

A Taxonomy of Abstract Form Using Studies of Synesthesia and Hallucinations

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Film historians William Moritz and William Wees have observed an overlap between the forms of hallucination/synesthesia and abstract film. The parallel histories of synesthesia, abstract painting and abstract film noted by these historians theoretically allows a consideration of synesthetic visual forms identified by psychology as the basis for a taxonomy of abstraction. This paper proposes a taxonomy of abstract form anchored in an examination of the history of synesthesia and abstract art. Existing work on abstract film, especially Wees's *Light Moving in Time*, suggests the possible utility of a taxonomy but does not provide one [1].

Because the taxonomy proposed here originates in Heinrich Klüver's study of mescaline hallucinations and Kevin Dann's discussion of synesthesia, a brief historical survey of the relationship between synesthesia and abstraction is appropriate. While any aesthetic taxonomy is necessarily a reification, a brief consideration of the historical context that justifies a taxonomy may suggest a degree of validity for some forms of abstraction.

DEFINITIONS

Because this paper employs a variety of terms drawn from art history and the study of synesthesia, a clear explanation of the terms is needed. The crucial, and most difficult to define, term in this taxonomy is "synesthesia." The use of "synesthesia" to describe art entails an ambiguity: Where for psychology "synesthesia" refers specifically to cross-modal sensory experiences, such as seeing colors at the same time as one hears sounds, in art its use is often metaphoric, identifying works that attempt to present analogues for one sense (such as hearing), typically sound or music, within another, most commonly visual, art such as painting. Bulat Galeyev has discussed these ambiguities in his "Open Letter on Synesthesia," noting that they are a part of the history of its use in art [2]. This ambiguity of use in discussion of art appears because "synesthesia" often refers to both the actual experience of synesthesia and its use as analogue in describing an artwork.

Within this framework, the term "hallucination" is needed to refer to subjectively encountered phenomena that individuals may experience. While "synesthesia" has an ambiguous meaning, "hallucination" retains its technical, clinical denotation.

As used in this paper, "abstract" refers to the broad understanding of the word identified by art historian Jeffrey

Schnapp, which was employed at the beginning of the 20th century [3]. This conception "rarely meant *abstract* in any pure, rigorously formal, non-referential, non-representational visual sense" [4]; it was instead "hybrid" [5], a formulation that encompasses the overlap of abstraction in film and painting.

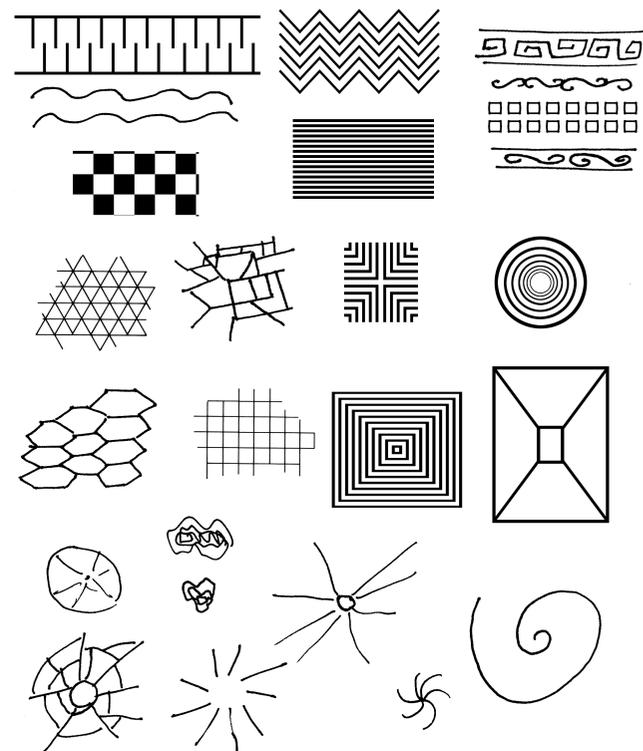
For historians such as William Moritz, those abstract filmmakers whose work focused on geometric forms, often synchronized to music, constitute an ongoing tradition of "visual music":

