and arts structures and institutions has endured rather well until very recently. At least in the 'high'-cultural circles of, for example, the major cities of Western Europe and the USA, a shared belief in what many of us took to be established certainties has not only shaped our habits and attitudes, but these have spilled over and been adopted in many other rapidly changing economies and societies – most notably in China, Southeast Asia and the Middle East.

One of the hallmarks of the system has been the quite extraordinary proliferation of concert halls, opera houses, museums and performing spaces – I have heard it said that more have been built in the last 20 years than in the whole of the last two centuries worldwide. What strikes me about this remarkable development is that the vast majority of these new venues are essentially modernised versions of a 19th-century concept and are updated versions of temples of high art for the middle classes, adapted predominantly for secular purposes and often incurring vast public expense both to build and to run.

And whether we look at the many wonderful and, within our current frames of reference, successful examples such as Elbphilharmonie, Philharmonie de Paris, KKL Luzern, Zaryadye Moscow or the amazing new multi-hall centre in Kaohsiung, just to mention a few – and there are many other examples I could point to around the world – the story is largely the same: these are halls built predominantly for mostly privileged sectors of society (and in Europe and in the US mostly for white and greying audiences), with more or less similar constructions whether shoebox or vineyard or horse-shoe opera theatre, many served up in extravagant, sometimes beautiful, but always extremely expensive monuments by brilliant star architects working closely with city politicians and property developers more concerned with short-term glory than with any very coherent social or focused agendas.

The primary users of these halls may be a well-established and well-supported symphony orchestra or opera or theatre company; or they may seem to have been built, as so often in China and in Japan, as a public utility, located often very far from convenient downtown locations, without any clearly defined purpose and with little popular access in ways that would enrich the lives and aspirations of wider sectors of the community.

As a result, the outcome is usually the same: no deeply thought-through vision of how such buildings can meet at least some if not all of the following criteria:

- provision of optimal acoustical and performance qualities;
- the best potential for participatory experience for as wide a cross-section of the community as possible;
- flexible facilities and resources that can be shared with academies and teaching institutions, encouraging collaborations among arts of different genres;
- adaptability for new technology and modes of communication;
- ability to contribute to the enrichment and social improvement of the local environment;
- provision of access and participation as widely and conveniently as possible to local communities;
- the enhancement of green environments in urban spaces, general embellishment of cityscapes, and the reduction of mass transportation across large urban spaces caused by poorly distributed venues.

Two general comments about London: the appalling ugliness and total lack of socially inclusive and cohesive cultural facilities in the huge luxury apartment and office developments throughout vast segments of the city are truly shocking. On the other hand, whereas I am naturally very much a supporter of what Simon Rattle, the LSO, and the Barbican are seeking to achieve in their efforts to build a new hall of a quality better fitting for a great city like London than what currently exists, I am also a critic of its location in that a great opportunity has been lost to mitigate the shocking situation whereby in about 85 per cent of London's urban landscape no important artistic institutions of the scale and quality of the Southbank and the Barbican halls have been established, while these two are in reality close neighbours serving similar communities.

Theoretically at least, this worldwide expansion of the stock of venues, costing in many cases hundreds of millions of euros, should last for many decades if not centuries, and some may even aspire to be the Parthenons or great cathedrals and historic palaces of our day… Or will they end up instead as mausoleums or sepulchres of the future?

Surely all of us in this room know that we are on the cusp of changes more enormous than any that societies have experienced for hundreds of years, and certainly more acute than anything since the end of World War II.

And these changes will affect not only those of us who believe in the values of art and culture but also the lives of all of the billions who populate this planet and who will probably never go even once to a concert hall or museum or gallery.

There is surely no doubt that we live in the most turbulent, disrupted and unpredictable set of circumstances since 1945, not only politically and societally but more generally in our daily lives. I will list just the five most obvious engines of change we are all facing:

OPPOSITE

Section of a facsimile of the Barberini Harp (1605–20), now held at the Museo Nazionale degli Strumenti Musicali, Rome.

- climate change;
- political radicalisation and the growth of tribal nationalism;
- the irresistible power of the cyber world and those who control or manipulate it;
- the incalculable impact of AI;
- the ever-accelerating and widening gap between the obscene levels of wealth of the few and the desperate conditions of poverty of the many, not only in terms of means adequate for a decent life but also of access to fundamental necessities like clean water, safety, education, equality of opportunity and freedom of expression.

Of these threats climate change must be the most important, not least because of the stupendous challenges all societies will face in the next 25 years, but also because any mitigations that are still open to us are opposed by the most powerful vested interests around the world.

On the very simplest of levels, if halls are built for orchestras or opera or theatre performances that require the regular presentation of top-level ensembles and performers from around the world, how will these halls need to be adapted to meet the realities of a world that will need to live with the exigencies, demands and disciplines determined by conservation and carbon reduction, not to mention mass migration? Why should we continue to invest so heavily in building halls and venues that may become redundant within the next 25 or 50 years, if many of them are already no longer fit for purpose?

Surely we need to bring together our expertise, our experience and our understanding of the longer term common good to think through much more coherently how to create spaces that will not only serve the best purposes of music and art and of the performances to be created within them, but that will also act as agoras accessible to and shared with individuals and organisations dedicated to aspirational learning and to participatory artistic and creative experiences, and that will enrich the lives of a much wider section of society.

Very recently I had a fascinating dream: I was sitting in a brand-new hall made up of multiple interlocking spaces separated one from the other by acoustically impermeable but totally flexible walls and dividers that, with the flick of a switch, could be flown up almost magically into the ceiling spaces of the halls so that the same building could serve not only the finest concerts of symphonic music or jazz but also a wide range of collaborations in every genre of music, dance, and theatre.

I am certainly no architect or engineer and this naive dream can probably be laughed off as the nocturnal ravings of someone who goes to too many performances.

Nonetheless it does suggest to me that with today's extraordinary technology almost everything is possible provided that we begin to understand better some of the processes and opportunities we need to work on together if we are to keep faith with the idea that mankind's individual and collective powers of imaginative and artistic creativity are the greatest assets we have not only for the conservation of harmonious and peaceful civil societies but also for saving the planet.

To end on a more pragmatic note, here is my short list of requirements for the future:

- Orchestras and all performing groups of ensembles should have at least two regular venues – one for their legacy repertoire and the other for experimental and innovatory work of all kinds. As a concrete example, when the Tonhalle orchestra moves back to their great historic hall in 2021 they hope to retain their Maag interim hall for the cultivation of new audiences and for new work.
- Arts institutions should be cultural spaces open all day and every day, welcoming citizens from all backgrounds, ages, and walks of life, and as such should offer wide ranges of opportunities for learning and participatory activities, especially for children, young people and also for seniors; the South Bank Center and Barbican score well with these aspirations but most Asian halls very badly or not at all.
- Different music and arts genres, ideally including an academy conservatory, should share overlapping spaces and facilities; Helsinki's Musiktali is an interesting example.
- Arts centres should have many different-sized performing and rehearsal spaces to which an extended network of partner organisations should also have regular access.
- Centres should have secure and climate-controlled exhibition spaces, regular lecture series, and literary and other debates with public participation: the interface of different creative genres brings added value to everyone.

Detail of a render of the Barberini Harp.

And lastly – but this must be a call to arms for another occasion – the music and arts communities around the world should raise their voices and take public and if necessary disruptive actions – we should learn from Greta Thunberg and from Extinction Revolution – to insist with our political classes that music and the creative arts are not elitist luxuries but essential and urgent priorities for all of our societies.

ART IN TIME

Alexander Nagel

The complete slideshow to accompany this script can be found at http://www.factumfoundation.org/artintime/.

Alexander Nagel is an art historian living in New York.

ACT ONE

SILENT SLIDE: *'Catherina Bollenes, widow of the late Sr. Johan van Meer, appears before the notary and declares that she has hereby ceded in full and free property to her mother Juffr. Maria Thins a piece of painting, done by the aforementioned late husband, wherein is depicted* The Art of Painting. *22 February 1676.'*

SLIDE: THE ART OF PAINTING (with a portion of the text)
H The figure mingles the attributes of History and Fame: the book to commemorate great deeds, the trumpet to ensure that the deeds are heard of far and wide.
S She holds the trumpet upside down, suggesting she won't be using it any time soon.
H The trumpet was slow to sound for Vermeer, who died in penury and became famous only in the 19th century.
P The young woman's head turns, her eyes swiveling with her head, as if to look backwards. History stands between a past that is unrecoverable and a future that remembers it through stories and figures.

SLIDE: THE ART OF PAINTING (detail of model)
S But we don't just see the figure of History or of Fame. We see how such a figure comes into being through painting. A double of Vermeer sits in a room with a model, probably his daughter, and he is in the midst of painting a personification of history and fame.
H The result is 'a piece of painting in which is depicted *The Art of Painting*'.
P Out of this small space, out of these assembled props, a painting emerges that opens a world and reaches a world.
S We witness the micro-processes by which meaning is assembled, manipulations and transfers that prepare the larger process of fame and historical commemoration. The painting is an orchestration of befores and afters. A living young woman is dressed up and turned into a mock-up of a personage, a 'figure'. And then painting begins its work of turning this performance into a picture (and then, in the picture before us, turning the process of making a picture into a picture).
P Branches broken from a living tree have been turned into an ornamental wreath and placed on the head of a living person.

SLIDE: THE ART OF PAINTING (detail of canvas)
P [continue:] The painter starts there, at the beginning, at the top, with the leaves. Right now, his brush is making known that the leaves form a wreath, and eventually it will show

OPPOSITE

'… a piece of painting, done by the aforementioned late husband, wherein is depicted *The Art of Painting*.'

it being worn on a head, and then it will describe a body wearing a robe and holding a book. Leaves formed into a crown, dyed cloth, and bound paper – these are advanced transformations of natural matter into culture. Painting adds a layer to the artifice of the world.
S The staggered relation of befores and afters is present at every moment in the painting of a picture. The process of painting is a micro-alternation of looking at the figure, then turning one's eyes towards the canvas to apply the brush in a rendition of what one has just seen. And then looking back again. Here, the painter is looking at his model with the brush on the canvas or very close to it, which means we are precisely at the juncture between the two moments, just at the moment of swiveling from model to canvas, or – more likely – just at the moment of swiveling from canvas to model.

SLIDE: THE ART OF PAINTING (detail of model)
H The model is draped with an ample robe that is meant to belong to no time in particular, putting her in a different realm from the painter, who wears a slashed doublet that was fashionable in the 1630s and then was newly fashionable in the 1660s.
S In the map on the wall, landmasses – geological realities undergoing very slow change – are coordinated with political developments that unfold month by month and year by year.

SAME SLIDE WITH ARROW POINTING OUT (signature)
P This is one of the ways that maps are like pictures. Pictures collect the world together and introduce snags in time, allowing history and recollection to form.

SLIDE: MAP
H The map was decades old by the time this painting was made, showing all seventeen provinces of a unified Holland, which by the time the painting was made had been broken up into a Catholic south and a Protestant north.
S Once folded and now unfolded, the map is a contraction of space that allows a person in a room to imagine a vast space. The map affords a vision of a whole domain that is now a historical memory, and that piece of territory opens onto the whole world. The painter sits under the map, directly in line with the city of Delft, where this painting was made.

SLIDE: MAP DETAIL
P The map is worn; it has lived a life, it has been unfolded many times. These aren't just folds but cracks, lovingly described.

SLIDE: DETAIL OF MAP WITH SHIPS
H The map shows boats coming towards and leaving from a bustling maritime empire. The blue pigment dotting the boats and the sea under the allegorical figures is ultramarine, which means 'from beyond the waters', because it is made up of ground lapis lazuli, which was imported from Afghanistan, making its way to Delft on ships like these.

SLIDE: DETAIL OF CANVAS
S The painter in the picture works on an easel, on canvas, and the picture we are looking at is also on canvas and is also easel-sized. It depicts a world that can be moved. It is a format designed to be independent of a given context – moveable, sellable, collectible.
H Vermeer's wife struggled to keep it from moving, passing it on to her mother in 1676 so that it wouldn't be used to settle Vermeer's debts. But the executor of the estate saw the trick and put it up for auction anyway. It disappeared from the record for over a hundred years, until in 1813 it was acquired by one Count Czernin. By that point it was no longer a Vermeer – it was attributed to the much better-known Pieter de Hooch.

SLIDE: MONUMENT MEN IN 1945 CROUCHING NEXT TO THE PAINTING
P Nothing is more lovable than what is loved by my rival.

SLIDE: MAP SHOWING VARIOUS PLACES WHERE THE PAINTING HAS BEEN EXHIBITED
H A trophy of the Nazis now reclaimed, Vermeer's *Art of Painting* needed to go on a world tour, a symbol of the triumph of European painting. For the decade after the war, it traveled every two or three months to a different location. More recently, in the 6 years between 1999 and 2005, the painting traveled to no fewer than 8 venues, which is to say it was on the road continuously. Precautions were taken, as always, to ensure that the painting would not suffer damage during transport and under different climatic conditions at each venue. But it DID suffer.

SLIDE: IMAGE OF PIGMENT
S The whitish tones in this work are, unusually, painted in more than one layer – a bottom layer where the pigment is ground somewhat coarsely and an upper layer of extremely finely ground pigment. The layering and the composition of the finely ground layer produced an unstable surface.

SLIDE: BACK OF PAINTING
P Out of a room where a painting is being made a world will arise. The first impression the picture makes is of a still scene. But in fact the painting is all about movement: we see a translation from life to art, from one time to another, from one scale to another. What about the painting itself? It is an easel picture. Was it also designed to move? [Pause:] Flakes of paint finer than snow fall from the painting every time it is moved.
H Particular damage occurred in 2004 in Kobe, Japan, where climatic conditions were not well controlled. At that point, the painting's home, the Kunsthistorisches Museum of Vienna, decided it would no longer allow the work to travel.

SLIDE: ART IN TRANSIT
H [continue:] Future historians will describe the decades we are living through as the era of the exhibition industry, when the migration of works of art to locations around the world came to dominate all aspects of artistic life. But it wasn't always like this. The spread of biennials and art fairs is a recent development. Old master paintings are swept up into these streams together with contemporary art.
S It is one system. The rules pertaining to contemporary art now apply to all art.

SILENT SLIDE
Nagel: I know that the 1970s saw the arrival of King Tut and a new era of blockbusters at the Met and elsewhere. But I want to know how many exhibitions were done at the Museum during the 1960s, when you were curator there?

SILENT SLIDE
De Montebello: None.

SILENT SLIDE
Nagel: None?

SLIENT SLIDE
De Montebello: None. The curator's job was to take care of the collection and make occasional acquisitions.

SLIENT SLIDE
Nagel: But what about The Great Age of Fresco of 1968, the show of detached frescoes and their underdrawings from Renaissance Florence?

SILENT SLIDE
De Montebello: Ah well, that was a highly unusual occasion. The frescoes were detached and restored after being damaged, or at least threatened, during the disastrous 1966 flood in Florence. The exhibition was really a diplomatic gesture of friendship to Italy. It was so unusual that we had a Princeton Professor, Millard Meiss, organize it. The idea that a museum curator would organize an exhibition was foreign at the time.

SLIDE: TORONTO ROYAL ONTARIO MUSEUM WITH NEW ADDITION
H In the era of the exhibition industry, museums have radically redefined themselves. Striving to detach themselves from any association with the art vaults of old, they now market themselves as sites of interest, programming centers, interactive spaces. Museums are now venues where *events* take place; their mission statements consistently emphasize 'experiences' over objects.

SLIDE: COLLAGE OF CARAVAGGIO EXHIBITIONS
S And the primary event and experience offered by museums is the temporary exhibition, one after the other, more than one at any given time.

SILENT SLIDE WITH REAL TIME EFFECT OF TYPING
It is being said, and will be said again and again, that this is a unique exhibition, that nothing like it will ever be seen again. That is not true: for better or for worse plenty of exhibitions like it will be organized for years to come, and the air routes of the world will soon be jammed once again by jets carrying their cargoes of Rembrandts and Rubenses, Poussins and Goyas. Minor damage will be repaired without publicity, and a failure to care for paintings that stay behind will not be connected with the pressure to attend to those that travel. But one day a major accident will occur and the current priorities of some of the world's greatest museums will be exposed as grossly irresponsible.' Francis Haskell, 'Titian and the Perils of International Exhibition', New York Review of Books, *August 16, 1990.*

SILENT SLIDE
[News story about National Gallery Beccafumi having been broken during de-installation.]

SILENT SLIDE
Curator who shall remain nameless: 'Major damage almost never happens when things go out on exhibition. However, they never come back in better condition'.

S [read screen slide silently, then start:] Here is one way to describe the situation in which we find ourselves. A new paradigm (the exhibition industry) has been introduced while maintaining an old model of art (based in the idea that artworks are unique and irreplaceable). The works must be originals, and at the same time they need to be in swift circulation. The most treasured works of art are the ones under greatest pressure to move. Exhibitions need originals, but moving them produces damage, requiring restoration work, which leaves less of the original.
P It is an accelerated half-life, or maybe it is a slow sacrifice.

SLIDE: VERMEER RESTORE DESTROY
P [continue:] Or it is a change of state. Logically speaking, with enough restoration the work slowly becomes a duplicate of itself. Maybe that is what works of art want to be when they move around – avatars of themselves.

