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Foundations for a Taxonomy of UAP Shape-Names

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Abstract

This paper presents information for use in developing a taxonomy of shape-names of unidentified aerial phenomena[1] (UAP). A consistent and easily useable shape-name taxonomy is sorely needed in order to categorize a wide variety of atmospheric phenomena into fundamental groups that can then be studied appropriately. Emphasis is given to their two-dimensional outline shape. First, we consider various problems that are associated with studying shape-names upon which a taxonomy might be developed. Second, we review previously published lists of UAP shape-names that provide a larger context for the present study of spherically shaped UAP. Indeed, while the sphere is the only three-dimensional shape in existence that is invariant when seen from any vantage it does not appear particularly frequently in ranked lists of names. Finally, we review some relevant research related to the visual perception of shape.

Introduction

The lack of a uniform shape naming and metric set has led to considerable confusion among investigators of atmospheric phenomena of all kinds. This includes both those working in the traditional sciences as well as those working in the so-called borderline areas where the phenomena of interest still are not well understood. A clear and suitably flexible categorization of object and phenomenon shape-names is a challenging task for many reasons as will be discussed here. At one extreme we might agree to adopt an entirely new set of words and/or symbols to represent shapes while at the other extreme we might agree to use existing words as long as they are rigorously defined. The first approach confronts human antipathy toward learning new words and concepts while the second requires people to more fully educate themselves and then remain consistent in their shape-name usage. Either of these approaches is prone to misuse or disuse; common shape-name usage may continue to prevail.

1 This term is used in its most general sense as any kind of phenomenon seen in the air that cannot be explained on the basis of known natural phenomena or man-made objects.

I. Problems Encountered when Studying and Assigning Shape-names

Language. Each language uses its own words to describe different shapes although there are some words that overlap one another to some degree from one language to another. However, even within the same language different shape-names are often assigned to the same geometric (physical) form of object. Herein lies one of the problems associated with developing a rigorous taxonomy of UAP shape-names. Consider the English words "round" and "circle" for instance. Is one justified in combining data from different research projects that use these two words? Or consider the words "egg" and "oval". Do these words describe the same shape or not? Are not most eggs viewed from an end virtually circles? Or consider the words "rectangle" and "trapezoid" (of certain dimensions). If one views a two-dimensional rectangle at a certain oblique angle it will appear the same as a particular trapezoid. Such ambiguity and overlap of ideas only contributes the problem of establishing a shape-name taxonomy.

Thus, every truly useful taxonomy of shape-names must employ terms that are clearly defined and that possess clearly separated boundaries between them. And, in general, the fewer terms that are needed to classify the universe (entire population) of possible shapes the better.

In keeping with prior work on the subject of human visual perception (Bartley, 1958) an important distinction is made here between commonly related words. The first two are used interchangeably, namely: "form" and "shape." We will reserve *Form* to refer to the three-dimensional surface configuration of all real (i.e., not virtual) physical objects, i.e., their objective, measurable, solid, geometric characteristics. *Shape*, on the other hand, will refer to the visually perceived configuration of these same surfaces and details. A definition for the word "shape" given in Wikipedia refers to the part of the space that encloses an object that is "determined by its external boundary" and considers the various spatial properties of the object such as its position and orientation in the space. The problem with this definition is that it requires an object, a three-dimensional form whereas the author’s definition refers to a two dimensional form. Another definition for “shape” from *yourdictionary.com* is "that quality of a thing which depends on the relative position of all points composing its outline or external surface." Again, except for purely ‘virtual’ optical phenomena, an object must exist in order for it to have a "shape."

The two terms "form" and "shape" can represent drastically different things depending on the immediate viewing conditions as has been shown elsewhere (Cornsweet, 1962; Haines, 1969, 1976; Tolansky, 1964). Documenting and understanding such discriminations are an important part of experimental psychology today. The author has studied a number of situations where the viewer can be totally fooled into seeing something that is very different from what actually is present. (Haines, 1991) This is an important reason for keeping the two terms separate.

Second, consider the nouns "point," "spot," and "dot." In the English language the noun “point” has at least eighty different definitions and/or usages. Here we shall use only one, viz., "something that has position but not extension, such as the intersection of two imaginary lines," " a place of which the position alone is considered," The English noun "spot" has thirty six definitions or uses; the accepted definition used here is "a comparatively small, usually roundish, part of a surface differing from the rest in color, texture, character." The English noun "dot" has twelve definitions and/or uses. The definition used here is "anything relatively small or speck like."

Now a useful method is to ask the question, does a ("blank") possess the quality of shape? For example, does a "dot" have shape? Does a "point" have shape? Does a "circle" have shape? If the answer is yes then the ("blank") has finite frontal area and if not then it doesn't. This is not at all a trivial matter. Does a star have shape? If one answers "yes" then by definition its shape is most likely a very small circle but it is not a point, spot, or dot (among other possibilities); of course, the star in question is not an infinitesimally small thing (as seen from earth) but possesses finite frontal area. Many UAP witnesses have described a light in the night sky as appearing like a spot, point, dot, all of which qualify as an optical point without frontal area. Does a bright planet have shape to the naked eye? To most observers with good distance acuity the answer is yes. If an observer knows he is looking at a planet he also knows that they are spherical and appear as a small circle with finite area. So this description (small circle) must refer to their shape and not their form even though most people are not aware of their actual three-dimensional form.