Indeed, visual music has a history that parallels that of cinema itself. For centuries artists and philosophers theorized that there

ABSTRACT

The author proposes a taxonomy of abstract form anchored in an examination of the history and theory of synesthesia and abstract art. The foundations of this taxonomy lie in empirical psychological studies of "form-constants" found in cross-modal synesthetic visions and hallucinatory states, specifically the work of Heinrich Klüver in his examinations of mescaline and the mechanisms producing visual hallucinations. While the proposed taxonomy is limited only to synesthesia-inspired abstraction, it has suggestive possibilities when considered in relation to other forms of non-synesthetic abstraction such as Islamic Art, the geometric forms found on classical Greek vases, and other kinds of decorative abstract patterns.

Fig. 1. A diagram showing form-constants derived from synesthesia/hallucinatory visions as discussed by Klüver and Dann. (© Michael Betancourt)



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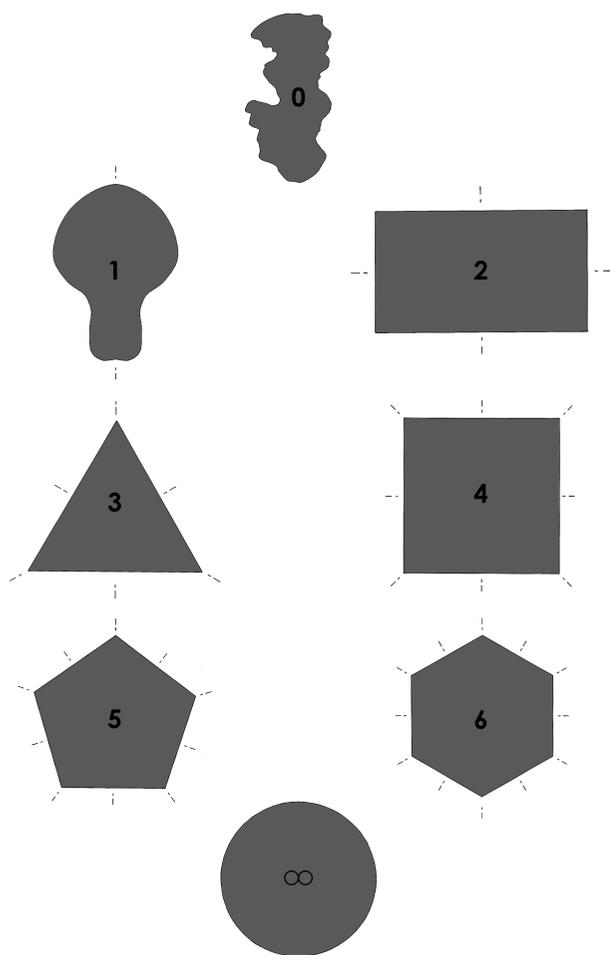


Fig. 2. A diagram demonstrating a series of symmetry axes.
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should be a visual art form as subtle, supple, and dynamic as auditory music—an abstract art form, since auditory music is basically an art of abstract sounds. As early as 1730, the Jesuit priest Father Louis-Bertrand Castell invented an Ocular Harpsichord, which linked each note on the keyboard with a corresponding flash of colored light. Many other mechanical light-projection inventions followed, but none could capture the nuanced fluidity of auditory music, since light cannot be modulated as easily as “air.” The best instrument for modulating light took the form of the motion picture projector [6].