SLIDE: SEBASTIANO DEL PIOMBO AT PALAZZO VENEZIA 2008
S The exhibition space is a space of fantasy. Works of art have been brought together as if by magic from far-flung places, and now are being held in suspension for a limited period of time. The works on display often have the quality of being images of themselves. Under the exhibition industry, works of art want to live a double life, irreducibly themselves and yet able to lift off from themselves and to move at the speed of the surrounding image culture.

BLANK SLIDE

ACT TWO

SLIDE: 26 GASOLINE STATIONS
M In the 1960s Ed Ruscha produced a number of books celebrating the serial conditions of modern life: 26 gasoline stations, 34 parking lots, some Los Angeles apartments. These small books were inexpensive and not unique. They are multiples. One copy was as good as another. The idea was that each book would be an open edition, with new printings produced as needed to satisfy demand.

SLIDE: GAGOSIAN WEBSITE SHOWING ED RUSCHA BOOK FOR SALE
M [continue:] The logic of the art market, which deals in authenticated originals, found a way to turn these works into expensive collectibles. The last printing of the gasoline stations book was issued in 1969, when it sold for $4. After that, they became famous, and the artist became famous, and… the new printings stopped. The existing copies became the only ones available, originals that now sell for four-digit sums.

SLIDE: ICONS IN SERIES
R In the Middle Ages, the most revered images were the ones most actively copied. The pressure to extend their reach had the effect of producing greater numbers of copies.

SLIDE: MAN OF SORROWS ICON AND RELIC (with arrows showing relic, which was not reproducible, and image, which was reproducible)
R [continue:] Images were considered copy-able but relics were not. To substitute a pig's

bone for a saint's bone was to commit fraud. What we have therefore is a spectrum ranging from certain objects, such as relics, that had to be originals, and a whole range of other objects, such as images, that could exist in legitimate copies. There was no actionable conception of art forgery before about 1500.

SILENT SLIDE: ISRAHEL VAN MECKENEM
(with transcription of the text)
R [continue:] Then the categories shifted, so that works of art, as they were now called, acquired the status of relics, contact relics of the artist. Only the original would do. The modern museum is founded on that notion.

SLIDE: OTSUKA MUSEUM IN JAPAN
M And yet the older idea has never died. The Otsuka Museum in Japan offers replicas of over 1,000 masterpieces of Western art, including a full-scale three-dimensional replica of the Sistine Chapel, its wall decorations all reproduced on ceramic board. Mr. Otsuka, an industrialist in ceramic manufacture, is imagining a future where all the frescoes, panels, and canvases will have disintegrated and all that survives are these ceramic reproductions, proof of the quality of his company's work.

SLIDE: VERONESE IN VENICE
M [continue:] Here is another kind of effort. The Madrid-based firm Factum Arte, headed by the artist Adam Lowe, has produced startling conjunctions of contemporary methods and older art. In 2007, using new, patented techniques, they produced an elaborately accurate three-dimensional facsimile of Paolo Veronese's *Wedding at Cana* of 1563, the original of which is in the Louvre, and put the copy in the painting's original location in the Benedictine monastery of San Giorgio Maggiore in Venice.

This image was made after the model and likeness of the well-known first image of the *Pietà*, which is preserved in the Church of the Holy Cross in the city of Rome.

SLIDE: DETAIL SHOWING RELIEF
R They copied the actual relief of the canvas, the irregularities, the seams, the repairs.

SLIDE: VERONESE IN THE LOUVRE
R [continue:] In 1797 Napoleon's troops entered the monastery's refectory and removed the vast canvas, cutting it in half in order to transport it to Paris, where it has been popular with visitors ever since. Though not always safe. It spent months packed in a box in the port of Brest during the Franco-Prussian War of 1870–71. The canvas was once more rolled up and hidden in World War II, when it was hauled around France on a truck to keep it from the Germans.
M By 1990, a time of great optimism about an emergent new world order, curators felt it was time for it to be restored. The damage of all this military conflict needed to be reversed, and the canvas needed to be brought back as much as possible to its pristine condition. Unfortunately this caused the greatest damage of all.

SILENT SLIDE: NEW YORK TIMES STORY. CANVAS TORN UNDERGOING RESTORATION IN 1992!

SLIDE: VERONESE IN VENICE
M [continue:] The irony is that the towers that tore through the canvas were there to newly position the canvas in the Louvre gallery at exactly the height at which it stood in Venice, a touching effort to reclaim historical accuracy in the physical experience of the work.
R The work predicted its own reception, by extending the proliferation that is at the heart of the subject.

SLIDE: DETAIL OF CENTER
R [continue:] Christ turns water into wine, allowing the party to continue and to grow more boisterous. From the iconic face of Christ the painting spreads out into the world. Christ is surrounded by the Virgin and his Apostles and then by a wider assembly of people. We see front and center a group of musicians, with none other than Veronese and Tintoretto on viole da gamba and Titian, the elder among them, providing the sustaining notes on his violone. Like the hourglass that stands between the musicians and through which sand still runs, the music figures the dimension of secular time.

SLIDE: VERONESE IN THE LOUVRE
P Opening the painting's subject to extend into the present as we look at the painting, or maybe don't look at it, distracted like so many figures in the painting itself.

SLIDE: VERONESE IN VENICE
M In 2007, Two-hundred-ten years after its removal by Napoleon, the facsimile was installed in the painting's original location, an event that was greeted as a kind of homecoming by the Venetian citizenry.

SLIDE
ADAM LOWE [recording:] 'Do I think the experience of the facsimile, a facsimile of this accuracy in Palladio's refectory, hanging in the right place, with the right light, and without a frame, is more authentic than the experience of the painting in the Louvre? Yes, I do think that.'

SLIDE: VERONESE IN VENICE
M [continue:] The authenticity of the in-situ experience is complicated by the fact that the refectory itself has undergone changes since Veronese's time. Also, the exact copy necessarily registers the seams introduced into the work when the canvas was cut in half and then resewn once it arrived in Paris under Napoleon, not to mention all the other work on it up until the major repairs required after the catastrophe of 1992.
O The facsimile doesn't cancel the removal, but simply gives back to Venice an imprint of the canvas with its 210 years of war scars.
R History reaches into the present…
O … and the present reaches back into history

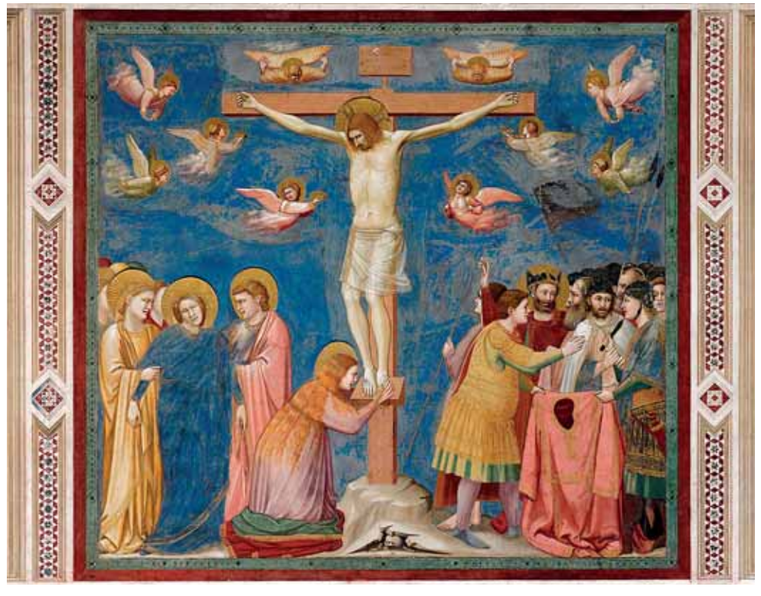
SLIDE: SMITHSON CORAL WITH MIRRORS
M The installation of the copy in Venice produces a tension with the work in the Louvre. Visitors who have seen the installation in Venice will look at Veronese's painting with a better-informed eye next time they visit Paris. Conversely, the existence of the facsimile means that visitors to the Louvre are now more strongly encouraged to go to Venice to see what the painting looks like in its monastic setting. Copy and original now cannot exist without each other.

BLANK SLIDE

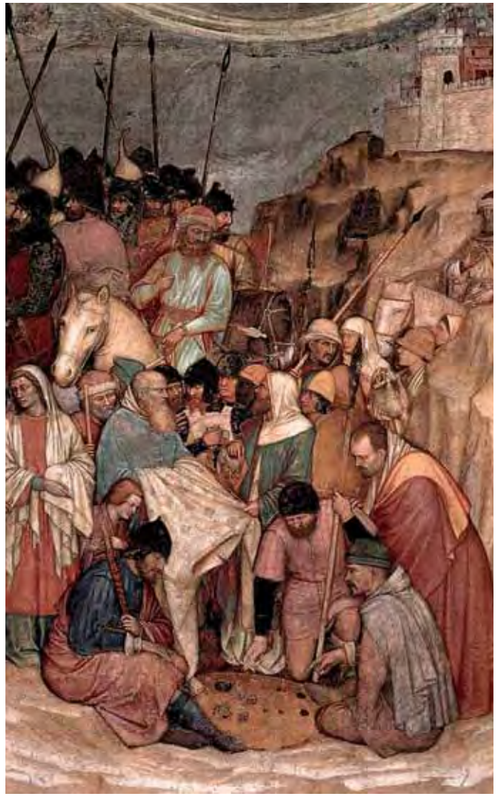
ACT THREE

SLIDE: GIOTTO CRUCIFIXION
S The painting is divided left and right. To Christ's right are the saintly companions of Christ, and at his left his murderers, one of whom, Longinus, has just now been converted, and already he bears a halo. Above, angels collect the blood of Christ, grimace in pain and bare their breasts in agony. At the bottom right of the scene the Roman soldiers vie for Christ's tunic, now empty of his body.

SLIDE
'When the soldiers crucified Jesus, they took his clothes, dividing them into four shares, one for each of them, with the undergarment remaining. This garment was seamless, woven in one piece from top to bottom. "Let's not tear it", they said to one another. "Let's decide by lot who will get it". This happened that the scripture might be fulfilled that said, "They divided my clothes among them and cast lots for my garment". So this is what the soldiers did.'
John 19:23–24; quoting Psalm 21 (22): 18–19



Giotto, *Crucifixion*, Arena Chapel, Padua, c. 1305.



Altichiero, *Crucifixion* (detail), Basilica of Sant'Antonio, Padua, 1376–79.

SLIDE: DETAIL OF ROBE
P The tunic is like a character in the story, empty and yet buoyant, as if filled by an invisible presence.

SLIDE: MAMLUK TUNIC
H It is of one piece and very much like tunics produced in the eastern Mediterranean at the time of Giotto.

SLIDE: GIOTTO CRUCIFIXION
S The tunic is not a gift, since it was stolen from a murdered man's back, nor is it a trade good, since it will be won in a game of chance. It is a pure object of transfer.

SLIDE: DETAIL OF THE ROBE OF CHRIST
P In their vying over the prize, the Roman soldiers unwittingly initiated the cult of Christ's relics. It is held up by the soldiers, as if under arrest, and slouches downward, as if submitting to more abuse, except that here, their aim is not to break it apart but to keep it whole. Misunderstanding the significance of the death they had just caused, the soldiers nonetheless are compelled to preserve this second skin. They knew not what they did in the crucifixion, and they know not why they preserve the relic.

SLIDE: ALTICHIERO CRUCIFIXION
H Giotto's follower Altichiero offered a vaster and more populated rendition of the crucifixion scene several decades later and down the road from Giotto's fresco. In the right-hand panel of this fresco triptych once again we see soldiers competing for the robe.

SLIDE: ALTICHIERO DETAIL OF ROBE
P The robe is shown again as a kind of skin, seamless and in the round as if it were a body made up of nothing but the skin tumbling head first toward the ground. Its arms reach down to the level of the clearing where the soldiers throw dice to win the prize.
S Altichiero adds subsidiary incident. We see bystanders pointing to this game of chance and commenting on it. We are far beyond what the Bible describes. It is impossible to know whether they are commenting because they're entertained or because they're mortified. And what of the figure who is offering the robe? He is not a soldier but instead appears to be one of the Jews who had called for Christ's crucifixion. And so there is a relay from the cross, into the hands of the unbelieving Jews, and eventually into the hands of one of the Roman soldiers who will come away with the prize.
P What will the winner do with his trophy? Will he wear it himself – literally clothe himself in the garment of Christ? Or will he sell it off?

SLIDE: THE TUNIC IN TRIER

H Somehow the robe made it into the treasury of a Christian church, or so it was believed. The tunic in Trier Cathedral is no longer whole, however, or rather no longer wholly original. Only a piece of it is the relic of Christ's robe. At some later date someone completed the original remaining fragment by weaving another garment resembling the original tunic around it.

P It is as if the remaining piece had regenerated the missing parts of the tunic, restoring the whole.

S The completed garment forms the reliquary for the piece of it that is authentic.

SLIDE: MANTEGNA CRUCIFIXION

H Andrea Mantegna spent his younger years in Padua learning from Giotto and Altichiero. In his *Crucifixion* for the high altar of the Church of San Zeno in Verona, Christ's body hovers above the horizon in the exact center of the picture.

SLIDE: DETAIL OF CHRIST'S FEET

S The blood on the cross traces both punctual time and durational time. There is the splatter caused by the initial blow of the nail into Christ's feet, and the longer drip down the cross, as if the blood's path down to the skull at the bottom of the cross clocked the time it took for the body to die.

SLIDE: MANTEGNA CRUCIFIXION

S [continue:] The stage is now emptying. Those who had come to see the crucifixion for an afternoon's entertainment are wending their way back up the hill towards the city of Jerusalem. Only the saintly companions remain, to Christ's right, and to his left the soldiers throw lots.

SLIDE: DETAIL OF SOLDIERS

H These soldiers are in foreign territory, far from home and with insufficient provisions. One sits with his legs outstretched, revealing holes in his footwear. A bald, bearded figure, swarthier than the others, suggests that recruits for the Roman army came from far flung provinces, a sign of an overstretched Roman army. Again, the robe is in the process of being handed over. A Roman soldier grabs it from the hands of a figure who seems to show regret at giving it up. The artifact is passing from a proximate source to a recipient who knows nothing of the meaning of its provenance but appreciates it for its intrinsic qualities. It is a seamless robe, a special item that cannot be simply divvied up like Christ's other belongings.

P For the 14th-century theologian Johannes Tauler, the four-part division of Christ's possessions represents the extension of the benefits of Christ's sacrifice to the four quarters of the world. But of all his possessions the tunic could not be divided and so represents the mysterious judgment of God, who decides who is to receive the Holy Spirit, who is to be clothed in Christ and who not.

S Mantegna has the soldiers throwing lots on a circle segmented into alternating sections of red and yellow.

SLIDE: ROTA BOARD IN LIBYA

H You can see this kind of game board on ancient Roman pavements. Here is one in Libya. It's meant for a sort of Roman tic-tac-toe game. You can look it up on the internet where you can play against a computer. In any case, it was not intended for dice throwing.

Andrea Mantegna, *Crucifixion*, from San Zeno, Verona, 1457–59. Musée du Louvre, Paris.

SLIDE: DETAIL OF SOLDIERS

S Mantegna adapted the Roman board here for its pattern. To make this segmented circle, you draw a cross and then inscribe an X through the cross. Add alternating colors and you have a stark diagram of radial distribution. Here, the board suggests that once the dice is thrown, the robe could go in any direction. In fact, Mantegna neatly aligns the board's pattern with the cardinal directions: East, West, North and South. It is marked like a compass.

SLIDE: MANTEGNA XION

H According to a non-biblical but long and pervasive tradition, Christ hung on the cross facing to the West. The viewer looks from the West towards the East, towards the hill of Golgotha, the place of the skull, outside the western walls of Jerusalem. We see the hill rise and then slope away on the far, east side, towards Jerusalem in the background. Those who know the city can recognize the tower of David, the highest point in the city, rising on Mount Sion, and a little further down to the west a round building modeled on the Dome of the Rock, which in the Latin West was often taken to represent the Jewish Temple.

S In the *Crucifixion* we are looking towards the East, towards the cross facing us in the West. Even the lighting confirms the topographical siting. If you look at the shadows,

for example the one cast by the feet of John the Evangelist, or the ones thrown by the crosses, or by the horse to the right, it is clear that we have a light source to the right and a little bit forward of the painting, which is to say the sun is to the south and west, as it would be in Palestine on an afternoon in Spring. The foreground is closest to us, on the western side of the picture. In the foreground are two soldiers cut off by the frame. They are shown at different heights, implying that they are walking down a flight of steps.
P They are leaving the space of the painting and entering our space and our time.

SLIDE: IMAGE OF CALVARY CHAPEL
H These steps are well known to any Christian pilgrim to Jerusalem. There are 18 of them leading up to the raised site of Calvary. For centuries, pilgrims have mounted these steps then took the sharp left behind the wall and mounted the rest, counting each of the 18 steps as they climbed to the place of the crucifixion. Mantegna's representation is relying on some other source, a drawing of the site, for example.