<u>Object Orientation</u>. Another general class of problems to be dealt with has to do with orientation of the object relative to the observer's line of sight (LOS). There is only one form that never changes as it is rotated, rolled, jawed, pitched, or translated relative to the LOS, that is the sphere. All others will assume a different outline shape when their orientation changes, in fact it can be shown that for any rigid three-dimensional object (form) other than a sphere there are an infinite number of different outline shapes produced merely by changing the object's orientation relative to the LOS. This is where still photographs become somewhat more useful in research since they capture the two-dimensional outline of the object at a moment in time; a video or movie becomes even more useful if the object should rotate. One of the reasons for selecting the spherical shape for the present monograph has to do with its relative unambiguity of its shape-name.

<u>Data Collection, Recording, and Sampling Error</u>. Still another group of problems related to shape-name assignments is related to so-called sampling errors. When many people contribute data about their UAP sightings and an investigator(s) develops statistical measures that are based on them that data is referred to as a single data set however complex and complete (or incomplete) it may be. If another investigator carries out another, similar statistical analysis years later and believes that he or she is studying an entirely new data set one might think that there could not possibly be any overlap or duplication between the old and the newer sets. But consider: (1) Did both investigators ensure that every witness used the single most accurate shape-name for what was seen? (2) Did each ensure that the second group of witnesses used the same shape-names and definitions that were used by the earlier group? (3) Did the second investigator ensure that he or she did not include any witnesses who had already been included in the earlier study? (4) Did the investigator(s) somehow ensure that all of their witnesses were telling the truth and were not hoaxing? (5) Was each investigator absolutely consistent in his own usage of shape-names or did he accidentally

combine some or use others erroneously? (6) Did the investigator insert some artifact or personal bias into the witness's description of what was seen? This is very easy to do without realizing it. Because of these and other sampling and recording errors it is not as simple as it may seem to develop a truly useful and universal taxonomy of shape-names. If those who study UAP are ever to become respected members of the larger science community they must first control for these (and other) factors.

Human Perception. Another large class of problems that has to do with both the strengths and weaknesses of human perception of object shape about which a great deal has been written already (Bartley, 1958; Graham, 1962; Haines, 1980; Luckiesh and Moss, 1931; Middleton, 1952; and many others). In spite of the truly remarkable capabilities of the normal, healthy eyeball and man's central (visual) nervous system that supports it there are numerous gaps in man's ability to see things accurately. Some are optical in nature others neurophysiologic others biochemical and still others cognitive.

The field of study that deals with visual illusions encompasses a wide variety of visual phenomena whose appearance often does not correspond with "reality." By "reality" is meant the original object, target, or stimulus that produced the visually appreciated phenomenon; indeed, the eye can be fooled. Shape-names should be selected to try to avoid these kinds of "mismatch" problems whenever possible.

Entoptic Phenomena. There are also physiological optical phenomena that can cause the viewer to see things that are not actually present such as distortions of the shape of very bright objects due to entoptic light scatter and other neural phenomena (Cornsweet, 1962; Haines, 1969, 1980) and changes in the perceived size of very bright objects (von Helmholtz, 1962), and afterimages (Ronchi, 1957) to mention three. Yet because these tend to be short-lived experiences they do not significantly influence the naming of shapes as do longer lasting phenomena such as mirages.

And so in taking all of the above problems into account, providing completely unambiguous names for different shapes becomes a challenge of great proportions but not an insurmountable one.

II. Previous Research on How Frequently UAP Shape-names are Used

Considering the importance of describing accurately an object's shape when unusual, mystifying, and even stressful phenomena are experienced it isn't surprising that UAP shape-names were included in early investigations conducted both privately and by the U. S. military. Almost as soon as airplanes had been invented sky spotters were being trained to identify different models by their outline (silhouette) shape. Indeed, such identification became of paramount importance when enemy airplanes had to be accurately and quickly discriminated from one’s own airplanes. Yet when UAP began to appear in the skies of America (and elsewhere) the U. S. military didn't know if they were hostile or not; at first they took the conservative view that they might well be.

One of the earliest reviews of UAP sightings was prepared as a classified Top Secret report and then most of the copies were destroyed by the U. S. Air Force as a part of its *Project Sign*, also called Project Saucer. *Project Sign* was established on December 30, 1947 and lasted only until the end of 1948. It included only 237 reports. While a preliminary review of early U.S. sighting reports was prepared by Brig. Gen. George Schulgen of the U. S. Army Air Forces Air Intelligence Division a somewhat longer work was directed by Lt. Gen. Nathan F. Twining, Head of the Air Material Command, Wright-Patterson Air Force Base. Twining's summary letter to Gen. Schulgen dated September 23, 1947 said (in part): "The apparent common description of the objects is as follows: (1) "Metallic or light reflecting", (3) Circular or elliptical in shape, flat on bottom and domed on top. As will be made clear in following paragraphs the Air Force worked hard to boil down a myriad of shape-names to as few as possible.

The U. S. Air Force then established *Project Grudge* as a follow-on activity to *Project Sign* and then in March 1952, it became *Project Blue Book*. According to Clark (1992) Project Blue Books' Special Report 14 contained 3,201 cases, some of which were included from earlier work. The early claim that only three percent of these were classified as unknown was challenged by Friedman (1979) who wrote that the identified objects were clearly different from the unknowns who were described as "metallic symmetric (sic) discs, or in some cases, much larger cigar shaped objects…". It also may be noted that a review of earlier Air Force summary reports of UAP (e.g., *Project Grudge*) didn't consider UAP in any significant detail and only used such general terms as object, light, star, planet, etc. (Anon., 1968)

Considering the matter of the shape-name categories employed in Special Report 14 it is revealing that only five shape-names were included in the report (see Table 1)[2] and a method for recording the witness's shape-name of what was seen wasn't even included in the computerized punch-card coding scheme. Without going through each of the 3,201 case report it isn't possible to recreate a list of shape-names that were submitted to Air Force personnel during these three official study projects nor can it be determined whether the shape-names given in the air force reports are the same as those given by the eye witnesses.