As Moritz notes, the creation of abstract art specifically seeking visual equivalents to the forms and structures of music defines a historical tendency that may continue in film. Filmmaker John Whitney’s influential theory of “digital harmony” [7] is one example of this link between abstract film and Moritz’s visual music tradition. The history of visual music implied by Moritz is one in which a desire to create a synesthetic art motivates the invention of visual music instruments and the eventual dominance of abstract film. As this relationship suggests, the history of visual music on film may be identical to the history of abstract film. These

links between early abstraction and synesthesia suggest a specific variety of abstract art predicated on an analogy between visual form and sound/music: In this paper, it will be identified as “synesthetic abstraction” in recognition of its basis in the analogical use of synesthesia in art and its tendency to cross the boundaries between different media.

While “visual music” is related to abstract film, instead of relying on the motion picture projector, these artists worked to invent new technologies to present their work. Perhaps the best known of these artists is Thomas Wilfred. His “lunia boxes” present continuous sequences of abstract imagery in motion, and his Clavilux instrument enables a “lumianist” to perform visually in the same way that live music is performed [8]. “Visual music” is the live performance-oriented aspect of the tradition referred to as “synesthetic abstraction.”

HISTORICAL BACKGROUND

The historical interrelationships between synesthesia and abstract art are complex, as are the forces that combined in the early 20th century when synesthetic ab-

straction emerged. Some aspects of this history have been established by previous studies, such as historian Kevin Dann’s book *Bright Colors, Falsely Seen* [9] or psychologist Lawrence E. Mark’s studies of synesthesia [10], which are both historiographic and experimental. There is enough work in this area that an exhaustive survey is beyond the scope of this essay. What is significant to note is that the study of synesthesia often overlaps with the art-historical study of abstract painting. Dann’s history of synesthesia suggests that the transcendent claims for synesthetic abstraction are a direct legacy of the analogy between imagery and music [11].

As noted regarding Moritz’s comments, synesthetic abstraction demands an interdisciplinary approach to these parallel histories. Those artists known for working in one medium often experimented in others: Painter Wassily Kandinsky experimented with visual music in his play *Der Gelbe Klang* [12]; the Italian Futurists Bruno Corra and Arnoldo Ginna made abstract films and then abandoned them to invent a color organ [13]; Oskar Fischinger, who made abstract films synchronized to music, became an abstract painter and built a visual music device called the Lumigraph [14].

The historical connections between synesthesia and abstraction are especially clear in Kandinsky’s paintings containing shapes often observed by synesthetes, thus providing a clear link between his abstract images and synesthesia, as psychologist Crétien van Campen has noted: “Kandinski’s early abstract paintings (that he labeled with musical titles such as *Composition* and *Improvisation*) contained the sort of blobs, lines, spirals and lattice maps that are experienced by synesthetes” [15].

The forms and shapes in Kandinsky’s paintings demonstrate two things: a use of forms seen in synesthetic hallucinations and the direct connection of these works to a musical analogy (via their titles). These works reveal an analogy between imagery and music that follows the earlier Romantic interest in synesthesia as a merging of “subjective” and “objective” worldviews [16]; the initial emergence of abstract art coincides with a widespread interest in synesthesia from both a scientific and an artistic perspective [17]. Cultural groups interested in synesthesia were also disenchanted with the rigorous, rational world of normative scientific and psychological theory. Dann notes:

The triumph of behaviorists’ view of the human mind and body as reacting machines only served to intensify the Ro-

matic quest for art forms and theories of knowledge that de-emphasized the world of material causes. Romantics held fast to the ideal of the primacy of the imagination, and synaesthetes would continue in their eyes to offer proof positive of the possibility of attaining new ways of knowing [18].

The 19th-century Romantics viewed both synesthetic art and the physiological phenomenon of synesthesia as escapes from the predetermined, mechanical world described by the empirical methods and rational procedures of materialist science and behaviorist psychology.