SLIDE: WHOLE PAINTING
S Mantegna thinks away the chapel later built on this site and sets us before the foundational event that took place there, the reason a church was built, the reason any Christian church was ever built. You can see other holes in the rock where previous crosses had been planted. You see the skulls and bones of previous victims amassed in the little cave to the left. This is still just the place outside the city where the crucifixions got done.
P And yet we feel the future presence of the chapel and the church even in this historical scene. The stone summit of the hill looks something like a reticulated pavement. The figures in the foreground descend pre-architectural steps, or rather proto-architectural steps, precursors of the steps that are there now.

SLIDE: WHOLE ALTARPIECE IN SAN ZENO
H Mantegna's *Crucifixion* was taken from the church of San Zeno in 1797.
S In its original location, Mantegna's panel stood under an assembly of saints in heaven. Standing in the church and looking towards the high altar, the congregation looks eastward, towards Jerusalem. In the *Crucifixion*, the central and most legible panel of the lower zone, Jerusalem is exactly where it should be: behind Christ, who faces west, towards the viewers in Verona.
H Once it was removed to the Louvre by Napoleon's monuments men, the panel's function as a compass was lost.
P At the bottom of the altarpiece, the *Crucifixion* panel touches the altar and the church space. It is a portal between spaces and times.

SLIDE: DETAIL OF BOTTOM PORTION
P [continue:] The soldiers climb down the steps, leaving the picture space and entering our space.
S The white lance tip drives upwards, its white blade set off against the wood grain, and curiously contained within the form of the cross beam.

SLIDE: WITH WOODCUT
H This must be the lance that was used to pierce Christ's side. It had entered the imperial collection in Nuremberg by this time.

P He is coming down the steps, leaving the scene. Christ's side is pierced and bloody. Yet the lance tip is pristine, gleaming white. Right up against the picture plane, crossing over into our space, the lance tip is a glinting wrinkle in time.

SLIDE: DETAIL WITHOUT WOODCUT
S This bottom edge is where the picture meets the church altar – it's not only a spatial threshold but a temporal one. Every mass said on the altar folds time over onto itself, reiterating Christ's sacrifice and directing its benefits into the present. In this zone, the seamless visual fabric of the picture starts to break down. The lance here is partly inside the scene, but its bottom half disappears into the ritual space outside the picture. It is the weapon used during the event, but it is also the relic that has come down to Mantegna, now presented again. The way it is set against the cross, emblematically, like a relic, suggests that it is not quite in the picture, but overlaid onto the picture from our space and our time. Images tell the story not just of the event but of the way that it peels off into its future commemoration.

SLIDE: WHOLE PAINTING
P In the distance, we see the people returning eastward, towards Jerusalem, returning to their ordinary lives. They turn their backs towards us and resume the routines of their daily history, all those little acts that history will never remember. In the foreground, close to us, we have the other extreme, a liminal zone of temporal interference.
S And in between we have the main stage. From the top of the steps, the cracks in the rock, marking out perspectival lines, accelerate into the picture's depth and also into the picture's time.

SLIDE BLANK

FOLLOWING PAGES

Giovanni da Modena, *Croce vivente* (*Croce brachiale*), c. 1420, Cappella Bolognini, San Petronio, Bologna.

Giovanni da Modena, *Croce verdeggiante*, c. 1420, Cappella Bolognini, San Petronio, Bologna.

Renders of two ushabtis from the tomb of Seti I.

1:1 scale 3D print of Amico Aspertini's *Deposition of Christ* (1526–30), from the right-hand portico of San Petronio in Bologna, 2020.




CASE STUDY 1

RESURRECTING THE BOLOGNESE RENAISSANCE

RECORDING AND RE-UNITING THE *POLITTICO GRIFFONI*

Adam Lowe

Adam Lowe is the Director of Factum Arte and the founder of Factum Foundation for Digital Technology in Conservation.

The work to record and replicate all 16 panels of the great Bolognese altarpiece, the *Polittico Griffoni*, painted in 1471–72 by Francesco del Cossa and Ercole de' Roberti, lasted for several years between 2012 and 2018. It was not commissioned by any organisation – it simply started and gained momentum. It is a demonstration of how digital technology can create new ways of studying, displaying, sharing and experiencing a work of art. In the *Polittico Griffoni*'s fragmentary form, the panels can be seen as independent works of art of aesthetic and historic importance. But the complete polyptych in its ornate gilded frame would have had a totally different impact and visual coherence. Marco Zoppo's *Polittico di San Clemente* in the Collegio di Spagna in Bologna is in a similar frame to the one drawn by Stefano Orlandi in 1725 (Archivo di Stato, Bologna). This is the only existing reference to the appearance of the *Polittico Griffoni*. It rises from the dynamic, temporal and perspectival world of miracles and social structures depicted in the predella to the gilded other-worldliness of the upper panels. Only together do they articulate their message. When looking at the facsimile of the *Polittico Griffoni*, we can grasp the physical and emotional impact in ways that cannot be achieved in a normal 'reproduction'. The panels are indistinguishable from the originals in scale, colour and surface to the naked eye under museum conditions. It is an objective replication generating forensic evidence that encourages a profound reflection on the dynamic process of originality.

The *Polittico Griffoni* was painted for the Griffoni Chapel in the Basilica of San Petronio, where it was installed between 1473 and 1475. It was displayed in an ornate gilded frame made by Agostino de' Marchi of Crema. The polyptych was removed in 1725 when the chapel was re-dedicated to the Aldrovandi family. The panels were taken out of their gold surround, separated and after a period of time decorating the Aldovrandi family house at Mirabello, near Ferrara, they were sold. Today, 16 parts of the altarpiece are scattered between the National Gallery in London, the National Gallery of Art in Washington, the Musei Vaticani, the Brera in Milan, Museo di Villa Cagnola in Gazzada, Museum Boijmans van Beuningen in Rotterdam, the Musée du Louvre in Paris, Collezione Vittorio Cini in Venice and the Pinacoteca Nazionale, Ferrara. The frame was destroyed and some panels are missing.

The museum protocols that governed the loans and specify the conditions of display in Bologna keep the original panels apart and discrete, displayed as separate entities. In the years since 1725 each panel has acquired its own character that reflects where it has been, how it has been valued and the ways it has been cared for. The National Gallery painting has been flattened and backed with balsa wood while the predella in the Vatican reveals the impact of the cradle fitted to the back of the panel, visible through the painted surface in the 3D recording. Once noticed, the

PREVIOUS PAGE

Partially restored detail of the map of Bologna from the Sala Bologna, Vatican Palace, 1575. Recorded and restored in 2011.

OPPOSITE

Proposed configuration (by Cecilia Cavalca) of the panels of the *Polittico Griffoni*.

Ercole de' Roberti, predella, 1472–73.

position of the wooden reinforcements and the dynamic forces they have created in the wooden boards are obvious. The recent restoration at the Pinacoteca di Brera resulted in the opportunity to scan the panels before and after treatment and compare the difference. Wherever possible, the front and back of each panel was recorded. The backs often reveal a great deal – the caution of restorers and archivists can be more relaxed when dealing with concealed parts of the object. The back of St George has been branded with the letters CGBC (Conte Giovanni Battista Costabili). Two small but unrelated panels by Ercole de' Roberti in the National Gallery in London contain the same stamp.

It is not known how many paintings have been lost but the drawing by Stefano Orlandi, made prior to the destruction of the altarpiece, shows six small paintings of saints on each side. The drawing is rough and the size of the upper and lower central panels has led Cecilia Cavalca to suggest there were actually seven saints on each side. This means that there are potentially either five or seven paintings of saints by Ercole de' Roberti still waiting to be found. Giuseppe Baraldi, the man in charge of the dismemberment of the *Polittico*, wrote to Aldrovandi on 21 November 1725, stating that the polyptych could be split up into 13 decorative paintings. This seems strange as there are 16 in existence. Perhaps he meant 23, lending credibility to Cavalca's intuition.

The high-resolution recording of the panels began in June 2012 following a conversation between Roberta Terra, Francesco Ceccarelli, Nadja Aksamija and myself while Factum was recording the main doors on the unfinished façade of San Petronio. All paintings were recorded using the Lucida Scanner designed by Manuel Franquelo and developed by Factum Arte to record the surface of paintings. They were also recorded using composite photography to ensure high-resolution accurate colour data.

The first three panels to be digitised were the small paintings by Ercole de' Roberti of St George, St Catherine and St Jerome in the collection of Vittorio Cini in Palazzo Cini at San Vio, Venice. This was part of the ongoing collaboration between Factum and the Cini Foundation that started in 2006 with the recording of Veronese's vast painting *The Wedding at Cana* in the Louvre. This was followed by the recording of the two roundels in the Cagnola Collection in Gazzada depicting the Annunciation. The recording at Villa Cagnola established the viability of the idea and led Nicholas Penny at the National Gallery to grant permission to record the main panel of the altarpiece. The figure of St Vincent Ferrer painted by Francesco del Cossa was recorded in the National Gallery in London in August 2013 as part of a demonstration of the importance of 3D-scanning the surface of paintings. The National Gallery now has a Lucida Scanner and carries out detailed documentation of their paintings before and after restoration.

The predella by Ercole de' Roberti, which depicts the miracles of St Vincent Ferrer, was recorded in the Vatican Museums in October 2013. The predella is a demonstration of the way perspective was changing representation. It contains one figure wearing a mazzocchio turban walking out of the picture plane and another figure riding into it. The perspectival games played with the architectural details frame the film-like narrative that runs from left to right along the long thin strip that would have been at about eye level on the framed altarpiece. The small panel depicting St Petronius was then recorded at the Pinacoteca Nazionale in Ferrara. This is of interest as the panel is set within a wooden surround that seems original, implying that the paintings were slightly recessed into the gilt frame. The two panels of St Peter and St John the Baptist, which complete the central section of the *Polittico*, were recorded in the Pinacoteca di Brera. They were recorded before a scheduled restoration and rescanned after the completion of the treatment.

In every case the recording was carried out on the understanding that each museum or collection would receive the files for the complete altarpiece while the copyright for each painting belonged for all current and future applications to the owner.

St Anthony Abbott was scanned and photographed in the Boijmans Museum in Rotterdam. The recording of the three paintings by Francesco del Cossa of St Florian, St Lucy and the Crucifixion was carried out at the National Gallery in Washington. The recording of Ercole de' Roberti's St Apollonia and St Michael Archangel in the Louvre completed the documentation of the altarpiece in October 2015, over three years after the first painting was recorded. A high-resolution viewer of each painting was prepared which will be supplied to all the owners, allowing each museum to place its own panel or panels into the larger context of the complete polyptych. The viewer, in Factum's standard format, includes colour and 3D information and a layer containing transparent colour superimposed over the 3D scan. The data can be viewed in layers or in a side by side synchronized format.

The first facsimiles were produced while the recording was still underway. Initially these were CNC milled into polyurethane but as the technology developed we moved to a mix of elevated printing and CNC milling. Océ-A Canon Company perfected the elevated printing technology resulting in an accuracy that exceeded the resolution of the data that was recorded. New developments led the production process. The separation of the general form (using Global Mapper and other cartographic software) from the surface that could be printed in 5-micron-thick layers has forced the team to work in new ways and rethink the relationship between shape and surface. Interesting parallel work is going on in the development of photo-realistic rendering of 3D models for film and architecture. Emerging software, like Substance Designer, is dramatically changing the relationship between virtual realities and the physical world.

While most digital data is viewed through the screen of increasingly sophisticated headsets, Factum's speciality is in physical facsimiles. The sixteen tempera panel paintings were realised as exact copies by moulding the relief prints and casting the surface in traditional animal-glue gesso. The colour is added by printing in multiple layers on a purpose-built flatbed printer. Varnishes and waxes are used to produce a character similar to each original panel. The gilding presents specific challenges and was done by hand with painstaking attention to surface detail.

In October 2017 facsimiles of the 16 panels were given to the Basilica of San Petronio by Factum Foundation. This triggered the idea of an exhibition at Palazzo Fava. A collaboration between Genus Bononiae (Fabio Roversi Monaco) and Factum Foundation resulted in loan agreements with all the museums and collections involved. The exhibition *La Riscoperta di un Caporolavoro* at Palazzo Fava will be the first time that all existing panels have been brought back together and can be seen in the same space since their sale in 1725. The facsimile will be displayed without the gold frame but in the spatial relationship proposed by Cecilia Cavalca in 2013.

After the exhibition in Bologna it is hoped that the facsimile, in physical or digital form, can help each of the collections holding parts of the *Polittico Griffoni* to explain the importance of their fragment when seen as part of a whole. It is also hoped that this focus could result in the discovery of some of the missing parts.

Many questions have been raised by the work carried out to record and replicate each of the paintings that form the *Polittico Griffoni*. Many more will emerge as skills and technologies develop. Reuniting paintings, objects, sculptural elements and architectural details that have been separated for one reason or another is at the heart of Factum's work. Questions about the careers of objects, the way they are valued, how they are displayed, how they are preserved and conserved, their meaning and ultimately about their social and aesthetic significance are emerging.

THIS PAGE

Gilding the printed facsimile of Francesco del Cossa's St Lucy, 1472–73.

Detail of the facsimile of St Lucy.

OPPOSITE

Recording the two panels by Francesco del Cossa depicting the Annunciation, 1472–73, at the Museo di Villa Cagnola, Gazzada.

Adam Lowe and Rafa Rachewsky working on the facsimile panel of Francesco del Cossa's St Peter, 1472–73.

Surface of the facsimile of the predella.

BEAUTY IN RELIEF

Carlos Bayod Lucini

Carlos Bayod Lucini is an architect and Project Director at Factum Foundation, where he is responsible for the digitisation of paintings and oversaw the recording of the *Polittico Griffoni* (2012–15). He is Adjunct Professor of Historic Preservation at Columbia University and is a PhD candidate at Madrid's Universidad Autónoma, where he is writing a thesis on the relief of paintings.

Lucida 3D Scanner: Manuel Franquelo conceptualised and designed the electronics, mechanics, optics and software. The scanner was fabricated and tested in Factum Arte by Carlos Bayod, Dwight Perry, Jorge Cano, Nicolás Díez, Manuel Franquelo Jr, Guendalina Damone, Enrique Esteban, Marta Herranz and Aliaa Ismail under the supervision of Manuel Franquelo.

OPPOSITE

Scanning the Crucifixion in the National Gallery of Art, Washington, D.C., 2015.

A 15-inch laptop screen may not seem like an ideal window into a painting. The digital image depicts an abstracted version of reality that only bears comparison to the original work of art in some ways. Nevertheless, all eyes were on the screen during the recording of St Lucy (Francesco del Cossa, c. 1473) at the National Gallery of Art, Washington, D.C., in October 2015. The object of rapt attention was an image simulating the painting's relief that was appearing on the screen in real-time.

As the Lucida 3D Scanner moved over the surface of the painting, the data materialising on-screen revealed an image that felt strangely familiar: one could quickly discern the punch marks delineating St Lucy's golden halo and the radial furrows on the golden background. It was also possible to distinguish the figure of the saint and her habit from the surrounding areas, as well as the painting's uneven surface, its subtle craquelure, the slight curvature of the panel, or even areas of paint loss around the edges. The digital image reconstructed the painting's texture by means of light and shadow, with clarity and precision, as though it were an aerial photograph exposing the relief of the Earth's surface.

If one examines a painting carefully, similar three-dimensional elements are usually visible to the naked eye. In a conservation workshop, raking light or a magnifying glass can also help the researcher to better understand surface texture. In a museum gallery, however, relief often goes unnoticed. This may be because paintings are uniformly lit, helping the visitor to see 'properly' from any position in the room. The ideal lighting creates a well-defined image with no shadows, but at the same time the painting is entirely flattened, to the point where it looks like a reproduction of itself. The work of art is thus standardized and packaged for consumption, easily recognizable as its catalogue image or in its multiple other photographic incarnations. Uniform lighting reduces the complexities inherent in the work of art. We may ask, though, whether the artist was in fact relying on textural nuances to produce a variety of aesthetic effects.

In a 15th-century work in tempera on board like del Cossa's St Lucy, textural details beyond the colour are crucial. The artist had recourse to a whole host of techniques that were used to modulate light and create a sense of movement, vibration and space. Punch marks and incisions, the slight differences in depth between the figures and the background… these were the *special effects* that made it possible to express an aesthetic idea on the pictorial surface. To ignore, therefore, the significance of relief in the perception of the work can negate a critical element of the viewing experience. To see the digital 3D image of St Lucy or of St Florian or the Crucifixion (also in Washington) was to appreciate the richness of their relief as if for the first time. The Lucida 3D Scanner, used to digitise all sixteen surviving panels of the *Polittico Griffoni* between 2012 and 2015, was designed specifically to record and reveal the textural qualities of the painted surface.

THIS PAGE

Colour data of the eyes of St Lucy.

OPPOSITE

3D render of the eyes of St Lucy.

The fruit of an exceptional collaboration between the artist Manuel Franquelo, Factum Arte and Factum Foundation, the Lucida is the result of nearly twenty years of research in the field of surface recording. The scanner works by capturing monochrome video of a moving line of light projected onto a surface. The light is emitted by a laser diode and passes through two different lenses (aspherical and cylindrical) to define on the surface a thin vertical line approximately 5 cm long. As the scanner moves parallel to a plane, at a constant distance of 10 cm, the cameras – positioned at 45° to the surface – record the distortions in the laser line produced by the relief. The movement of the linear guides is controlled by an Arduino board and the system is operated using custom software on a laptop. Lucida's structure is modular and easily adaptable to the requirements of each project.