Column A of Table 1 (from Blue Book in Special Report 14; Davidson, 1971) presents the percentage that each shape-name represented of the total based on 498 reports. Column B presents these percentages based on all 3,201 computer cards used in their analysis at the time.

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2 The interested reader is referred to Davidson (1971) for a copy of the original (Figure 15) that shows the distribution of object sightings by shape of objects.

Table 1

Distribution of UAP Shape-Names Included
in Project Blue Book Special Report 14
(Davidson, 1971)

Shape-name	Total	Pct. A	Pct. B
Elliptical	331	66.5	47
Rocket & Aircraft	43	8.6	5.1
Meteor or Comet	8	1.6	2.7
Lenticular, Conical or Teardrop	32	6.4	5.7
Flame	18	3.6	4.8
Other Shapes	66	13.3	11.2
(Unstated)			23.5
	498	100	100

Several things are interesting about these data. First, apparently, no witnesses reported round, circular, or spherical objects/phenomena despite the fact that these shape-names appear in almost *all* other published reviews of UAP shapes that the author has found. Secondly, the Air Force deliberately chose not only a small number of shape-names to characterize their entire database but used those that lent themselves to prosaic explanations for the alleged cause of the sighting itself, thus rocket and aircraft, meteor or comet, lenticular (cloud), etc. were presented (Ruppelt, 1956). It isn't known whether these were the shape-names provided by the eye-witnesses or were added later when the report was prepared. Such a rudimentary list of shape-names as this, one that is not based on well-established geometric shape-names, is both misleading and almost useless.

Another list of shape-names was carried out by the author using the 891 cases presented in Vallee's book Passport to Magonia (1969). This analysis was published in Story (Pp. 332-333; 1980). A total of almost eighty different shape-names (including adjectives and nouns) were found. The author subdivided them into the seven more basic categories shown in the left column of Table 2.

Table 2

Summary of UAP Shape-names [3]
in Passport to Magonia
(Vallee, 1969)

General Shape-name	No. of Other Specific Shape-names	No. of Times used	Pct.
Sphere	8	104	24
Oval	24	248	57
Hemisphere	11	28	6
Cylinder	7	13	3
Square	3	5	1
Triangle	8	18	
Misc. Shapes	15	22	5
Totals	76	433	100

In testimony prepared for a symposium on unidentified flying objects convened by the House Committee on Science and Astronautics, Shephard (1968) developed a drawing of sixty three different UAP shapes that were based on actual photographs in his collection. All of the cases and photos were drawn from actual UAP sightings from such sources as Edwards (1966), Hall (1964), Michel (1967), and others but excluded any references to color that were given on the original reports. He presented these black ink drawings in a single, large matrix made up of seven columns by nine rows; he attempted to group them into roughly similar shape categories. He then presented to each of nineteen college students a subset of 25 photos (from a total of 75 alleged UAP photos that include most of the set of 63) in order to discover what words they would use to describe each shape. When finished each student looked through and described another 25 photos. Each of the name labels given below was given two or more times. Further details are given in his (1968) testimony. The left-hand column of Table 3 presents the descriptive shape-names/labels that these participants gave spontaneously to the 475 student-photograph encounters. Labels that are not shape-related have been omitted.

3. Vallee used the same shape-names as were used by the eye witnesses; he did not add to or change any of them. (Personal correspondence, September 26, 2009)

Table 3

Name/Label Describing the Visual Appearance
of a Photographed Object (Shephard, 1969)

Shape-name	Number of Occurrences in 206 actual cases	475 descriptions of photos
1. Disk	27	42
2. Circular	24	24
3. Round	22	25
5. Domed top	15	21
6. Star like (point of light)	14	6
7. Cigar	13	1
8. Spherical	12	9
9. Ball	11	0
10. Firey appearance	11	0
11. Trail of vapor or smoke	10	13
15. Oval	6	19
16. Flat	6	8
17. Elliptical	5	9
18. Dumbbell	5	0
19. Football	4	1
20. Saucer	3	12
21. Egg	3	5
22. Diamond	3	0
23. Saturn	2	7
24. Top	2	5
25. Conical	2	3
26. Washtub	2	0
27. Two washbowls rim to rim	2	0
28. Two plates rim to rim	2	0
29. Hat	1	35

Metallic	19	41
Portholes or windows	10	0
White filaments emitted	9	0
Pattern of lights	9	0
White	4	0
Silvery	3	0
Long tail	2	0
Emitting flame	2	0
Total =	265	251

The findings presented in Table 3 suggest that: (1) Owing to the difference in sample size the numbers in the right-hand (photo) column should be about twice those in the left-hand column of numbers but they aren't. Shepard concluded that the real encounters evidently were relatively more productive of descriptive terms on the average. (pg. 232, Ibid.), (2) Of the 33 shape-names assigned in this study several were not overall object shape-names at all but rather details (e.g., metallic, fiery appearance, portholes or windows, white filaments emitted, white, silvery, emitting flame), (3) Several names/labels (e.g., circular, round, spherical, ball) could have accurately described the same object. (4) No apparent attempt was made to try to determine what the test participants meant by such terms as cigar, oval, elliptical, football, washtub, etc. It would have been better to ask each participant to make a drawing of what they meant by these terms.

A statistically oriented report by Gindilis, Menkov and Petrovskaya published in 1979 was based on 256 reports of UAP in the former USSR. It includes a classification of phenomena on the basis of shape-names (in Russian).[4] Table 8 from their report is reproduced here as Table 4.