The Lucida has condensed the joint visions of Manuel Franquelo and Adam Lowe about what it is that defines the dynamic nature of a work of art. The complex and constantly evolving surface of a painting speaks to us about its historical trajectory. Painters understand this physicality, as do those who are responsible for safeguarding and conserving works of art. However, the tools to document it accurately have not existed until now. Therefore, a scanner developed by artists to record works by other artists was inevitably going to be based on the following fundamental principle: a painting is *recognised* as much by its material qualities (its relief) as by the image it represents (its colour). Lucida allows us to effectively separate the two aspects, as if we were virtually removing the colour layer in order to look more directly at the object's material qualities. Without the *distraction* of colour, it is easier to see detail in the texture: the marks that denote the passage of time and the indicators of successive repairs and modifications are all revealed in a Lucida scan.

Since a first prototype was released in 2010, Lucida has been used to digitise almost 200 works of art, including paintings, altarpieces, drawings, maps, books, tapestries,

decorative objects, tiles, murals, bas-reliefs, sculptures and architectural elements. Objects of various sizes, with diverse origins and from different eras, belonging to both private and public collections around the world, have all been recorded with the aim of contributing towards their conservation, study, or dissemination.

In Summer 2012, three diminutive panels – St George, St Jerome, and St Catherine of Alexandria (Ercole de' Roberti, c. 1473) – belonging to the collection of Vittorio Cini (1885–1977) were among the first paintings to be scanned with Factum Foundation's innovative system. In the Palazzo Cini's art gallery on the Campo San Vio near the Grand Canal in Venice, an early Lucida prototype was used to digitise the almost flat surface of the tiny panels. The 3D scans marked the starting point of the *Polittico Griffoni* digital conservation project; the recording of two round panels depicting the *Annunciation* (Francesco del Cossa, c. 1473) soon followed at the Museo di Villa Cagnola in Gazzada.

Seven years and several dozen projects later, in August 2019, the latest version of the Lucida Scanner was used to document the seven Raphael Cartoons at the Victoria and Albert Museum in London. With a total scan area of more than 120 sqm, this constitutes perhaps the most important 3D recording of pictorial works realised to date. The data resolution is constant at 10,000 points/cm^2, as is the capture speed at approximately 4 hours/m^2. These numbers are irrespective of the area recorded: monumental works like the Raphael Cartoons are approached in the same way as the small Venetian panels. There are no shortcuts with the Lucida.

During a Lucida scan, there is plenty of time to contemplate the surface of the painting in question. One can also entertain oneself by watching an undulating line of light glowing white on the black background of the scanning application. With each new photogram, Lucida's cameras record the change in shape and position of the light projected onto the painting – a translation of physical relief into abstract language. Nevertheless, Franquelo, the artist responsible for Lucida's design and software, tends to describe this

THIS PAGE

Colour data of the halo of St Lucy.

OPPOSITE

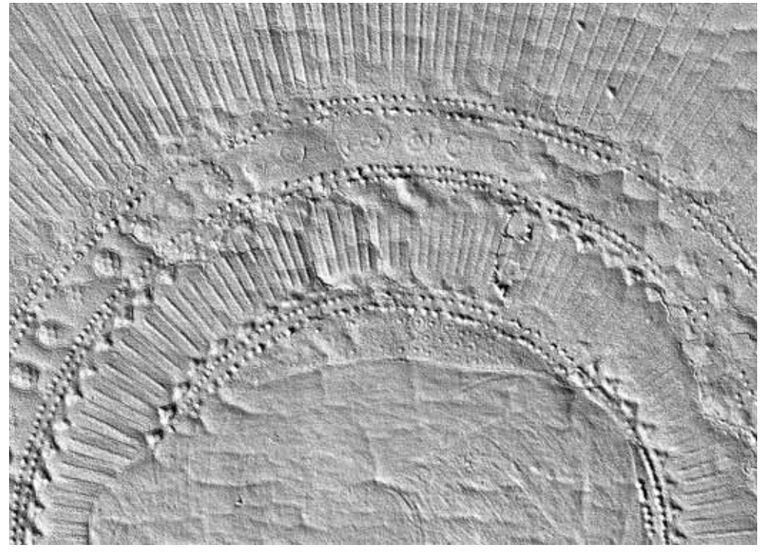
3D render of the halo of St Lucy.

process as the *condensation* of the surface. The term *abstraction* implies simplification, that information is somehow lost. Condensation, on the other hand, is suggestive of information that is being preserved in its most complete, elemental form. In this manner, any relief surface can be documented and stored as a series of ordered profiles.

It is precisely this mode of approaching relief digitisation that makes the Lucida Scanner so relevant within the field of heritage conservation. Whereas most 3D scanning systems automatically perform a transformation on the data during capture, usually to make data processing more user friendly, the Lucida stores *raw* files. This means that in the future it will be possible to access this essential repository of information and re-process the video files with more powerful algorithms than are available today. Implicit in this working method is the current generation's responsibility to ensure that data remains useful even after newer technologies have been developed.

As well as storing the raw video files, the Lucida converts relief into a depth-map – a digital image in which each pixel is assigned a grey tone corresponding to a specific height. Greyscale accurately represents the three-dimensional nature of a scanned surface while allowing a user to work with high-resolution data in a manageable format. Representing three-dimensional information in image form is analogous to seeing in a painting's relief the wrinkled orography of a terrain at reduced scale.

The system was, in fact, designed to digitise flat objects with low relief (maximum depth 25 mm) or what is known as 2.5D – where the X-Y axes that define planar surfaces are fundamentally greater than the Z-axis that establishes depth. Halfway between 2D and 3D, the data captured by the Lucida accurately characterises the original object when the image representing the object reproduces its aesthetic qualities. This is achieved with a different type of digital file, the *shaded render*, which is used to visualise the relief data obtained in the digitisation. The two file types – greyscale depth-map and shaded render – are complementary and serve different purposes. The depth-map enables the



physical reproduction of the surface using digital fabrication means, while the shaded render makes the 3D data visible.

A shaded render can visually reconstruct a scanned surface using the effects of light and shadow. It is generated from the original raw video and based on the simulation of relief using an artificial light source. The light illuminates the scanned 'landscape', creating shadows where it hits the virtual model. The result is an accurate representation of surface texture, very similar to the information obtained when raking light is projected onto a painting. The visualisation imitates reality and the resulting representation of the relief is therefore intuitive, readable and inherently beautiful: a monochrome image composed of light and shadow that establishes a direct correspondence with the visual appearance of the original object. It is subjective in the sense that it is created artificially and *digitally mediated*, but it is also an essentially objective, quantifiable reconstruction of reality. As such, a Lucida shaded render is also a snapshot of an artwork's state of conservation at a concrete moment in its historical trajectory. This constitutes the primary function of the Lucida: it is most useful as a system for documenting objects of cultural and artistic heritage, especially during conservation processes.

The central panel of the *Polittico Griffoni*, St Vincent Ferrer (Francesco del Cossa, c. 1473), was recorded at the National Gallery in London in 2013. The painting had been conserved in the 1980s, when its support was changed to balsawood, the curvature flattened, and the surface cleaned in a process that returned intensity to the colour. The *National Gallery Technical Bulletin* describes, for example, how following treatment the form of the saint's black habit became more distinct and the colour of the sky more vivid.[1] The 3D scan of the painting revealed a surface in a good state of conservation, with few areas

1 Alistair Smith, Anthony Reeve and Ashok Roy, 'Francesco del Cossa's *S. Vincent Ferrer*', *National Gallery Technical Bulletin*, vol. 5 (1981), 44–57, http://www.nationalgallery.org.uk/technical-bulletin/smith_reeve_roy1981.

of damage or paint loss beyond the borders (except for an area on the face that required significant remedial work). The figures' contours are clearly distinguished by the subtle height difference in relation to their surroundings. This variation is particularly evident in the uppermost area of the panel, in which the figures emerge from a golden background. The characteristic punches surrounding Christ and the angels' halos were used by the artist to generate the effect of light bouncing off the surface of the gold, part of the delicate play of depth and texture that completes the viewer's perception of the work.

The predella, *The Miracles of StVincent Ferrer* (Ercole de' Roberti, c. 1473), was also scanned in 2013 in the Pinacoteca Vaticana; it presented an entirely different state of conservation to the National Gallery panel. The data exposed a succession of linear cracks along the central axis, corresponding to the wooden frame that was fitted to the back. The 3D scans created a precise and detailed record of the state of the surface of the panels revealing the need for the attention of the restoration team. The dynamic character of the support was causing the brittle paint layer to crack and lift. The ability to inspect the surface with and without colour adds another layer of complexity to the photographic documentation. The benefits of using the Lucida to monitor change in a work of art before and after conservation treatment became evident in the case of the St Peter and St John the Baptist panels (Francesco del Cossa, c. 1473), which belong to the Pinacoteca di Brera in Milan. The first scan was carried out in 2014 and later used as a base for the facsimiles. Two years later, following restoration and surface cleaning at the Barbara Ferriani studio in Milan, the panels were scanned a second time; the repairs and superficial stabilisation were clearly visible when comparing the scans from before and after the restoration.

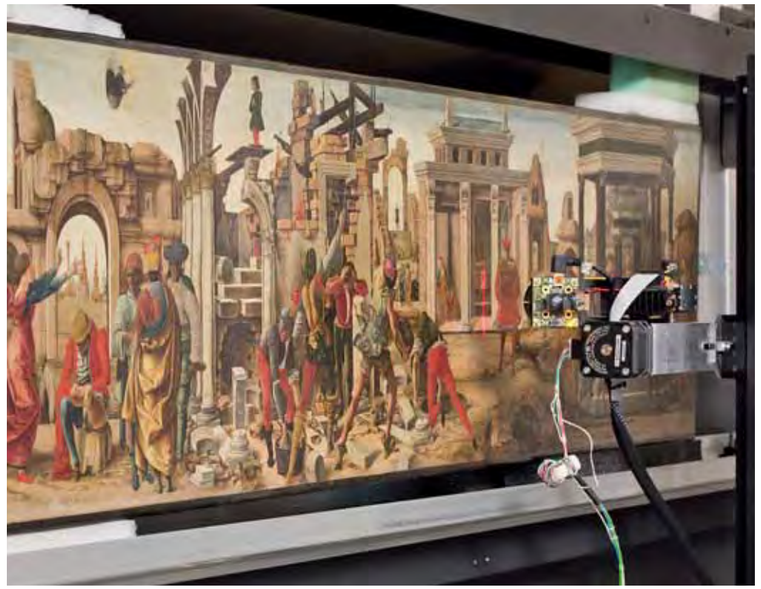
High-resolution 3D recording allows one to look at a work of art without being distracted by its colour. As in a bird's-eye view of a landscape, the geographic accidents of

THIS PAGE

Recording the predella at the Pinacoteca Vaticana, Vatican City.

OPPOSITE

Carlos Bayod Lucini recording Francesco del Cossa's Crucifixion, 1472–73, at the National Gallery of Art in Washington, D.C.



a painting are revealed in the greyscale image and its visual interpretation using light and shadow. One can only begin to intuit the complexity of the pictorial surface when one understands that a painting is more than a flat image – it is in all respects a three-dimensional object where each groove corresponds to the physical imprint of the events that have shaped its appearance. When these three-dimensional traces are made apparent in the scan data, they can generate new questions about the work of art. The 3D recording of paintings and other low-relief objects is a relatively recent and quickly evolving method of documentation and analysis. The Lucida system is a reference point in the field of 3D scanning whose development has paralleled the digital reconstruction of the *Polittico Griffoni*. Since the digitisation of the panels began in 2012, interest in the technology from conservators and heritage practitioners has grown exponentially because, beyond the capability to physically reproduce a work of art, Lucida data makes it possible to study the detail of a painted surface on a computer screen – a unique and novel experience in the world of art.

The surface of a painting reveals much about the artist's intention and aesthetic conception of the work. Texture can produce exquisite effects of light and shadow that complement colour as a vehicle for the transmission of the artist's ideal of beauty. A method of digital mediation that translates surface into an image created from light and shade results from the determination to faithfully convey the unique character of a painting's relief. A system like Lucida, created by artists to record and reveal the beauty of the painted surface, necessarily creates aesthetically appealing images. Beyond its usefulness for forensically accurate documentation, there is a seductive aesthetic in the renders themselves that invites an intimacy with the object. The Lucida's success is based upon its capacity to reveal the aura's physicality.

HISTORIC CARTOGRAPHY AND DIGITAL TECHNOLOGIES: FACTUM FOUNDATION AND THE VIRTUAL RESTORATION OF THE COUNTRYSIDE MAP FROM THE SALA BOLOGNA AT THE VATICAN

Nadja Aksamija and Francesco Ceccarelli

Nadja Aksamija is Associate Professor of Art History at Wesleyan University. Her primary research interests revolve around villa architecture, literature, and ideology during the Counter-Reformation. She has also published on late Cinquecento emblem books, painted sacred landscapes, gardens, landscapes of the 'sacri monti', and cartography (including on the Sala Bologna at the Vatican), as well as on modern restorations of Renaissance buildings in Venice and Bologna and on the concept of the architectural palimpsest.

Francesco Ceccarelli teaches architectural history at the University of Bologna. The focus of his research is the early modern and modern Italian city, from the Renaissance through Neoclassicism. He has curated international exhibitions in architectural history and has authored numerous monographs and edited volumes and scholarly articles. With Nadja Aksamija, he has co-edited the volume on the Sala Bologna at the Vatican and co-directed the research/exhibition project on this cartographic masterpiece, which resulted in the production of Factum's facsimile of the city map of Bologna for the Museo della Storia di Bologna.

OPPOSITE

Recording the Sala Bologna, Vatican City, 2011.

In 2011, under the auspices of the Museo della Storia di Bologna and the Musei Vaticani, Factum Foundation conducted high-resolution digital recording of the entire painted cycle at the Vatican's Sala Bologna. This important state room, located within the Terza Loggia of the Apostolic Palace, was created for the Jubilee of 1575 and adorned with frescoes celebrating the native city of the reigning pope, Gregory XIII, the Bolognese Ugo Boncompagni. Almost five centuries later, this monumental space – originally an open loggia overlooking the city of Rome – has changed functions multiple times inside an architectural context that has also been profoundly transformed following the construction of the Palace of Sixtus V (1589–1605). Today, the Sala Bologna sits between the private apartments of the pontiff and the Secretariat of the Vatican State; it is inaccessible to visitors due to its location at the center of a network of routes used exclusively by the Roman Curia.

Famous for its monumental fresco of the city of Bologna, the biggest city portrait painted during the Renaissance (456 x 607 cm), as well as the enormous chorography of the Bolognese territory, the largest representation of an Italian region ever made (466 x 850 cm), the Sala Bologna contains an extremely significant cycle of frescoes featuring geo-iconographical and astronomical content. It is a direct precursor to the Gallery of Maps, realized five years later for the same pope, Gregory XIII, in the Belvedere Palace, and as such should be recognized as an extraordinary experimental laboratory where various ways of representing a city and its surrounding territory were first tested out.

Thanks to the initiative of an international group of scholars focusing on the study, publication, and digital transposition of the Sala Bologna's geo-iconographical program, Factum Foundation was able to produce a facsimile of the entire south wall of the Sala Bologna (which is now on permanent display at the Museo della Storia di Bologna) and a non-contact digital restoration of the chorography of the Bolognese territory from its west wall. On this occasion, we would like to address the latter project, which provides an exciting glimpse into the many unexpected and fascinating possibilities of digital archaeology and virtual restoration when dealing with monuments of similar complexity. In fact, it was only thanks to the high-resolution recording data that it was possible to read and interpret this map for the first time. Given its extreme size and compromised state of conservation, this would not have been possible with traditional photography. Digital recording has allowed us to examine the

THIS PAGE

Detail of the map showing the castle of San Martino in Soverzano before restoration.

OPPOSITE

Detail of the map showing the castle of San Martino in Soverzano after partial restoration.

map centimeter by centimeter, analyzing over 650 toponyms and investigating the various depictions of architecture, which could then be studied in a variety of new ways.

At first glance, the monumental chorography of the Bolognese territory gives an impression of being an objective and balanced rendering of the countryside in 1575, the Jubilee year in which Lorenzo Sabatini and his team painted it on the basis of drawings provided by Domenico Tibaldi and Scipione Dattari. Its enormous size and extensive topographical and architectural details seem to imply scientific accuracy and comprehensiveness, leaving the modern viewer with the misguided notion that this is an exhaustive and truthful document regarding the Bolognese *contado* at the outset of the Boncompagni pontificate (1572–85). However, like all other cartographic products of the period, the chorography of the Bolognese territory should, in fact, be understood as a highly selective, manipulated, and idealized territorial portrait. When examined against the historical picture painted by various documentary sources, its inclusions and exclusions, its orientation, size, and representational techniques all reveal the pressing ideological and practical needs and ambitions of Gregory XIII's court from which this fresco emerged as one of its most historiographically underappreciated, yet most remarkable products.