Table 4

Shape Distribution of UAP in 256 reports from the USSR
(Gindilis, et al , 1979)

"Object" Shape	Number of "Objects"	
	Duplication Not Allowed For	Duplication Allowed For
Star like Objects	97 (21%)	78 (19%)
Stars	85	66
Stars of noticeable volume	12	18
Spherical Bodies	47 (10%)	44 (11%)
Regular sphere	28	28
Deformed sphere	6	6
Round Bodies, Disks	66 (14.8%)	65 (15.6%)
Disks with apparent edge	7	7
Round disks (frontal)	46	45
Crescent-Shaped Objects	109 (24.6%)	93 (22.5%)
Symmetrical crescent	72	61
Asymmetrical crescent, "comma"	18	16
Elongated Objects	31 (7%)	31 (7.5%)
Oval Body	19	19
Highly Elongated Oval "Cigar"	4	4
Regular "Exotic" Shapes	32 (7%)	30 (7%)
Triangle	4	3
Rectangle	4	4
Strip	7	7
Ring	6	6

4 It is not known if the investigators added, deleted, or changed any of the shape-names given here.

Dome	3	3
Hemisphere	2	1
Irregular Shapes	30 (6.5%)	30 (7%)
Irregular Spot	7	7
Cometoid Object	6	6
Irregular Polygon	4	4
Dumbbell	1	1
Continuously Changing Shape	2 (0.5%)	2 (0.5%)
Difficult to Determine Shape	12 (2.5%)	12 (3%)
Shape not Indicated in Report	31 (6.5%)	31 (7%)
Total =	457 (100%)	416 (100%)

The authors remark, "The observed shapes of the anomalous objects are extremely diverse. This can be explained, either by the diversity of the phenomenon itself, or by the fact that, here, we are dealing with phenomena of various natures. It is possible that both factors are valid.[5] Besides, it must be kept in mind that the same object, observed at different angles of approach, can appear and be classified differently…. Of course the classification of shapes given in Table 4 (above) is arbitrary. The shape designations adopted in it were taken from the eyewitness descriptions (as they are designated in the reports)." The rest of the section that accompanies these data discusses the practical difficulties in categorizing the different shapes without ambiguity.

Haines (1994) analyzed reports of two or more UAP seen at the same time and place and recorded the precise shape-name(s) provided. A total of 473 cases spanning the period 1504 BC to 1993 are included, however only 197 shape-names were provided.

Table 5

Shape-names Used by Observers of 473 Reports of Multiple UAP
(Haines, 1994)

Shape-name (Basic)	Number of Reports	Percentage
1. Disc	31	15.7
2. Point Source	23	11.7
3. Oval	14	7.1
4. Round	14	7.1
5. Sphere*	10	5.1
6. Ball*	8	4.1
7. Cigar	7	3.6
8. Star(s)	7	3.6

5. Of course another possibility exists, namely that different people used a wide diversity of shape-names and may not have accurately described what they saw.

9.	Cylinder	5	2.5
10.	Globe*	4	2
11.	Elliptical	4	2
12.	Circular	3	1.5
13.	Balloon	3	1.5
14.	Delta	2	1
15.	Hemisphere	2	1
16.	Flat-round	2	1
17.	Egg	2	1
18.	Saucer	2	1
	Others (1 each)	39	19.8
	Object	15	7.6
	Total =	197	99.9

If the names "sphere," "ball," and "globe" are combined in the above table their total is 11.2 percent. This has been done for inclusion in Table 9.

Another analysis of UAP shapes was conducted by the U.K.'s Defence Intelligence Analysis staff (2000). Chapter 3 of this extensive report, entitled "Statistical Analysis of the UAP Database, presents their findings. Their study covered the period 1996 to 1997. Shape-names were provided by the witnesses for 67% of the 1,014 total reports.[6] Figure 3-8 in their report presents a graph of the percentage that was associated with fourteen shape-names and an additional name unrelated to a specific shape. These findings have been reconstructed in Table 6 for comparison with others presented here. It isn't made clear why these values do not add to 100.

Table 6

Approximate Percentage Distribution of UAP Shape-names
(U.K. Ministry of Defence Intelligence Analysis Report, 2000)

Shape-name	Percent of Total
Ball	29
Triangular	8
ST (undefined)	7.5
Oval	3
Tail	3
Saucer	2
Disc	2
Oblong	1.8

6. The author(s) make an important point that a reported shape may be "… defined by an observer from several individual objects which form a shape (formation) but are individually generally round. Hence, three objects which become a triangle when viewed in plan together form a "line" or "bar" or even a "cigar", when viewed sideways-on." (Ibid., Para. 43, pg. 17)

Square	1.7
Cross	1.7
Cylinder	1.7
Mushroom	1.5
Diamond	1
Wheel	<1
Domed	<1
"Object Shape very bright"	22
N = 1,014 Total =	87.9

In his monumental review of worldwide UFO sighting reports for the thirty-year period 1965 to 1995, Hall (2000) presents a summary of their shape-names. One would think that such a comprehensive review would include spherically shaped UAP, but it doesn't! This term is not found at all, at least in Section 9 entitled "Structure, Lights, and Colors!" What he does present are the data presented in Table 7.

Table 7

Summary of UAP Shape-Names (Hall, 2001)

Shape-Name	No. Cases	Pct.
Inverted saucer, Bowl, or Saturn-shaped	25	37.3
Triangular, Boomerang and Delta	16	23.9
Dome, Hemisphere, Mushroom, Cones	11	16.4
Top	9	13.4
Small discs	6	9
Total =	67	100

It is beyond the scope of this paper to speculate why Hall did not identify any spheres except some kind of non-deliberate sampling error.

Weinstein (2001) developed a catalog of military, commercial, and private pilot sightings of UAP from 1916 to 2000 consisting of 220 worldwide entries. Sixty four of them (29%) did not include any shape-name at all. Of the entries having shape-names a total of forty two (19.1%) contained the names given in Table 8. If the four shape-names with asterisks are combined they account for 23% of the total.