Unlike the much smaller depiction of the region on the 1580 map of the *Bononiensis Ditio* at the center of the celebrated Gallery of Maps at the Vatican Belvedere, the Sala Bologna fresco is a 'pure' contemporary chorography, free of symbolic allusions and narrative markers of historical events that make the later map a cartographic intersection of history and geography. Moreover, territorial links to sacred history – which at the Gallery of Maps unfold in the vault above the mapped regions to which they correspond – are also absent. In fact, the Sala Bologna as a whole lacks traditional Christian iconography, leaving the program's chorographic, cartographic, and allegorical apparatus to carry a religious message that is not exactly devotional, but rather 'infrastructural' in its representation of papal hegemony over the entire region. Together with its urban counterpart on the south wall, this great chorography demonstrates, among other things, a vision of good ecclesiastical government in Gregory XIII's homeland, presented here as an exemplum of structural and spiritual reforms in the city and the countryside. In addition to accentuating certain strategically significant topographical features of the province, such as its rich hydrographic system (which was of direct relevance for the pressing question of borders between the Papal State and the Duchy of Ferrara), the map also highlights the *contado*'s devotional and

agricultural aspects above all others, instrumental as they were for the implementation of Gregory XIII's and Cardinal Gabriele Paleotti's reformist policies.

Despite a complex and discontinuous territorial reality at the time, the countryside map at the Sala Bologna presents a neatly regimented agricultural landscape with Bologna at its center, appearing regulated and 'civilized' thanks to an ubiquitous network of civic and religious institutions in its midst. Marked by disproportionately large toponymic labels and architectural symbols – most of them generic and not indicative of the size of the communities or monuments they represented – over 350 of these were small settlements and various types of non-devotional structures (including a few villas and fortified castles), while some 300 were religious establishments such as churches, monasteries, *ospedali*, and oratories. The 250 agio-toponyms simultaneously identified the rural communities and their corresponding system of rural parishes, thus serving as a synoptic visualization of Bologna's rural population, whose exact number was not known until 1587, when the census conducted under Sixtus V finally determined it to be at around 150,000 people. The exaggerated graphic emphasis on the religious infrastructure sought to highlight the Church's omnipresence in the *contado*; focused on the diocesan organization of the Bolognese territory, this chorography portrayed the natural landscape as coated with a political layer of ecclesiastical authority.

Aside from the religious institutions, another potent instrument of urban hegemony in the countryside were the numerous villas of the local patriciate, located mainly in the fertile plain. Of all the sites and structures depicted on the chorography of the Bolognese territory, the small castle of San Martino in Soverzano ('sopra Zena') – a fortified villa of the Manzuoli family located between the Fiumicello and the Zena in the township of Minerbio some 20 km north of the city – was depicted with the greatest architectural and topographical accuracy and a level of detail unmatched anywhere else on the map. Its exploded size relative to the representation of the city has made the castle appear as large as the radius of the city walls. Such an extreme close-up has revealed some previously unknown aspects of the site, such as a large formal garden present there in the 1570s. It has also confirmed that the castle's signature architectural features visible today, including the internal courtyard, the defensive moat, the tall central tower, and the crenelated profile are all original elements, rather than fanciful results of Alfonso Rubbiani's 'medievalizing' interventions in the early 1880s. The remarkably detailed portrayal of San Martino in Soverzano at the Sala Bologna suggests that it had a particular significance for Gregory XIII. In fact, in 1570, while still Cardinal of San Sisto, Ugo Boncompagni managed to get this castle returned to the three Manzuoli brothers (Melchiorre, Alessandro, and Giorgio), who had lost it to the Bentivoglio for a number of years due to inheritance issues. As several inscriptions throughout the castle attest, these three nephews of Cardinal Paleotti proudly restored the late medieval structure in 1571, transforming it, according to contemporary chronicles, into the most important fortified villa in the Bolognese countryside.

Unfortunately, unlike the perspectival map of the city painted on the south wall of the Sala Bologna, the adjoining territorial map is in critical state of conservation. Over the course of the 19th century, when the Sala Bologna was still part of the museum tour through the Pinacoteca Vaticana, its entire west wall was completely covered with tapestries which hid it from view until 1884, when it briefly reappeared during the restoration of the city map; considered 'unworthy of being shown', it was immediately covered up again. It was only in 1934, this time during the restoration of the celestial map on the vault, that the countryside map was finally revealed in all of its 'not negligible geo-historical importance', though its state of conservation was immediately recognized as 'desperate'. A restoration project initiated on 13 May 1943 under the guidance of Giovanni Micozzi was interrupted by the war soon thereafter, and it was consequently never completed.

More than 70 years since that time, there have been no other documented conservation interventions on this map, which currently requires urgent – and no longer postponable – physical care. Though still riddled with holes for tapestries (hung there two centuries ago by the Floreria Apostolica) and worn down in several sections, the map is still legible enough to allow us to gauge its notable technical quality and understand its exceptional historical significance.

Thanks to the rich documentation gathered through Factum's digital recording of the countryside map in 2011, it is now possible to entertain innovative practical solutions regarding its physical restoration in the future. The study of the original cartographic and pictorial techniques, together with historical research on the place names, the chorographic and architectural representation of various sites, the hydrography, and the historic roads, have created both theoretical and practical foundations for a virtual restoration, aided by custom-made software. The Factum team has successfully filled in the lacunae in some sections of the painting, proposing an extraordinary chorographic recreation of the whole that now allows for full legibility and comprehension of the work, which has once again become intelligible as a geo-historical document. This virtual restoration can now be seen and appreciated in a video and in section facsimiles produced at different scales, which can further the study of this map as well as help guide the hand of future restorers intervening concretely on the actual wall.

Digital technology is now at a point where it can provide extremely compelling alternatives to the traditional (and sometimes irreversible) interventions on the objects themselves. A range of new recording techniques, including three-dimensional scanning and multispectral photography, as well as complex archiving systems for the storage and exploration of the acquired data, have been developed and mined by Factum Foundation and Factum Arte over the past several years for purposes of non-invasive conservation of the world's cultural heritage. Factum's multi-layered digital archives – at times translated into extraordinary conservation facsimiles – facilitate the examination and use of the recorded data in a variety of previously unimaginable ways. The virtually restored map of the Bolognese territory provides us with an exciting window into what is already possible to do with these new and constantly improving digital tools.

FOLLOWING PAGES

The partially-restored map.


MODONA
C.FRANCO
VALLE DI S.GIOVANNI
POE
RENO
ARGENTA

OPPOSITE

The façade of San Petronio, with zones that were scanned at high resolution marked in red.

PUBLICA MAGNIFICENTIA AND ARCHITECTURAL PALIMPSEST: THE RESTORATION OF THE FAÇADE OF SAN PETRONIO

Roberto Terra

Roberto Terra is a founding partner of the Cavina Terra Architetti studio in Bologna. He has designed and directed restoration interventions for monuments, historic buildings, cultural heritage and liturgical art, and has worked on the exhibition design of museums and temporary exhibitions. He has also carried out research, edited volumes and published articles and essays on the practice of restoration and the history of architecture.

The only people who have no architecture
are those who have no history.

Eugène Viollet-le-Duc

In 1390, the free municipality of Bologna decided to erect a grand new church in the centre of the city – not a cathedral, but a civic temple dedicated to the cult of San Petronio, patron saint of the city. The municipality entrusted the construction to the Fabbriceria, the institution that has taken care of its conservation and maintenance up until today.[1]

Contrary to the practice of that time, the construction began with the façade. Facing north towards the main public space of the city, it became the foundational element, gauge and generator of the new architectural organism, the vastest ever imagined in Bologna up to that point. From the beginning, the façade represented the symbolic fulcrum of the venture, reflecting the historical everyday life of the city, to the point that it gained the stature of a monument in its own right, to some extent independent of its building context.

After a quick start, the construction lasted many decades, during which time Antonio di Vincenzo's original project was transformed according to contemporary tastes and contractors' wishes. Ambitions for expansion of the ground-plan, however, eventually came up against the limits of town planning – they were incompatible with the new organization of the central urban spaces of the city. When the advancing works reached the point where a great cupola was intended to be built – at the planned intersection between the aisles, the transept and the apse – they were interrupted. It was here in 1663 that the building was terminated, not as specified in the by-now ancient design, but in the form that we know today. The façade itself was completed as far as the mural structure was concerned, but nevertheless remained bare on the upper part, without the marble cladding which had already been finished for the lower part.

The entire construction process, with its progressive adaptations and innovations, was never disconnected from the role of the temple within the historical life of the city. In 1530, the coronation of Charles V as Emperor of the Holy Roman Empire, conducted in San Petronio by Clement VII, was preceded by the construction of the minor portals that, next to the *Porta Magna* by Jacopo della Quercia (1426–38), completed what

1 For the history of the church, see *La Basilica di San Petronio in Bologna* (Bologna: Cassa di Risparmio in Bologna and Cinisello Balsamo: Arti Grafiche Amilcare Pizzi, 1983–84), 2 vols.

would become one of the most celebrated sculpture cycles, not only decorative but also narrative, of the Italian Renaissance.

The projects for completion of the façade[2] shifted from age to age, corresponding to ever-changing stylistic conventions, and finally ran aground in the failure of the competition notices, first in 1887 and finally in 1933–35. At this time, the 'unfinished' parts, with their vivid contrast of refined marble and bare bricks, which up until that moment had provoked opposing feelings and reactions, gained acceptance as a civic icon by at least a part of the community. This was an upending of values which made made this extraordinary architectural palimpsest the most modern demonstration of the *publica magnificentia* sought by the builders of this civic temple. It was based on the ideas of Giosuè Carducci, who had stated in 1881 that it was 'appropriate and permissible to leave the illustrious monument in its present state, which is the result of the events of Italian art, mindset and history'.[3]

In this process, the material history of the façade cannot be considered as limited solely to the chronological scope of its construction. It must include every event, planned or accidental, natural or artificial, which has determined its transformation and conservation up until today. San Petronio represents an architectural *unicum* that integrates every structural, decorative and iconographic element, along with natural decay due to use, the stratification of various interventions, and previous restorations.[4]

In 2009, as continuation and completion of the interventions conducted since the 1970s, the Fabbriceria of San Petronio set out to plan the necessary maintenance for the conservation of the monument, this time integrating operative, technical and scientific needs with functional, economic and financial ones within a single programme.

Entrusted with this task, an interdisciplinary team coordinated by Cavina Terra Architetti drafted a project that started out with an analysis of the basilica's state of conservation. Preventive actions and restorative interventions to be carried out immediately were also outlined, alongside a longer-term plan for periodic maintenance. In this regard, the observation and understanding of the constituent elements in their complex material state served as primary guidelines for every phase of the project, from fact-finding to execution.

The methodological procedures of the building site have also been characterised by patient and constant verification of the ways in which specific solutions work in practice, together with an awareness that every intervention is in itself superimposed on top of previous strata, sometimes irreversible and therefore requiring maximum attention. The solutions chosen, therefore, sought to minimise alterations, favouring permanence where possible. Efforts were also made, at the express request of the Fabbriceria and also according to our own strong convictions, to not overlook 'either … the practical

THIS PAGE

Scanning the façade of the Basilica of San Petronio.

OPPOSITE

A LiDAR recording of the façade of San Petronio and the Piazza Maggiore.

2 *La Basilica incompiuta. Progetti antichi per la facciata di San Petronio* (Ferrara: Edisai, 2001).
3 Anna Maria Matteucci, 'La facciata: dal Seicento al Novecento', in *La Basilica di San Petronio in Bologna*, II, 34.
4 Andrea Emiliani, *Jacopo della Quercia e la facciata di San Petronio a Bologna. Contributo allo studio della decorazione e notizie sul restauro* (Bologna: Edizioni Alfa, 1981).

and financial means, nor the administrative procedures, nor the management criteria of a building site' which, as stated by Eugène Viollet-le-Duc, 'the architects entrusted with such restorations, often very difficult, should know inside out'.[5]

Methods and aims have been shared with the parties involved, primarily the Basilica of San Petronio, the supplier of the financial resources (mainly collected through fundraising); the Archdiocese of Bologna, the proprietor of the building; the peripheral offices of the Cultural Heritage Department responsible for conservation; and finally the city and its institutions – a plurality of voices united in the Honour Committee making up the cultural matrix of this civic monument.

The project began in 2010 with a preliminary analysis of the state of conservation of the building. From this significant points emerged regarding the priorities of intervention for the cladding materials, the external parameters and the internal chapels – all of them complex parts of the vast building, whose characteristics were sometimes typical and recurring, but more often specific and differentiated.[6]

The first phase was dedicated to the façade, considered for the first time both as a single entity and also as a composition made up of three main parts: the rough brick structure, the marble cladding, and the sculpted portals.

The extent and complexity of the façade and the scale of the intervention gave rise to particular problems. First of these was the operational challenge of extending scaffolding over its entire surface (to a height of 58 m). To this were added difficulties regarding the heterogeneity of the materials (brick, marble, stone, mural paintings, plaster, wood, metals), the finishes of these materials (paint, protections, patinas), the state of conservation and finally, particularly with regard to the marble cladding and the portals, the results inherited from previous restoration interventions.

5 Eugène Emmanuel Viollet-le-Duc, 'Les monuments historiques, «Gazette des architectes et du bâtiment»', in *Eugène Viollet-le-Duc. Gli architetti e la storia. Scritti sull'architettura*, ed. R. Tamborrino (Turin: Bollati Boringhieri, 1996), 178.
6 Roberto Terra, Rossana Gabrielli and Michela Boni, 'Restoration of San Petronio: four-year project between innovation and eco-sustainability', in *Built Heritage 2013 Monitoring Conservation Management*, Online Proceedings of Conference, Milan, 18–20 November 2013, editor in chief M. Boriani, eds. R. Gabaglio and D. Gulotta (Milan: Politecnico di Milano, Centro per la Conservazione e Valorizzazione dei Beni Culturali, 2013), 1461–71.

Scanning one of the sculptures on the left-hand doorway.

In response to these problems, a diagnostic plan was put forward. This comprised a sequence of investigations, non-invasive and non-destructive, which involved a contextual consideration of historical, metrical and instrumental features, as well as the establishment of a corpus of information allowing the identification of morphological, material and structural characteristics of the façade, and the classification of their state of conservation.

With specific regard to the portals, in 2010 the Basilica of San Petronio commissioned the Opificio delle Pietre Dure in Florence, as one of the Central Institutes of the Cultural Heritage Department, to collaborate on the development of the diagnostic plan. This was regulated by a first agreement in 2010, which in 2011 evolved into a second agreement for the operative intervention handled by the Stone Materials Restoration Sector of the same Institute.[7]

The façade intervention, finished in 2014, combined actions of prevention and inclusive restoration. As Amedeo Bellini stated, it encompassed 'all the appropriate technical operations to preserve its material consistency, to reduce intrinsic and extrinsic decay factors, and to satisfy all requirements of the building's use while making only the most necessary alterations'.[8]

The legacy of the project will need to be assessed; it cannot be regarded as resolving once and for all the conservation issues associated with the building's future. One important question relates to the conservation of the outdoor sculptures which, as Marco Ciatti observed, 'is one of the most difficult and represents a still unresolved challenge for the science of conservation'.[9] A debate that emerged in the project's early stages, and continued throughout the duration of the works, concerned the possibility of removing those façade sculptures (such as Amico Aspertini's *Dead Christ*) which are most exposed to degradation, to 'a more protected environment, substituting them with copies, today more easily obtainable thanks to non-invasive 3D recording systems'.[10] At the end of four years of activity on the project, the Regional Management for Cultural and Landscape Heritage of Emilia Romagna, together with the civic authorities and the proprietor entity, decided that more time for reflection was needed. It was determined that not all the necessary conditions had been reached, i.e. technical, cultural, economic and functional, given the fact, moreover, that this kind of decision 'is not only on a technical level, but also regards the foundation of modern restoration theory, as it concerns the dramatic dilemma that arises every time between two equally important factors: the connection of the work of art with its historical location on the one hand, and, on the other, the maintenance of its physical integrity, which is more clearly obtainable with the substitution of a copy and an inside location'.[11] Although the initial intervention has ended, the conservation of the façade continues in the form of maintenance and periodical supervisions which are performed 'using preventive analysis and plans, as instruments for increasing knowledge'.[12]

The documentation collected in the preliminary phase and during the works has contributed to the creation of a scientific report on the intervention. This data is a prerequisite for future site maintenance as well as an indispensable element in the ordinary practice of the site's safeguarding and financial management; it constitutes an indispensable aid to scientific study and to the wider project of making the monument and its values accessible to the public.

In this context, the widest range of potential techniques have been explored and analysed, including the creation of a digital three-dimensional representation of the façade, made possible thanks to the scaffolding. The sculptural and decorative scheme was recorded in detail with high precision using photographic and laser scanning; there was no direct contact with the work of art. The recording, carried out between 2012 and 2013 by Factum Arte, involved constant work during the periods and the hours when restoration was suspended, mainly during the night. The data gathered in this endeavour made it possible to update, and in some ways to revive, the chalcographic records common in the 19th century in Bologna, which include many valuable testimonies of San Petronio's *Porta Magna*. Made since 1822, these models are now conserved in the Art Academy of Bologna. The cast of the whole portal, taken in 1886 by Oronzo Lelli, was bought in two copies by the South Kensington Museum in London, and is now at the Victoria and Albert Museum, where it is still exhibited as part of the Cast Collection.

The virtual model created by Factum Arte, which also integrated the historical, diagnostic and conservation data, has significantly expanded our frame of knowledge of the work and its state of conservation. It is in line with the best current technical standards, but still leaves space for the expansion of documentation following future developments in recording technology.

In addition to increasing our understanding of the structure, the project to restore the façade of San Petronio has achieved its main goal – that of preserving the non-material values of the monument through the conservation of the material data – and has thus itself become an instrument and component part of the basilica's cultural heritage.

7 *Il restauro dei portali di San Petronio a Bologna*, ed. M. C. Improta (Florence: Edifir Edizioni, 2016).
8 *Che cos'è il restauro? Nove studiosi a confronto* (Venice: Marsilio Editori, 2005), 24.
9 Mario Ciatti, 'Presentazione', in *Il restauro dei portali di San Petronio a Bologna*, 25–26.
10 Ibid.
11 Ibid.
12 Amedeo Bellini in *Che cos'è il restauro?*, 24.

RESTORATION, REPLICATION, RESURRECTION: CHOOSING A FUTURE FOR AMICO ASPERTINI'S *DEPOSITION OF CHRIST*

Elizabeth Mitchell

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Sculpted by Amico Aspertini and his workshop between 1526 and 1530, the lunette tableau above the right-hand portico as you look at the façade of San Petronio shows either Joseph of Arimathea or Nicodemus lowering Christ into the tomb while the two Marys lament to either side. Famously described by Vasari as 'an eccentric man of extravagant brain, whose figures … are equally eccentric and even mad', Aspertini (1474–1552) was a skilled and prolific painter and sculptor; Vasari writes that 'there is no church or street in Bologna which has not some daub by the hand of this master'.[1]

The tableau from San Petronio brings out both the agony and the compassion of the Deposition: while Joseph tenderly supports the slumped corpse, his expression is one of deep distress, and even the expression of the dead Christ retains something of the pain of crucifixion. The two Marys offer a further division of response: Mary Magdalen is hunched over in grief, her eyes turned away from the sight of the entombment, but Mary the mother of Christ stands straight, looking directly and serenely at the figure of her son. Where Niccolò dell'Arca in around 1463 had presented female members of a pietà scene as the agonised descendants of classical Furies or Niobids, here it is the male figures who are most demonstrative in their anguish, with the female mourners subdued by contrast.

By 2010, when the team from Factum Foundation undertook to scan the three doors on the unfinished façade as part of a larger restoration scheme directed by Cavina Terra Architetti (and carried out by the Opificio delle Pietre Dure and the restoration firm Leonardo), the central group of Joseph and Jesus was in a state of extreme fragility. Sections of the marble had denatured and dissolved as a result of time and exposure, a process probably accelerated by modern airborne pollutants and acid rain, and the arms of Jesus in particular, projecting from the main bulk of the statue, were in need of significant consolidation work. Given these circumstances, there was extensive discussion at this time as to whether the most deteriorated statues of the façade should be left in situ or whether they should be brought down from the façade and exhibited in a museum setting within the church complex. This latter solution would have allowed the sculptures to be seen up close and at eye-level in a far more controlled setting, with facsimiles or copies replacing the originals on the front of the Basilica.

The Opificio delle Pietre Dure ultimately decided to preserve Aspertini's original sculptures in situ. But the use of copies, far from being radical, is one which has long been used in church restoration schemes and is deeply embedded in historical practice – one thinks, for example, of the replicas of the horses from Constantinople that now occupy

OPPOSITE

The 'prosthetic' 3D-printed arm made to investigate restoration options for the figure of Christ.

1 Giorgio Vasari, *Lives of the most eminent painters, sculptors, and architects* [1568], eds. Kenneth Clark, Gaston du C. De Vere and Michael Sonino (New York: Harry N. Abrams, 1979).

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Amico Aspertini, *Deposition of Christ*, lunette above the right-hand portal of San Petronio, Bologna, 1526–30.

Detail showing the fractured left arm.

3D print of Nicodemus / Joseph, with the turban and its locating peg clearly shown as a separate unit.

OPPOSITE

The *Deposition of Christ* within the façade.

the place of the fragile originals on the loggia of San Marco in Venice, or of Viollet-le-Duc replacing the damaged 13th-century sculptures of the kings of Judah in Notre Dame, decapitated during the French Revolution.

During cleaning it was decided to remove previous restorations from the left arm of Jesus in order to safeguard the group, leading to a further difficult decision: whether to replace the deteriorating stone with a lightweight facsimile, which would place less stress on the fragile upper arm, or whether to reattach the original using a metal pin which would add to the stress on the marble. Scans made by Factum (using a NUB3D Sidio Pro 3D Scanner, with additional data provided by a Breuckmann Smartscan 3D) provided the restorers with detailed information to aid them in making this decision. The original arm was carefully removed and a 'prosthetic' acrylic resin arm was made and tested, but a collective decision was ultimately made by the restoration teams to keep the original

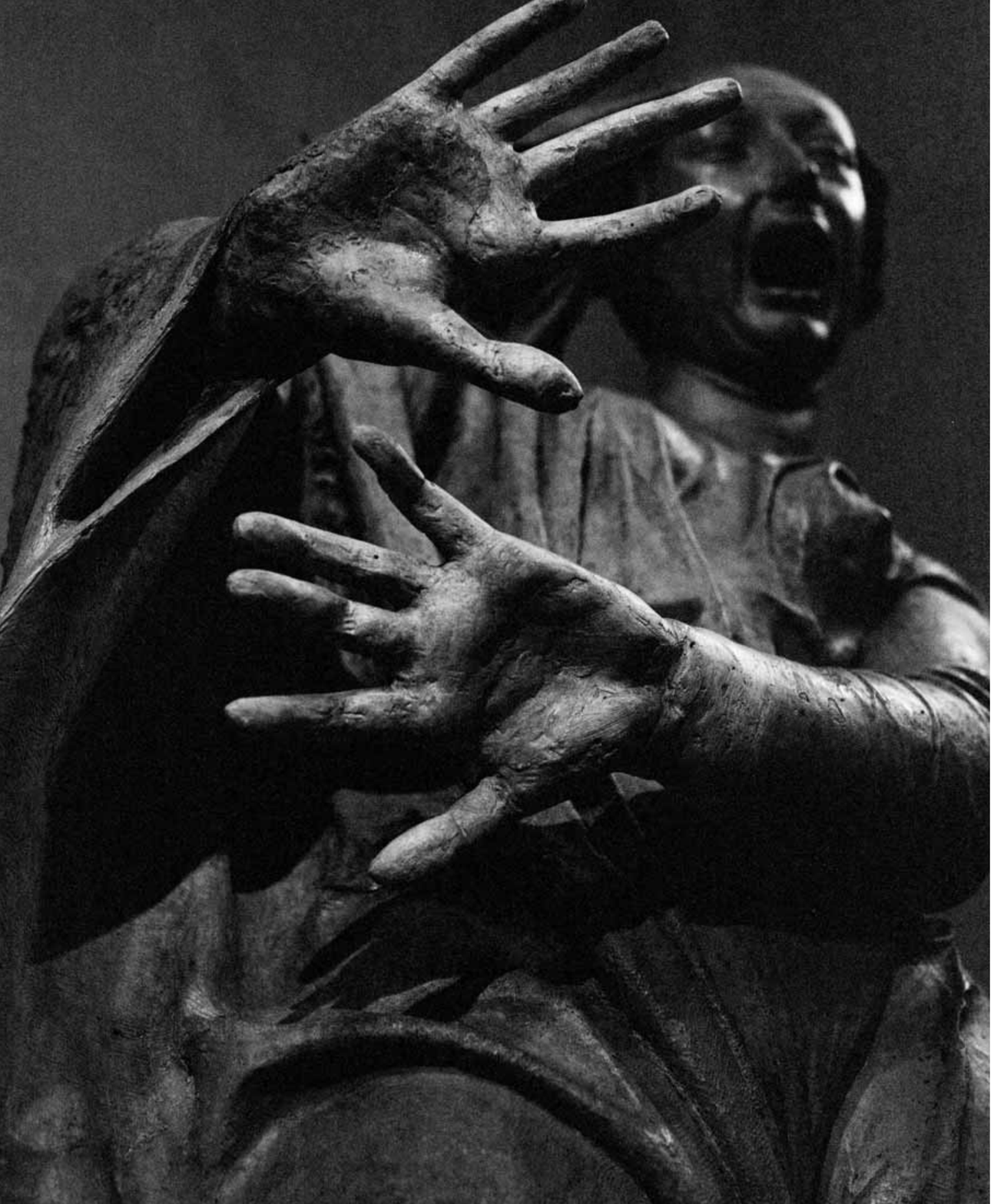
sculpture on display. This involved reattaching the arm with a visible metal support structure – a solution that, although it avoids the stress which would have been caused by a single pin, remains aesthetically awkward.

The scan data turned out to be important for condition monitoring sooner than expected. During the restoration process the right arm of Christ also broke as a result of the weakness of the stone, resulting in damage to the hand and fingers. Fortunately, as scanning had been carried out before the breakage, the data could be used to inform the reconstruction, and the restored arm was also replaced using a metal exoskeleton. Although the main aim of the recording was to create an accurate report for monitoring the condition of the sculptures, the scan data will also provide future restorers with a firm basis from which to replace the damaged original arms with digitally restored facsimiles should they ever wish to do so.

Another place in which scan data has resulted in substantive changes to our knowledge of the sculpture is the turban of Joseph of Arimathea. This is carved as a separate unit from the head of Joseph and is held in place by a square locating extrusion. The turban was removed during cleaning and was scanned independently of the sculpture, allowing both the visible surface and the connecting join to be recorded. Once removed, it became evident that there were two feasible positions for the headpiece, one with the knot at the front and one with the knot at the back. Following the 1972–79 restoration campaign the turban was placed with the knot at the front, although the scan data suggests it fits the sculpture better with the knot at the back.

As Amico Aspertini's *Deposition* clearly illustrates, the state of an original artwork changes significantly over time. The choice faced by the restoration team is one faced by all guardians of buildings and works of art: whether to leave external sculptures in their original location to slowly deteriorate, treating them as objects with a quantifiable life-span, or whether to preserve the originals and to replace them with replicas (to borrow the opposition presented by Jean Clair in *L'hiver de la culture*, Paris: Flammarion, 2011).

While there is no one-size-fits-all answer, the fact that objectively accurate facsimiles are now a possibility makes this choice a more real and immediate one than ever before.



OPPOSITE

Mary of Cleophas from Niccolò dell'Arca's *Lamentation over the Dead Christ*, c. 1463. Church of Santa Maria della Vita, Bologna.

RECORDING EMOTION: NICCOLÒ DELL'ARCA'S *LAMENTATION OVER THE DEAD CHRIST*

Tess Tomassini and Guendalina Damone

In 1260, Raniero Barcobini Fasani, a hermit turned member of the Order of Friars Minor who was eventually beatified, moved from Perugia to Bologna following the advice of a chief magistrate (*podestà*) from the illustrious Bolognese family Orlandini Marescotti. He arrived with nearly 20,000 followers, established the brotherhood of the Battuti Bianchi (flagellant monks) and founded a hospital in the city centre to tend to invalids and pilgrims. The hospital and the brotherhood began operations around 1275 and the small church next to the hospital, previously dedicated to San Vito, soon became its official chapel and took the name of 'Church of Life' thanks to the good reputation of its doctors. In this way, the hospital, church and oratory of Santa Maria della Vita were established.

The sculptural group of the *Compianto sul Cristo morto* (*Lamentation over the Dead Christ*) by Niccolò dell'Arca is situated to the right of the sanctuary's main chapel. This dramatic depiction of sorrow and death was commissioned by the Battuti Bianchi in around 1463 and consists of a group of life-sized terracotta figures – the Madonna and the Three Marys, St John the Apostle and Joseph of Arimathea – weeping over the dead body of Christ, which is laid out between them ready for deposition in the tomb.

The spectator is instantly struck by the tortured look of the mother of Christ and the painful scream of Mary Magdalen, who runs into the scene with her clothes flying out behind her. The extreme realism of the terracotta figures and the 'petrified scream' described by Gabriele d'Annunzio[1] must have had a deep impact on the users of the hospital, many experiencing their own private grief and loss, and it is even possible that the anguish of patients and their relatives influenced Niccolò dell'Arca during the production of the work. But while they may be partly inspired by life, the figures are also embedded within the visual discourse of contemporary image-making: there is a striking resemblance between Niccolò dell'Arca's Mary Magdalen and the two symmetrically disposed women who animate the central section of the predella in Ercole de' Roberti's *Polittico Griffoni*, and also between between Niccolò dell'Arca's Mary of Cleophas and de' Roberti's Weeping Mary from the Garganelli Chapel of Saint Peter, now in the Pinacoteca in Bologna. While most of the statues that make up the *Compianto* are thought to have been made around 1463, it is possible that these two were added later, after the painting of the *Polittico Griffoni* predella in 1474.

The fragility of the seven statues led Factum Foundation to record the group in December 2019. Working at night over the course of a week within the Sanctuary of

1 'This Christ will never be forgotten. Was it made from earth? Was it rotting flesh? I didn't know what the medium was … The three Marys enraged by suffering, demented by the suffering … Listen to me. Can you imagine the petrified scream?' [translated by the authors]. See Gabriele d'Annunzio, *Il secondo amante di Lucrezia Buti* (1924).

THIS PAGE

Otto Lowe recording the sculptures using photogrammetry.

Pedro Miró using a structured light scanner to record the statues.

OPPOSITE

Niccolò dell' Arca, *Lamentation over the Dead Christ*, c. 1463.

Pedro Miró recording the sculptures.

Santa Maria della Vita, Factum's team used an Artec Spyder, a hand-held structured light scanner, and photogrammetry to record each of the statues. As the figures are fixed to the ground and had to be recorded in situ, this two-pronged approach was necessary to minimise the equipment required and reduce the risks associated with working in restricted spaces. Reality Capture and other specialized software were then used to process this data into digital models, and ZBrush was used for organic modelling in places where data was missing due to the impossibility of accessing the sculptures safely.

While the primary aim of the recording is to provide accurate data for condition monitoring, it will also facilitate new research into the figures, particularly with regard

FOLLOWING PAGES

Render of Mary mother of Christ, produced from photogrammetry data.

Render of Christ laid out for burial.

Render of Mary Salome.

Render of St John.

Render of Joseph of Arimathea.

Render of Mary of Cleophas.

Render of Mary Magdalene.

Detail of the predella of the *Polittico Griffoni*.

to their original positioning. In the current display the terracotta figures are fixed to the ground, with visitors and scholars kept at a safe distance from the group. But now they have been reproduced in digital form, it is possible for researchers to reposition the group of mourners around Christ, moving them both in subtle and in more dramatic ways to explore the possibilities of Niccolò dell' Arca's work. Digital recording will thus open up new possibilities for the display of the sculptures – certainly within the virtual sphere, but perhaps even in the physical space of the sanctuary.


OMNIA PVLVIS

St Petronius, the patron saint of Bologna, is easily recognisable in artworks from the model of the city of Bologna that he holds, complete with the striking silhouette of the *due torri*. This image presents him as the guardian of the city, which lies safely nestled in his protecting hand. It is as if the artists in Bologna were pre-figuring the moment at which the world was removed from the shoulders of Atlas and re-presented as a hand-held collection of maps.

Petronius was a protector both symbolically and practically. When he arrived in Bologna as bishop in 431, the city had just been sacked by the Visigoths; he was a notable restorer of buildings, as well as the builder of the Monastery of Santo Stefano. Over a millennium later the saint offered protection to Bologna's artworks in a different way: when Napoleon's forces entered the city in 1796, the inscription above the statue of Gregorio XIII in Palazzo del Comune was changed to suggest that this was a statue of St Petronius, deterring the invading army from removing the iconic work. Even today, the inscription still mislabels the 16th-century pope as DIVUS PETRONIUS – PROTECTOR ET PATER.

Perhaps Bologna still has a need for St Petronius in his role as protector, generator and educator. While the Visigothic threat is long gone, exposure to weather and pollution continues to pose a threat to Bologna's fragile cultural heritage, and the twin towers seem more vulnerable than ever in a region with regular seismic activity. Maybe the role of the patron saint is now a socially shared responsibility: a collective duty to preserve, protect, educate and disseminate the information of our shared cultural heritage in order to protect the past for future generations.

Tess Tomassini

OPPOSITE

Jacopo della Quercia, statue of St Petronius holding the city of Bologna, from the lunette above the central doorway of the Basilica of San Petronio, 1425–38.

CASE STUDY 2

THE THEBAN NECROPOLIS PRESERVATION INITIATIVE

WORK IN THE VALLEY OF THE KINGS, EGYPT

IMMORTALITY AND BEYOND

Nicholas Reeves

Nicholas Reeves FSA is an archaeologist and specialist on the Valley of the Kings and the tomb of Tutankhamun. He has held curatorial positions at the British Museum, Eton College and the Metropolitan Museum of Art, New York.