Table 8

Distribution of Shape-Names Related to Spheres
(Weinstein, 2001)

Shape-name	No. Cases
Ball of Fire, Fireball*	15
Sphere*	12
Ball*	8
Round	4
Circular	2
Globe*	1
Total =	42

A more recent review of 300 UAP sightings by military and civilian pilots was published by Weinstein (2009). One of the many characteristics of the UAP reported was shape. Table 9 presents his findings (used by permission). The percentages shown are for the first 12 shape-names only (i.e., 152 cases). It is not known why no shape-names were reported in the other 95 cases.

Table 9

Distribution of UAP Cases by Shape
(Weinstein, 2009)

Shape-name (by group)	No. Cases	Pct.
Circular (14); Disc (25); Saucer (5); Round (17)	61	40.1
Oval (25); Elliptical (1); Egg (2)	28	18.4
Sphere (15); Balloon (2); Globe (1)	18	11.8
Cigar (11)	11	7.2
Missile (5): Rocket (1); Torpedo (1); Fuselage (2)	9	5.9
Hemisphere (2); Inverted bowl (3); half-moon (1)	6	3.9
Triangle (3); Delta (1); Flying Wing (1)	5	3.3
Cylindrical	5	3.3
Bullet	3	2.0
Bell	2	1.3
Cone	2	1.3
Rectangular	2	1.3
Changes shape (during observation)	1	99.8
Miscellaneous[7]	13	

7 Crescent, hexagon, losange, diamond, inverted V, doughnut, pancake, sausage, dark mass, mushroom, pear, tube, elongated.

Unspecified	39
	Total = 205

Interestingly, Weinstein chose to group four shapes into the first category, presumably because they would tend to all appear alike, however, the second and third shape categories might also be confused with the names "circular," "disc," "saucer," and "round." For example, an oval of certain width to length proportions might appear round when tilted at a particular angle relative to the line of sight. A "disc" and "saucer" will also appear round when viewed normal to their surface.

A total of nineteen basic shape-names are used by the Mutual UFO Network within its Case Management System (CMS): blimp, boomerang, bullet/missile, cigar, cone, chevron, circle, cross, cylinder, diamond, disc, egg, fireball, oval, saturn-like, sphere, square/rectangular, star-like, and teardrop. They also include an "unknown" and "other" category. <www.mufon.com>.

Lee (2010) published a review of 127 reports obtained from a variety of English language articles, books, research files, and internet sites in which ground witnesses described spherically shaped UAP apparently in pursuit of an airplane or vice versa.[8] This review was part of a larger study in which UAP of all shapes were reported. Table 10 presents the UAP shape-names included in this larger study rank ordered by frequency of occurrence.

Table 10

Ranked Distribution of UAP Shape-Names
(Lee, 2010)

Shape-name	No. uses	Pct.
Sphere	56	53.7
Light(s)	8	7.7
Disc	6	5.8
Circle, circular	5	4.7
Orb	5	4.7
Oval	4	3.8
Chevron	2	1.9
Fireball	2	1.9
Object	2	1.9
Saucer	2	1.9
Ball	1	1.0
Boomerang	1	1.0
Cigar	1	1.0
Cloud	1	1.0
Cone	1	1.0

8 See 3.3.1 for selected results from this study.

Diamond	1	1.0
Donut	1	1.0
Globe	1	1.0
Parachute	1	1.0
Starlike	1	1.0
Triangle	1	1.0
Tube	1	1.0
Total	104	100

Considering the names "sphere" "balloon," and "globe" it can be pointed out that all are three-dimensional objects but a balloon and globe may or may not be spherical as is shown in Figure 1 and 4.1 and 4.2. As discussed elsewhere, many balloons are distorted in shape due to payload packages suspended beneath them and/or by the impact of wind. So a more precise set of shape-names is needed in the study of UAP in order to reduce the confusion and lack of precision that accompanies the use of so many different shape-names.

Figure 1. Photograph of Weather Balloon
Viewed from the Side Prior to Launch

Table 11 provides a comparison of the UAP shape-names given in Table 1 through 10. They have been rank-ordered by the names used most often within each author’s study.

If the following data show anything it is that there is little consistency in the UAP shape-names that have been used in the past. Whether or not this accurately reflects an actual change in the shape (or form) of UAP over these particular spans of years remains to be seen, however, this is very unlikely. These data also point to the need for a universal shape-name taxonomy. Note the use of such shape-names as elliptical, oval, and lenticular each of which might be used to describe the same form; likewise, the shape-names: sphere, globe, and ball.

Table 11

UAP Shape-names Rank Ordered by Frequency of Usage
from Previously Cited Reports

Author/Reference	Rank-ordered Primary UAP Shape-names				
	1st. (Highest)	2nd.	3rd.	4th.	5th.
Blue Book #14 (1971)	elliptical	rockets & aircraft	lenticular	flame	meteor/ comet
Vallee (1969)	oval	sphere	hemisphere	misc.	triangular
Shepherd (1968)	disc	circular	round	domed top	star(like)
Gindilis et al. sphere(ical) (1979)	crescent	star(like)	round disk	elongated	
Haines (1994)	disc	point	sphere ball, globe	oval	round
UK (MoD) (2000)	ball	triangular	ST(?)	oval	tail
Hall (2001)	saucer bowl	triangle delta	dome hemisphere	top	disc
Weinstein (2001)	ball sphere	round	circular	-------	-------
Weinstein (2009)	disc saucer	oval elliptical	sphere balloon, globe	cigar	rocket missile

III. Selected Shape Perception Research Findings

Several reports are available describing the results of controlled studies of how accurately people can draw briefly presented visual images flashed on a screen. Haines (1976) presented a rigorous method to use with eye-witnesses in order to recognize shape and other details rather than relying on memory-based reconstruction methods that tend to be less accurate. His method employs the use of several sets of line drawings of shapes that vary along one or two perceptual dimensions at the most. Much like the criminal suspect identity “recognition test” used by police departments today, all the witness has to do is point to the drawing that looks most similar to what was seen and (later) add various details to it if necessary.