Factum Arte's decision to record the tomb of Tutankhamun (KV 62) as a follow-on from their earlier work of documentation in the tombs of Seti I and Thutmose III was to prove an archaeological game-changer. The commission came from the Egyptian Government, and would be an ambitious one: to prepare a full-sized replica of Tutankhamun's famous monument which might be employed to alleviate tourist pressure on the fragile original. For most Egyptologists, little interested in copies, the project scarcely registered.

Factum set to work in 2009, employing a powerful combination of high-definition digital photography and surface scanning: in a bid for greater authenticity, the team aimed to generate a record not merely of the tomb's decoration but crucially, as we shall see, of the walls' materiality also – the ground on which these paintings sat.

A first glimpse of Factum's results would be offered by Adam Lowe at a presentation in Luxor that same year. They proved a revelation: his team had achieved a visual record of Tutankhamun's burial chamber which was close to perfect – complete, and able to boast consistently well-lit imagery at a level of magnification many times higher than the original. As enlarged, every stroke of the artist's brush could now clearly be traced; every correction and emendation seen; every subtle change in the painterly palette noted; and, of course, for the conservator, each and every defect and repair detected. The work set a completely new and exceptionally high standard in archaeological recording, emphasizing the inadequacy of everything which had gone before.

Five years on from Lowe's presentation, and with the Tutankhamun replica successfully installed on Luxor's west bank, adjacent to Howard Carter's house, Factum's digital record was made available online. Logging on to their website from my office in New York's Metropolitan Museum of Art, I was not to be disappointed by this extraordinary new resource. Although located some 10,000 km distant from the Valley of the Kings, I was able to study the tomb in greater detail than if I were standing in front of the walls themselves. The online imagery was crystal-clear, and could be manipulated at will, ruminated on at leisure, and returned to again and again for checking as required. What Factum had produced was a researcher's dream.

And there was more. Thanks to the scanning component of their survey, Factum's online coverage offered a wholly unexpected bonus: at the simple click of a mouse it was possible to digitally *strip away* the tomb's painted scenes in their entirety, to reveal the undecorated physicality of the burial chamber walls beneath – plastered surfaces as they had last been seen more than three and a half thousand years before. Here was the tomb as metaphorical blank canvas – a canvas which, to my astonishment, displayed a network of undulations and differences in texture clearly referencing the room's structural history. This was not *better* data than Egyptologists had had before; it was completely *new* data,

PREVIOUS PAGE

Colour registered with relief data from the Hall of Beauties in the tomb of Seti I.

OPPOSITE

Scanning the surface relief of Tutankhamun's sarcophagus with a NUB3D Studio Scanner, 2009.

hitherto unnoticed by us all, including the Getty who had spent months and years nose-to-wall engaged in cleaning and conservation – unnoticed for the simple reason that surfacial examination is insufficient to separate ground from colour.

With the benefit of the new Factum scans, these underlying details were now as visible as archaeological features on a good aerial photograph, and they could be analysed in much the same way. Striking was the presence of lines so precisely vertical that they could not possibly represent natural faults; nor were they digital artefacts, since their contours can actually be *felt* on Factum's physical recreation of KV 62. The manner in which these verticals came together, in fact, seemed to suggest the framing of long-blocked doorways; doorways which, by virtue of their size, form and particularly their alignment to other features within the tomb, gave every indication of being real.

Astonishingly, we seemed to be in the presence of additional chambers: to the west, what may turn out to be a further, Tutankhamun-era storeroom; to the north, an apparent continuation of the antechamber ground-plan, which would serve in turn to identify KV 62 as a significantly larger, right-turning corridor tomb – the tomb of a queen. A queen who can

THIS PAGE

Installing the facsimile in the Valley of the Kings, 2014.

Javier Barreno putting finishing touches to the facsimile.

Colour data for the north wall of Tutankhamun's tomb.

OPPOSITE

Relief data for the north wall of Tutankhamun's tomb.

The entrance to the facsimile.

now be identified as Nefertiti, both from the implications of an overwritten cartouche and by the lady's facial features in the decoration applied to close off and camouflage this putative corridor extension; the wall behind which Nefertiti's burial ought, theoretically, still to lie. Investigations were set in train…

The media response to these proposals would be immediate and loud – so loud, in fact, that the larger story would be quite drowned out: the demonstration that Factum's method of capture and combination of imagery and materiality – the data on which my conclusions were based – represents a fundamental advance in archaeological science. What the Tutankhamun revelations demonstrated was that the potential of Factum Arte's recording technique extends far beyond the tourist arena: it is preservation in its purest form. For, come vandalism, theft, terrorism, wars or natural disaster – the fact is that *any* monument recorded in the manner of Tutankhamun will have the ability to rise physically from the ashes; to re-materialize completely whole – and, as experience now shows, with its forensic potential effectively intact. What Factum Arte have developed is nothing less than the technology required to save the archaeological world.

End note. It is to their credit that Egypt's Ministry of Antiquities has acknowledged the importance of this work by facilitating the launch of the Theban Necropolis Preservation Initiative in collaboration with Factum Foundation and the University of Basel. This initiative has now equipped and trained seven local people to become scanning experts, and this team is currently engaged in recording the tomb of Seti I in its entirety. It is exciting to speculate on what might result from this work too – and comforting to know that Seti's tomb will be joining that (so far select) list of monuments now destined, in the ancient expression, to 'live forever'.

THE THEBAN NECROPOLIS PRESERVATION INITIATIVE

A collective text by the team from the TNPI and the University of Basel, including: Aliaa Ismail, Adam Lowe, Susanne Bickel, Carlos Bayod, Elizabeth Mitchell, Silvia Álvarez and Charlotte Skene Catling

Factum Arte and Factum Foundation have been working in the Valley of the Kings since 2001, as part of a long-term collaboration with the University of Basel under the aegis of the Egyptian Ministry of Antiquities. Since 2009, this work has primarily been carried out through the Theban Necropolis Preservation Initiative (TNPI). The TNPI works on conserving and sustaining Egyptian cultural heritage using non-contact digital technology, with Egyptian staff in charge of all operations on the ground and external involvement focused on capacity development, training, support and technology transfer. The aim is to develop a sustainable structure that will help the Egyptian Ministry of Antiquities to preserve the Valley of the Kings for future generations while encouraging tourism to Luxor and the West Bank. In 2019, the Initiative received the official patronage of the Egyptian National Commission for UNESCO.

Following Factum Arte's initial survey of the tomb of Seti I in 2001 and a project in 2002 to build a replica of the tomb of Thutmose III (for a touring exhibition starting at the National Gallery of Art in Washington, D.C.), Factum Foundation was formed in 2009 to record the tomb of Tutankhamun. At that time, about 1,000 visitors entered this 3000-year-old tomb chamber each day, bringing with them humidity, heat and dust which posed (and still pose) a major threat to the integrity of the painted walls. The Foundation's team used a custom-built scanner to record the walls and the red granite sarcophagus with its broken lid, subsequently making this data public so that conservators would be able to monitor the condition of the tomb and scholars study its surfaces in detail. The Foundation also made a facsimile – a suggestion first made in 1988 by Erik Hornung and Theodor Abt from the Society of Friends of the Royal Tombs in Egypt – which was installed in 2014 next to Carter's House at the entrance to the Valley of the Kings. The facsimile and associated exhibition have been open to the public since 2014, allowing visitors to experience both original and facsimile in one location, and to reflect on the problems of preserving sites whose original builders never intended them to be visited.

THIS PAGE

The Egyptian team in the tomb of Seti I. Left to right: Inspector Ashraf Gaber, Mahmoud Abdellah, Abdo Ghaba, Mahmoud Salem, Mina Fahim, Amany Hassan, Aliaa Ismail and Hagar Ahmed.

OPPOSITE

Facsimile of the tomb of Thutmose III, National Museum of Art, Washington, D.C., 2002.

STOPPELAËRE HOUSE: THE RESTORATION OF THE BUILDING AND THE ESTABLISHMENT OF THE 3D SCANNING, ARCHIVING AND TRAINING CENTRE

This prominent mudbrick building at the entrance to the Valley of the Kings was designed by architect Hassan Fathy in the 1950s and was restored in 2017 by Tarek Waly using traditional methods; in exchange for funding the restoration, Factum Foundation was granted free use of the building for 10 years as the home of the 3D Scanning, Archiving and Training Centre. This centre was opened by Irene Bokova, the former Director General of UNESCO, in February 2017. At time of going to press, Stoppelaëre House had just been shortlisted for the ICCROM-Sharjah 2019 'Award for good practices in cultural heritage conservation and management in the Arab Region'.

The sharing of skills is a core element of the TNPI's work. The model has already led to the training of a team of specially selected local residents, the majority of whom are employees of the Ministry of Antiquities. The training is led by Aliaa Ismail, who has developed an initial three-month training module, based in Stoppelaëre House and focused on the skills needed to work on fragile heritage sites. At the end of this intense course, trainees are capable of operating, assembling and maintaining the scanners, planning the scanning work in the tomb, processing and archiving the data and ensuring that it is delivered to the Documentation Centre in the Ministry of Antiquities. The team in Luxor are supported by remote access from Madrid and assisted by visiting specialists from Factum Foundation and Factum Arte.

The preservation of cultural heritage will always be largely dependent on the interest and sense of ownership of local communities, and recording ventures like this have the potential to contribute substantially to the local economy. Members of the local community who are working with Factum in Luxor are extremely capable and know how to work with technology with limited access to resources and infrastructure. The TNPI is making available the technologies and skills which will allow them to preserve and make decisions as effectively as possible. This recording project is resulting in a significant archive of high-resolution data that is stored locally, owned by the Ministry of Antiquities and made accessible globally to further preservation, knowledge and research.

THIS PAGE

Detail of Hassan Fathy's architecture.

OPPOSITE

Restoring the roof and domes.

The restored building, with render of a projected sign for the Centre.

THE RECORDING OF THE TOMB OF SETI I

In 2016, the TNPI and Factum Foundation embarked on the complete recording of the tomb of Seti I, including all fragments and other objects that were still part of the tomb at the time of its initial excavation by Giovanni Battista Belzoni in 1817. In 2016, work began to record the internal space of the tomb as it is today, using a LiDAR scanner, the Lucida 3D Scanner, photogrammetry and panoramic photography. This work is ongoing with an entirely Egyptian team, almost all from the West Bank in Luxor. Once the recording of Seti's tomb and all of its fragments is complete, the local team will be able to transfer the skills they have learnt to other projects within the Valley of the Kings and elsewhere in Egypt.

In October 2017, on the bicentenary of Belzoni's initial excavations, the first facsimiles of the tomb were shown at the Antikenmuseum in Basel within the exhibition *Scanning Seti: The Regeneration of a Pharaonic Tomb*. The exhibition included facsimiles of the Hall of Beauties and Pillared Hall J as well as a further, interpretative recreation of the Hall of Beauties as it might have looked in 1817, based on the watercolours made for Belzoni by Alessandro Ricci. *Scanning Seti* demonstrated that objects and

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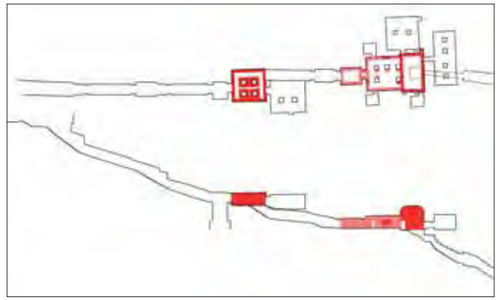
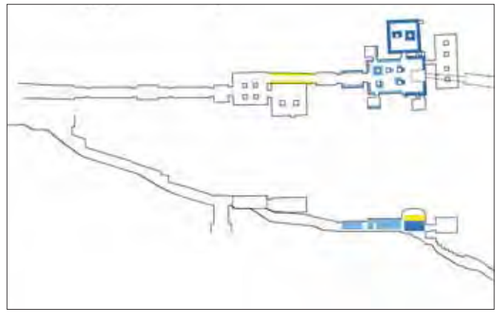
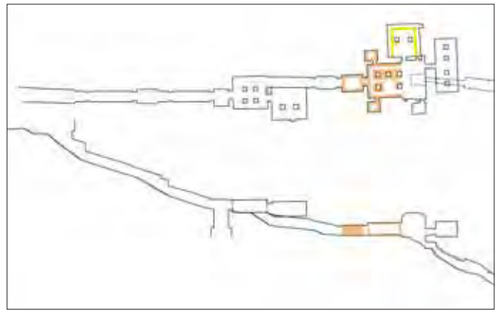
Panoramic photography in the Sarcophagus Room.

OPPOSITE

Carlos Bayod and Aliaa Ismail recording in the tomb with Lucida 3D Scanners, 2016.







cultural sites are dynamic and not static things, which can change from one century to the next in both material composition and geographical location. For the first time in 200 years, the exhibition made it possible for Seti's sarcophagus and many of the tomb's fragments to be seen (as originals and in facsimile form) alongside chambers from the tomb from which they were removed. Visitors could inspect the details of the sarcophagus' fine carvings and gain new understanding of the profound ways in which conservation can affect the appearance of an artefact by comparing the different appearances of fragments that have been conserved in different places at different times. It is arguable that by some measures at least, the facsimiles of *Scanning Seti* offered viewers a more complete understanding of the tomb as it is today than they would have acquired from a visit to the tomb itself.

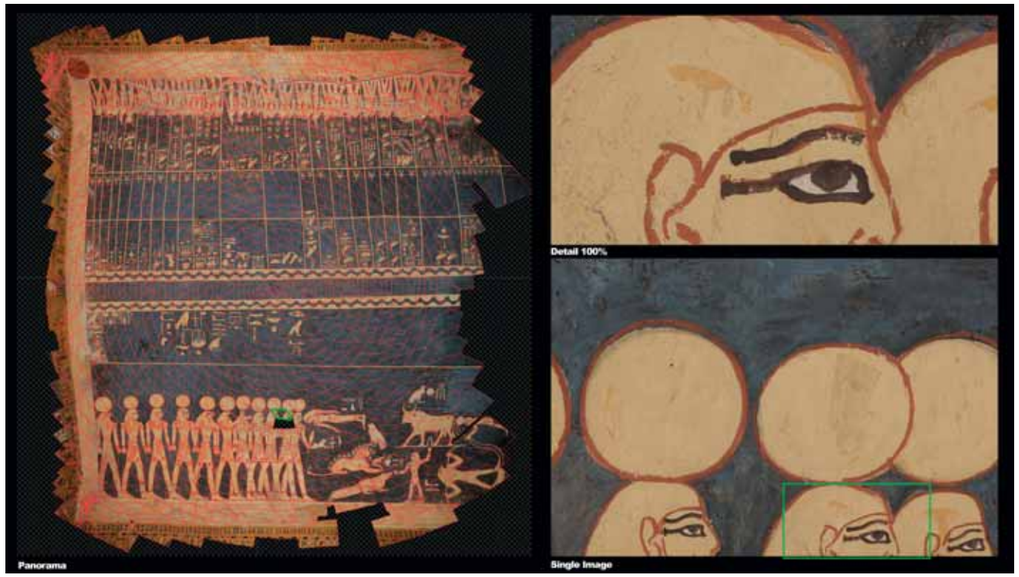
Recording progress: panoramic colour photography.

Recording progress: Lucida 3D scanning.

Recording progress: photogrammetry.

Relief data for the same section of the Hall of Beauties as shown on p. 362.

Colour data from the Hall of Beauties.



Hundreds of overlapping high-resolution photographs of the ceiling of the Sarcophagus Room are automatically stitched together using PTGui software. This is the first stage of a process which combines software and human skill to create high-resolution panoramas.

Recording in the tomb.

The TNPI's ongoing work will result in a facsimile of the tomb of Seti that will be even more complete than that shown in Basel, incorporating many more of the fragments from the tomb; the eventual full facsimile will be the largest and most elaborate ever made. It is a sad irony that the love for cultural heritage is contributing to the destruction of the very things it fetishises, but facsimiles like this one offer visitors an alternative option, allowing them to engage with the present materiality of a pharaonic tomb, to understand its complex history, and to invest in its uncertain future, all with no detrimental effects to the tomb itself.

THE SARCOPHAGUS OF SETI I: RECORDING AND RE-MATERIALISATION

The Sarcophagus of oriental alabaster, was found in the centre of the hall, without a cover, which had been removed and broken, and the body that had once occupied this superb coffin, had been carried away. We were not, therefore, the first who had profanely entered this mysterious mansion of the dead.

Giovanni Battista Belzoni in *The Edinburgh Annual Register for 1808–26*, vol. 14 (1821), chap. 4, 'Geography', 358.

On 16 October 1817, Giovanni Battista Belzoni, a 6'7" engineer and former strongman, discovered the rock-cut tomb of Seti I, the most magnificent and complete in the Valley of the Kings. For 3,100 years this tomb had remained in almost the same condition as on the day it was sealed. As few contemporaries could travel to Egypt, Belzoni made a facsimile of his spectacular find and brought it to London. The relief surface was cast from moulds made on site, removing much of the original colour and fabric in the process. The casts were then painted by hand, following the meticulous watercolour records made on site by Belzoni and Alessandro Ricci. The facsimile caused a sensation when it opened at the Egyptian Halls on Piccadilly in 1821, and the following year was described in detail in Alfred Thornton's *Don Juan in London*, accompanied by a colour engraving of the gas-lit interior which had fascinated fashionable Londoners.