In 1977 Haines published the results of two UAP drawing tests given to several groups of alleged UAP eyewitnesses and non-witnesses. The main objective was to see if any differences could be found in the drawings of the two groups such as the width to height ratio of the object, amount and kind of surface details, amount of associated scene details, etc. Interestingly, no discernable differences were found. This doesn't prove that the two groups of participants came from the same population sample or that all UAP witnesses may be merely portraying a commonly held social stereotype image of what UAP are supposed to look like although the evidence could be interpreted this way. Figure 1 in Haines (1977) presents twelve line drawings of spherically shaped UAP or concentric rings/circles. Other shape-names the author chose to include were: hemispheres (flat bottomed dome); saucer (with or without raised dome on top); symmetrical disc with central circumferential band of detail(s); rocket or bullet; miscellaneous.

In Haines (1978/79, 1979) the 1977 series of studies described above was repeated with a larger number of volunteers but using the same basic procedures. Again, the main objective was to determine whether there are differences within the pencil drawings of what UAP look like between groups of people who claim to have seen a UAP and other people who have not. It was found that the "have seen a UAP" group drew a larger percentage of: (a) non-ludicrous object shapes, (b) object shapes that were at some angle relative to the edge of the paper, and (c) two or more shapes on the same page than did the "have not seen a UAP" group. They also drew a lower percentage of: (a) shapes in side or isometric view, (b) symmetrical shapes, and (c) surface details like apertures, markings, lines outside the basic shape, etc. Both the "have seen a UAP" and "have not seen a UAP" participant groups drew the same average width-to-height ratio of the outline shape (or its dome, if one was drawn).

These and many other studies have shown that the visual perception of object shape is a complex process that can be influenced by a host of factors including: viewing duration, brightness contrast, number of objects visible at the same time, object velocity and change in direction of travel, object orientation and critical details, the witness's visual capabilities, and last but certainly not least whether or not the person had actually seen a UAP or was making one up. These studies have also shown the great value of using a shape recognition procedure rather than a memory-based reconstruction from scratch method. In the next section the subject of critical detail is discussed.

A Recommended Field Investigative Procedure

If a thoroughly rigorous study of UAP is one's goal, field investigators should only record the shape-name(s) that is used by the eye witness and not change them to suit their own personal preference, familiarity, or currently accepted usage (cf. Haines, Pp. 389-390, 1979). After the witness's own words have been recorded only then should the investigator go back and clarify them if necessary.[9] Field investigators should also attempt to clarify shape-name ambiguities using drawings, photographs, etc. *after* all other sighting data have been recorded and *not* during the primary interview session. Finally, since the field investigator should be considered to be an integral part of the UAP reporting process (along with the eyewitness) it would appear to be justified to allow for them both to be cross-checked by the involvement of a second, trained investigator whose chief responsibility is to verify the point-by-point correspondence of the eyewitness's report and the (later) investigator's report. (Haines, pg. 393, 1979)

Critical Detail

The basic idea behind the concept of "critical detail" is that every shape is correctly identified because it contains one or more critical details. These details usually become increasingly obvious as the object grows in size and/or increases in contrast. Consider the following relatively large and well known object.

An airplane viewed from the side from several hundred feet distance has a vertically oriented tail[10] (for lateral stability and guidance) attached to its fuselage. The *same* airplane viewed from underneath has two wings and two elevators protruding from opposite sides of its fuselage. The *same* airplane viewed from the front (or rear) has two wings, two elevators and a tail (among other details).[11] But if that airplane is twenty or more miles away its presence (much less its identity as an airplane) may be noticed only by virtue of a flash of reflected sunlight from a window or other non-critical detail. In this case the observer might assume that an airplane was the source of the light flash but they could not be certain. It is because of one's prior familiarity with airplanes in general that these critical details may define the object; but, if one isn't familiar with airplanes (as a class) they won't be able to identify the thing as an airplane. So prior familiarity becomes a critical factor in shape-naming.

Or consider the critical details of a less rigid object such as the weather balloon shown in Figure 1. As is discussed by Efishoff elsewhere in this report (4.1) weather balloons in particular and other kinds of balloons and LTA craft in general can assume a wide range of shapes depending on many factors.

U.S. weather balloons are usually white or tan, rounded, with some distortion at their lowest point where a payload is attached, and flexible to some degree. The shape-name "teardrop" or more precisely "inverted teardrop" seems somewhat appropriate here. As it

9 This procedure helps reduce personal biasing of the witness by the investigator.
10. Also known as a vertical stabilizer.
11. During wartime airplane spotters (and others) are trained to identify different airplane models rapidly on the basis of their silhouette outline shapes.

rises to greater and greater heights it expands and approaches a spherical form for reasons that will not be discussed here. When a pilot sees this balloon from the side at the same (high) altitude its only critical detail may be the payload hanging beneath it on a supporting cable. Its rounded shape is not necessarily a critical detail. Depending on viewing distance, the size of the payload package, the presence of a supporting cable, and illumination conditions, the payload package may or may not be visible at all. A pilot may correctly identify the object as a weather balloon merely on the basis of its location in the upper atmosphere from NOTAM advisories he or she has read prior to the flight or its visual correspondence with other weather balloons he or she has seen in the past (including photographs). Because inflated balloons are not rigid they can assume different shapes.