Belzoni acquired Seti's sarcophagus and transported it to London, where John Soane eventually bought it in 1824 after the British Museum had declined the chance to purchase it. It is still displayed in the crypt of Sir John Soane's Museum, under glass, which makes it difficult to examine the delicate carvings (or Belzoni's name graffitied into the foot of the sarcophagus, a very visible 'scar'). The stone was white when it arrived and is now honey-coloured, stained by the 19th- and early 20th-century London smog. The blue infill that originally delineated the carving fell out or was scrubbed away by over-enthusiastic cleaning. Now only traces of the blue remain, and most are 19th-century.

FLESH-EATING STONE

Decay and change are inherent in the idea of a 'sarcophagus': literally a 'flesh eater', it protects the body and the soul during their most vulnerable transformation. The sarcophagus of Seti I contains the protective figure of the goddess Nut on the base and the hieroglyphic text of The Book of Gates on both its inside and outside surfaces; this describes the Sun God's complex journey after death, through the 'dark hours of the sun' to his rejuvenation each morning.

OPPOSITE

Finishing the facsimile.

RECORDING AND RE-MATERIALISING THE SARCOPHAGUS

THIS PAGE

Recording Seti's sarcophagus in Sir John Soane's Museum using photogrammetry, 2016.

OPPOSITE

Silvia Álvarez working on the facsimile of Seti's sarcophagus.

3D render of the sarcophagus.

Archaeologists and geologists use the term alabaster differently. 'Oriental alabaster' is a fine-grained, banded calcite (rather than the geologists' gypsum), with a low index of refraction, allowing light to penetrate several millimeters into the stone before it is scattered back out. This causes the ethereal translucency that makes it so desirable – but also makes it almost impossible to scan with a laser. Factum tried and failed to scan the shape, colour and surface of the sarcophagus in 2001. The scanning was part of a conference based around Factum's work in the tomb of Seti I that took place in Sir John Soane's Museum, organised by Michael Mallinson from the University of Cambridge and Dr Gaballah Ali Gaballah, the Egyptian Minister of Antiquities at the time. Using a Modelmaker scanner (made by 3D Scanners UK) the recording was a failure as the translucent alabaster resulted in a high level of noise in the data. In 3D scanning, the relationship between noise and information is critical. In this case the artefacts in the data exceeded the accurate information, making the data meaningless. It took 14 years and a different approach to record this enigmatic but fundamentally important object.

In 2016, a second attempt was made, funded by Jeffrey and Veronica Berman. A multi-disciplinary team made up of engineers, photographers, cartographers, sculptors, specialist printers and restorers took part in the challenge of recording the sarcophagus and then fabricating a facsimile. This time the recording was done using photogrammetry and a specially designed camera rig with integrated lighting. Over 5,000 photographs were taken and processed with RealityCapture software (the only photogrammetry software available at that time capable of processing this number of high-resolution images). The outcome was a 3D file of over 12 billion polygons: vast, unwieldy, and impossible to handle in one piece. Factum's 3D studio ingeniously transformed the data and, using both photogrammetry and topographic mapping software, separated the sarcophagus surface

from its undulating form. The form was milled into a polyurethane block while the surface was distorted into a flat plane for elevated printing.

The printed surface of the sarcophagus was built up in 5-micron color layers of UV cured resin by Océ - A Canon Company. Once printed in relief and colour, the surface was mapped back onto the curvilinear structure and glued into its final position.

This process of re-materialisation was experimental from the outset and modifications were improvised as new difficulties were discovered. The facsimile of the sarcophagus of Seti I is an object with its own visual qualities, and in the same way that plaster casts were valued as objects with unique qualities and scientific value, so the sarcophagus has become more than an imitation. It is an object of wonder and excitement that reveals the evidence of the past through the technologies of the present.

A monograph entitled *Sir John Soane's Greatest Treasure: The Sarcophagus of Seti I* by John Taylor and Helen Dorey was published to accompany the exhibition *Egypt Uncovered: Belzoni and the Tomb of Pharaoh Seti I* (October 2017 – April 2018). The virtual 3D model of the sarcophagus was displayed alongside the fragments of the lid in their 19th-century mounts made by Joseph Bonomi. All the fragments of the lid were also recorded by Factum's team.

Using the knowledge that has been developed, it is now possible to carry out a digital restoration, based on Joseph Gandy's watercolours, to show how the sarcophagus looked when it first arrived in England. Hopefully this innovative approach to the study of the past will reveal why the object looks as it does now, and possibly why it aged as it did.

OPPOSITE

Two panels removed from the same doorway within the tomb, now in the Museo Archeologico Nazionale, Florence (left) and the Musée du Louvre (right). The panels have been subject to very different conservation choices.

RECORDING FRAGMENTS IN EGYPT AND IN COLLECTIONS AROUND THE WORLD

In the years following the discovery of the tomb of Seti I, large sections of the decorations were removed from the walls. Hundreds of fragments are now in the collections of museums across the world. Others were left in and around the tomb, some removed by the 'excavators' and others from general damage; there are indications that the first ceiling in the sarcophagus room had collapsed. In recent years, over 8,000 fragments have been found inside the tomb itself or in the rubble deposited outside it. The work has been done by a team from the University of Basel under the direction of Susanne Bickel and Florence Mauric-Baberio. The recording of all of these fragments is a fundamental part of the collaborative effort by the Theban Necropolis Preservation Initiative to document the complete tomb in its current condition, including all the fragments in museum collections and all those that are currently stored in the nearby tomb of Ramesses X. This will result in a complete digital restoration and hopefully a facsimile that will communicate the importance and spectacular nature of the tomb and its painted relief carving.

Since 2016, Factum Foundation has recorded fragments in the Boston Museum of Fine Arts, the Louvre in Paris, the Ägyptisches Museum und Papyrussammlung in Berlin, the British Museum and Sir John Soane's Museum in London, the Griffith Institute in Oxford, the Archaeological Museums in Bologna and Florence and in a private collection. Most of these fragments were removed from the tomb soon after its excavation and documentation by Belzoni, Champollion, Rosellini and other well-known figures from the early history of Egyptology. Over the intervening 200 years they have undergone very different treatment at the hands of their new custodians. Two large relief-carved door frames that were situated in corridor G, at the exit from the room containing the Book of Gates, show this clearly. The first, now in the collection of the Florence Archaeological Museum, has a profoundly different colour palette and surface character from its matching pair in the Louvre, the result of different choices made by conservators at the two institutions during restorations that took place in the 1930s and 1990s respectively.

In the Valley of the Kings the excavations carried out at the entrance to the adjacent tomb of Ramesses X (KV 18) between 1998 and 2005 have brought to light thousands of fragments of different sizes that can all be traced to the tomb of Seti. Many other fragments, often large and with colour, were found in the tomb itself when rubble was cleared from some of the rooms. The fragments are currently in storage awaiting recording in colour and 3D. In 2015 the Supreme Council of Antiquities authorised analysis of this material, and the high-resolution 3D and colour recording of these fragments is scheduled to start in early 2020. This is one of the main goals of the

Recording a fragment at the Museum of Fine Arts, Boston.

Currently, fragments have to be pieced together manually in order to determine their original configuration. The digital recordings of the fragments will make it possible to undertake this puzzling process without risk to the originals.

TNPI and the 3D Scanning, Training and Archiving Centre at Stoppelaëre House for the coming months. The aim is to build a complete record of these pieces that can be used in a digital restoration.

The recordings will allow the Basel team to piece together the fragments, reconstructing damaged sections of the walls and making it possible to visualise elements of the tomb which have suffered from the effects of time, archaeology, and tourism. Over the past few years the team has been analysing and re-assembling some of the fragments found inside the tomb. The fragments themselves will be safely stored but in facsimile form they can assist in the study and understanding of the tomb. Several of the pillar faces in the upper part of the sarcophagus room have already been reassembled to a considerable extent. It is hoped that as more fragments are recorded, they will provide insights into the ceiling of the sarcophagus room and lead to a better understanding of the complex history of this vast chamber. Factum Foundation, through ARCHiVe (the centre for the Analysis and Recording of Cultural Heritage in Venice) is committed to assisting with the computer visualisations that will help with the study and re-integration of these fragments, facilitating a better understanding of the tomb for both scholars and the general public. The re-integration of the fragments into the facsimile will result in an exact copy that is more complete than the original, incorporating all the elements. Such a facsimile will lead to a deeper understanding of the tomb, the texts it contains and the prospects for their long-term preservation.

The long-term goal of the Theban Necropolis Preservation Initiative was always to establish a visitor centre on the Ministry-owned land between Carter's House and Stoppelaëre House. The first stages of this ambitious project have already been achieved; the facsimile of Tutankhamun's burial chamber was installed in May 2014 and the full restoration of Stoppelaëre House was completed under the direction of

Tarek Waly. It is now proposed that this will be accompanied by the complete facsimile of Seti I's tomb, along with workshops where further facsimiles can be produced. This will become a new visitor attraction and it will generate a self-sustaining economy for the local community.

LIST OF FRAGMENTS RECORDED OUTSIDE OF EGYPT

Museum of Fine Arts, Boston
Inv. no. 72.645ab; 300 x 200 mm
Inv. no. 72.646; 70 x 80 mm
Inv. no. 72.647; 160 x 140 mm
Inv. no. 72.649; 220 x 150 mm
Inv. no. 72.650; 100 x 40 mm
Inv. no. 72.651; 130 x 100 mm
Inv. no. 72.653; 180 x 180 mm
Inv. no. 72.661; 90 x 120 mm

Musée du Louvre, Paris
Inv. no. B7; 2260 x1050 mm

Ägyptisches Museum und Papyrussammlung, Berlin
Inv. no. ÄM 2058; 2610 x 880 mm
Inv. no. ÄM 2079; 1050 x 530 mm

Museo Archeologico Nazionale, Florence
Seti and Hathor; 2350 x 1030 mm
Maat; 740 x 470 mm

British Museum, London
Inv. no. EA855 (Side A); 1660 x 630 mm
Inv. no. EA855 (Side B); 1660 x 200 mm
Inv. no. EA884 (Side A); 490 x 400 mm
Inv. no. EA884 (Side B); 490 x 210 mm
Inv. no. EA5602; 240 x 180 mm
Inv. no. EA5603; 250 x 240 mm
Inv. no. EA5604; 110 x 70 mm
Inv. no. EA5605; 130 x 100 mm
Inv. no. EA5606; 100 x 180 mm
Inv. no. EA5608; 280 x 200 mm
Inv. no. EA5610; 250 x 380 mm
Inv. no. EA35499; 80 x 110 mm
Inv. no. EA35500; 50 x 80 mm
Sarcophagus lid fragments:
Inv. no. EA37928; 100x 160 mm
Inv. no. EA29948; 350 x 240 mm
Inv. no. EA37927; 120 x 140 mm

Sir John Soane's Museum, London
In addition to the main sarcophagus, 18 fragments of the sarcophagus lid have been recorded. Two are presented in a glass case while the others are set into plaster and housed in four wooden cases with glass protection designed by Joseph Bonomi the Younger.

Museum of Archaeology, Bologna
8 Shabtis from Seti's tomb have been recorded.

Ongoing research is bringing new fragments to light – one was recently recorded at Gallery Eberstein in Paris and another has been located through a dealer in London. The aim is to create a database of all existing fragments and to keep updating it as new pieces emerge.

THIS PAGE

Facsimile of an early Twelfth Dynasty funerary garden recently excavated at Dra Abu el-Naga in Luxor. The facsimile can be seen in place of the original garden, which has been reburied in order to preserve it – it is only the second Egyptian funerary garden to be excavated, and the first to receive proper archaeological documentation. Installed 2020.

OPPOSITE

Facsimile of a funerary stele from the entrance to the tomb of Djehuty in Luxor, made for the Consejo Superior de Investigaciones Científicas and displayed outside the Templo de Debod, Madrid.

CONCLUSION

Adam Lowe

Adam Lowe is the Director of Factum Arte and the founder of Factum Foundation for Digital Technology in Conservation.

Alva Noë writes about *ek-stase* – the breaking of stasis. As ideas find a way to move there is a real sense of excitement and potential. Paul Valéry wrote about this and is quoted by Walter Benjamin predicting a real change in what we consider and how we value art. But in the 85 years since Benjamin's essay 'The Work of Art in the Age of Mechanical Reproduction', the aura has become like a new iconostasis – a fixed barrier of images that separates the sacred domain from the public space. Techne (the practical act of making or doing rather than an understanding based on theoretical abstractions) once again replaces a notion of art for art's sake, emphasising the work that is needed to give the work of art meaning.

The essays and reflections in this book aim to chart a new space for debate and discussion. They span a decade, from Richard Powers' writing about the facsimile of Veronese's *Wedding at Cana* written in 2009 to Mari Lending, writing at the very end of 2019, renegotiating the relationship between the original and the copy, or Hartwig Fischer addressing the issues of the responsibilities that museums face. Over this time, the team from Factum Arte and Factum Foundation has been working collectively and in a way that dissolves professional compartmentalisation, re-evaluates value and sets an anachronic agenda for the things that are important in human communication – understanding, empathy and sharing are among the most important. Celebrity, fixed notions of originality and the art market need to move aside.

High-resolution recording of the surface, colour and structure of things is leading to a new digital connoisseurship, just as medical imaging is reshaping our understanding of health and its treatment. It is providing access to the thought processes and decisions made by people who have lived at different times, with different social structures, different gods, different philosophical frameworks, different value systems and different ideas about the way materials combine and become articulate objects. When concepts are divorced from physical evidence they tend to disperse. Thoughts and ideas need to find their form. They are always rooted in their time but accessible to those who take the time to look, listen and question.

When our own prejudices prevent us from looking and when we fail to embrace the technologies at hand that allow us an intimacy and time to reflect, objects remain mute. Sharing is critical and issues of data ownership, access and long-term archiving all need addressing. While there is a growing interest in applying digital technologies to the preservation of cultural heritage, this is often dismissed as an expensive luxury. Six billion euros were spent on the construction of the MO.S.E. (MOdulo Sperimentale Elettromeccanico) to protect Venice, even though its eventual impact on the preservation of the lagoon is less than clear. The MO.S.E. should have been completed in 2011. It is still unfinished and has never been used. Compared to this level of expense,

PREVIOUS PAGE

Facsimiles of two paintings by Bartolomé Esteban Murillo, *The Miracle of the Fish and Bread* (1669–70) and *Moses Drawing Water from the Rock* (1669–70), each measuring 236 x 575 cm. Recorded in the Instituto Andaluz de Patrimonio Histórico, Seville, 2018.

OPPOSITE

Rafa Rachewsky working on the facsimile of *The Sacrifice at Lystra*, one of the Cartoons by Raphael recorded by Factum at the Victoria and Albert Museum, London, 2020. The Cartoons have been loaned from the Royal Collection by Her Majesty Queen Elizabeth II.

OPPOSITE

3D and colour + 3D data for tiled surfaces from the Casa de Pilatos, Seville, recorded 2018.

FOLLOWING PAGES

Render of the Sepulchre of Cardinal Tavera by Alonso Berruguete, 1552, Hospital Tavera, Toledo, Spain. The Sepulchre is currently undergoing rematerialisation as a facsimile for the Auckland Project, Bishop Auckland, UK.

Renders of a 3D sculpture after Giulio Romano's *Disegno per una brocca a forma di delfino* (*Design for a ewer in the form of a dolphin*), part of an ongoing project to create 3D sculptures in silver based on designs by artists of the Cinquecento.

the application of recording and analytic technology for preservation is a drop in the ocean. If a fraction of this money had been spent on infrastructure, equipment, skilled operators, archiving the data, and understanding how to disseminate it, Venice's future would still be fragile, but we would understand it and the perils it faces a lot better. Hopefully in the future we will be able to make informed and often difficult decisions with a collective understanding.

The return of the 16 physical panels from the *Polittico Griffoni* to Bologna, where they will be seen together for the first time since 1725, is a reason to celebrate. Seeing them as both original tempera paintings and as physical facsimiles, alongside an exhibition about the impact of digital technology on preservation, is also something to celebrate. This publication is not intended as a definitive or coherent thesis. It is a positional document based around the thoughts of many people, as well as Factum's work to map out some of the changes required to reframe our thoughts on the importance and purpose of recording and reproduction. The digital revolution is ushering in an alternative way of thinking that is accumulative rather than sequential – it builds up like a 3D print rather than flashing before our eyes like a film. Perhaps the old dualities – analogue / digital, authentic / fake, virtual / physical, original / copy, Art / Science – are not really so useful in this context.

Digital natives need to seize the opportunity and think as imaginatively as Paul Valéry about what happens next. In a world without electricity there would be no access to digital data. It's not impossible to imagine. As all the data being generated and stored dissipates, what form will our memory take? In a Jurassic Park scenario we can extract the DNA of a dinosaur from a mosquito, but will today's digital depositories survive the test of time? Digital microfilm and data stored as laser-etched glass can survive without electricity, but it will take political will to ensure secure archives with a significant life expectancy, just as it will take dramatic social change to address the issues of climate change. Preservation of our environment and our culture is possible if it is prioritised and if there is a will to preserve.

Tradition is not the worship of ashes
but the preservation of fire

Attributed to both Thomas More and Gustav Mahler

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