Consider the large research balloon shown in Figure 2 photographed by T. Dunham of the Lowell Observatory through a telescope. This balloon was launched from Fort Sumner, New Mexico on June 11, 2009. It reached an altitude of between 110,000 and 120,000 feet and had an estimated diameter of six hundred feet. It was seen by many people on the ground in Arizona the same evening of the launch. (Lowell, 2009) The heavy payload distorted its shape from what otherwise would have been nearly a sphere.[12] Both the payload and the teardrop shape become the two primary critical details. Other critical details here include the barely visible payload package's suspension cable and the vertical lines that form part of the stress-support harness.

Figure 2. Research Balloon at High Altitude

Compare the two objects in Figure 3. For the moment try to ignore their surface colors and shading.[13] Consider each object only as a silhouette. Because the critical shape details

12. Strictly speaking, gravity and other forces (e.g., wind pressure) will prevent large balloons from being spherical.
13. Shaded surfaces within the perimeter of each of these objects may provide some useful information concerning the identity of the object (e.g., the color/reflectivity of its surfaces, its orientation relative to the source(s) of illumination) yet they play no role in determining their outline shape. Such features do form a component of each object's critical details, however.

are found only around the perimeter of a two-dimensional object this cube can be discriminated from the icosahedron by two things, the number of protruding corners (six) and the total angle between two adjacent faces (typ.120 degrees depending upon its orientation) as compared with (eight) corners (20 faces), for the regular icosahedron.

Cube Regular Icosahedron

Figure 3. Two Static Objects

Shape-name Taxonomy

A taxonomy is merely a standardized method of classifying things, in this case two-dimensional shapes of things. But why only two-dimensions? Because the perceived <u>outline shape</u> of any object - having a finite width and height - can only be seen one instant at a time. Like the film in a camera, each retina receives only two-dimensional images.[14] Over time, object motion (rotation), different paths of illumination, and other factors these "static" images may be integrated in higher central nervous centers into far more complex three-dimensional shapes.[15] So to keep the naming process as simple and uncomplicated as possible we will deal only with static, two-dimensional outline shapes.

A taxonomy becomes a means for classifying shapes into meaningful and useful compartments or boxes to which unique numbers (or letters, or both) may be assigned for later statistical purposes. The use of computers has made it feasible to employ as almost as many compartments as is necessary or highly complex nesting and branching techniques. Following are a number of elements of a taxonomy.

<u>Shape-name Independence</u>. Every shape-name should be independent from every other shape-name. Thus: "line," "square," "circle," "pentagon," etc. are acceptable but "oval," "egg," "teardrop," "smoke trail," etc. are not acceptable candidates (used by themselves and without qualification) because there is more than one well accepted definition and/or sample of each one.

14. While binocular vision can afford a three-dimensional appreciation of a solid object it must be relatively near the witness (typically within twenty or thirty feet). Beyond this distance visual cues for the third (depth) dimension diminish rapidly.

15. Laboratory studies that present rotating, three-dimensional objects only visible in silhouette have shown how observers impute three-dimensional characteristics to the object only by virtue of the indentations and protrusions that appear around its boundary as it rotates, that is its critical details. It is only when the observer can see the front surface(s) of the object that these three-dimensional characteristics are 100% confirmed.

<u>Shape-name Precision</u>. Scientific precision calls for mathematically definable shape-names such as "line," "square," "pentagon," etc. whenever possible. Each of which has one established definition. Considering the wide range of shape-names found in Table 1 through 10 above, it is apparent that naming precision has not been taken very seriously in the past by UAP investigators or military personnel.

<u>Shape-name Qualifiers</u>. Most UAP eye witnesses are not aware of nor use precise shape-names; many resort to descriptions that are virtually useless from the standpoint of science. Even approximations such as "rectangle," "triangle," "chevron," "saucer," "cone," etc. are of only of the most general scientific value. However, if qualifying words are added these approximations may become acceptable. For example, a "rectangle with a six to one ratio," or a "right triangle with 30, 60, and 90 degree corners" become immediately precise. At one extreme then, many verbal descriptions indicate little more than that something was seen. At the other extreme, they may indicate that the object or phenomenon had, for instance, a flat edge as opposed to curved (or some combination) and possessed sufficient critical detail to be identified by its shape - for example, an airplane. So an acceptable taxonomy of shape-names should allow for different levels of precision through the addition of “qualification" as may be required.

<u>Shape-name Extension</u>. There should be enough shape-names to encompass all present *and future* UAP shapes that may appear. This is a difficult criterion to meet since no one knows what new shape(s) may appear in the future. If newly coined words are permitted (accompanied by clear definitions, photographs, and illustrations) then this requirement can be met with relatively little difficulty. In addition, use of statistical shape measures can permit expansion along particularly descriptive axes. Gibbens and Cook (2006) proposed a method using cluster analysis in order to lend structure to heterogeneous image data sets and to provide a "…framework for more powerful, open-ended analysis of large data sets." Their approach involved using statistical shape parameters within segmented image regions.

<u>Shape-name and Cultural Influences</u>. A truly useful and lasting taxonomy of UAP shape-names should be as independent as possible from the cultural norms of the time in which it was introduced. One researcher traced the "Geography of Knowledge" in which he showed that the Dewey Decimal (taxonomy) system of book classification is skewed strongly toward the 19th century system views of its creator. (Bower, 2007) The writer argued that the Dewey Decimal System "…can't be fixed because knowledge itself is unfixed. Knowledge is diverse, changing, imbued with the cultural values of the moment. The world is too diverse for any single classification system to work for everyone in culture at every time."

If we adopt the above view we might not even attempt to develop a workable UAP shape-name taxonomy in the first place. However, if we agree to limit the usefulness of our taxonomy to the length of one generation or to permit additions (not strictly equivalent to taxonomy changes) along flexible dimensions then a more lasting and culture-free taxonomy is possible. However, Bower goes on:

"The real problem is that any map of knowledge assumes that knowledge has a geography, that is a top-down view. That assumption makes sense in the 1st and 2nd orders of order. It unnecessarily inhibits the useful miscellaneous ness of the 3rd."

So what about UAP shapes? Do they have a geography, fixed boundaries so to speak? Since we do not yet know what the phenomenon is we cannot say for sure.[16] Following this more geographic approach use of a set of outline forms from which a witness simply points at the one most similar to what was seen would make most sense. As mentioned, the author has proposed such a methodology that does not depend on memory but rather shape and detail recognition which is considered to be more stable and reliable over time. (Haines, 1979; Pp. 53-68, 1980) Next we will consider shape and various other characteristics of the object to be named and classified.

Shape, Size, and Distance. Every optical system including the unaided human eye has limits to its resolution (Bartley, 1962; Haines, Pp. 107-115, 1980). The bases of the human eye's resolving power is discussed in detail elsewhere. (Ogle, 1961) The question can be raised when does an optical point imaged onto the human retina begin to take on a recognizable shape? The answer depends on many variables but suffice it to say that at moderate contrast levels, the retina fully adapted to ambient illuminance and in a healthy condition, accurate perception of simple shapes can occur when the object's critical detail subtends about one to two minutes of arc.[17] Of course the form of the small or distant object plays an important role here. Most so-called eye charts in optometrists' officers are based on this principle of critical detail.

More complex forms (e.g., pentagon, octagon) require greater magnification than simpler shapes (triangle, square) in order for their shape to be identified correctly. In light of the many weaknesses in today's UAP field investigation one should always err on the side of the most conservative estimate of object size and shape. What is conservative? To the author it is to accept a "large star" and a "large planet" as being a round self-luminous source of light (a circle as a two-dimensional shape) whose radius may or may not be constant within about five percent or so.

The interrelationship between shape and size is illustrated below using familiar geometric forms. First consider a self-luminous source of octagonal form that is slowly increased in size. When it is very small it will appear only as a point of light. But as it expands some and then all of its critical detail will eventually be discerned and the viewer will call out "octagon". The same can be said for the triangle (particularly the equilateral triangle), square, pentagon, and so on. As each is gradually enlarged a point is reached where their form will be accurately discerned with confidence. And this response will rest on discriminating the number of points (critical details) that protrude from the continuous edge.

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16. Section 4.3 concerning ball lightning as well as section 3.1 and 3.3.1 concerning pilot and ground witness descriptions of UAP presents a wide diversity of UAP shapes that appear to change rapidly during the sighting!
17. So-called 20-20 distance acuity is based on the ability to correctly discriminate a particular shape from another or the annular position of a gap in a circle of this angular size.

It is asserted with some confidence that as these shapes slowly increase in size and under relatively low and medium contrast levels, a triangle will be correctly identified before a square of the same area and a pentagon before an octagon, etc. In this instance their critical detail is their pointed corner protrusions.

Now consider a symmetrical polygon[18] having many sides with that of a circle. It is asserted that the more sides a symmetrical polygon has the harder it will be to distinguish from a circle. Place a symmetrical polygon with 100 sides immediately next to a circle of the same area. Beyond a certain viewing distance the two forms will appear identical. Yet upon bringing both of them closer and closer to the observer - so as to enlarge the critical details of the polygon's points - at some distance the two forms will be seen as different. And so viewing distance, i.e., angular size of an object is a primary contributor to perceived shape.

Shape and Object Dimensions. Objects that are two-dimensional (i.e., flat), small in angular size, viewed normal to their surface and seen at relatively large distances will appear about the same as a three-dimensional object at the same distance and possessing the same outline form. But as the three-dimensional object changes in orientation, shadow structure, motion, etc. its shape likely will become increasingly apparent.

Shape and Brightness. Certainly an object without any reflected or radiated brightness or luminance is invisible in total darkness, i.e., its visual contrast is zero. But as its luminance or illuminance is gradually increased the object will first be detected (as being present) and then its shape will be perceived. Helson and Fehrer (1932) found that luminance had to be increased by a factor of about twenty five times over its detection level before shape could be identified even in a vague way. Some of their target shapes called for less luminance than did others in order to yield 100% correct shape identification.

At the high luminance end of the intensity scale the author and others have shown that shape and apparent size of targets can be distorted to the point where a very bright equilateral triangle begins to appear like a circle, a fat rectangle looks like a hotdog; this is due to scattered light within the eyeball itself. (Cornsweet, 1962; Haines, 1966a, 1966b)

Shape and Viewing Duration. Bartley (Pg. 93, 1958) has pointed out that when three-dimensional objects are viewed during very brief (flash) durations and are moderately bright they appear quite vaguely defined and are two- rather than three-dimensional. Increasing the viewing duration achieves three things: (1) it increases the probability of correctly identifying what we refer to as "critical details," (2) the two-dimensionality of the object changes into three at some point, and (3) the shape-linked identity of the object becomes maximally certain at some point. In short, the longer the duration of viewing the better in terms of overall perceptual accuracy, all other factors being equal.

Summary

This section has presented various considerations that are thought to be related to the development of an effective UAP shape-name taxonomy. The complexities that are involved

18 For this illustration this term refers to such forms as pentagons, octagons, etc.

are great but the eventual rewards in having such a taxonomy *and* applying it consistently will far outweigh the effort to develop it.

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