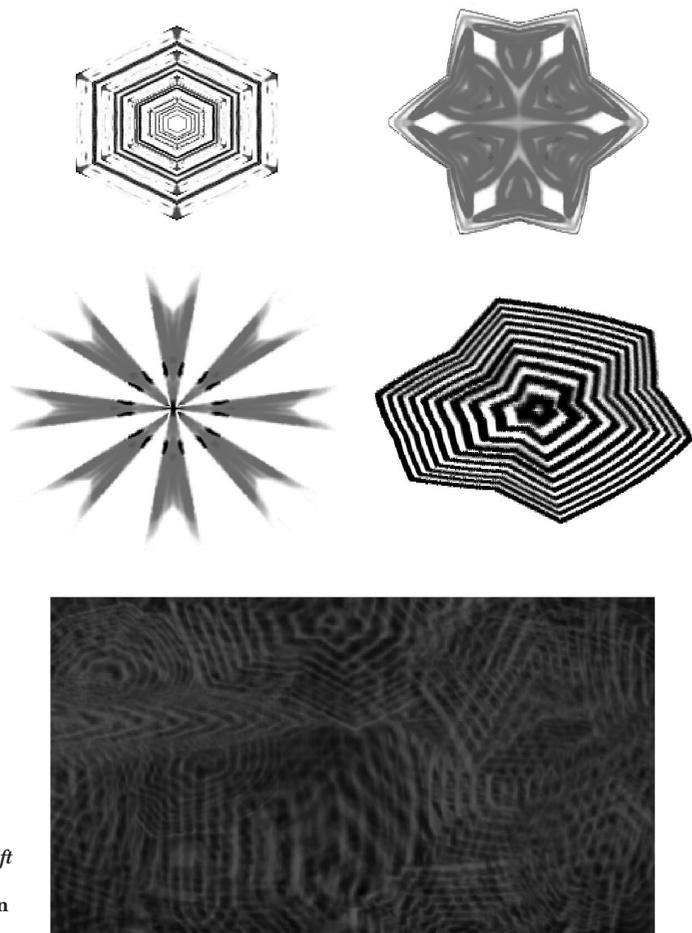
The possibility that some artists initially promoting abstraction—Kandinsky especially—were themselves synesthetes [19] suggests a further connection between synesthetic abstraction and synesthesia. As Dann has observed, in Romantic ideology, synesthesia’s sensory fusion attained a primordial purity superior to the “fallen” state of normal perception [20]. Synesthesia offered a recovery of primal experiences—a more “accurate” depiction of reality. Since some forms of early abstraction are linked to Romantic “non-rational” world-views, they have a quasi-religious universal “spiritualism” that emerges as their transcendental content. Synesthetic abstraction, by adopting the form of cross-sensory modality, presents the transcendent reality that Romanticism found in irrational states of consciousness and perception.

Dann’s commentary on artist A.B. Klein further reveals the links between the transcendence of synesthesia and the universal, utopian aspirations of Romanticism as they refer to synesthetic abstraction:

A.B. Klein, a painter whose early work aimed at abstraction and who had designed a color projector in 1921, was in 1925 still rhapsodic about the possibilities of color music: “Can one imagine anything in the arts which would surpass the visible rendering of sound, which would enable the eyes to partake of all the pleasures which music gives to the ears?” Noting Western civilization’s disillusionment about its own future, Klein ranked the dream of a color music with religious and political utopias: “For the singularly few who enjoy loveliness, it might snatch one or two more gems from the chaos before the end” [21].

The dualism of Dann’s observations about Klein is typical of the utopian proposition of synesthetic abstraction: This utopia/decay dialectic is the meaning of the spiritualism contained by synesthetic abstraction. It is the Romantic rejection of rationality, materialist sci-

Fig. 3. Some representative geometric forms demonstrating various degrees of symmetry produced using the guidelines provided by this taxonomy. (© Michael Betancourt) I employed some of these in *Eigengift* (2006), stills of which are shown in Color Plate F.



ence and behaviorist psychology that Dann identified within the early abstract artist’s universal claim. However, to object that abstract art is not, in fact, universal is to ignore the *critical* dimension of that claim. The discrepancy between the empirical belief that a “universal” must be uniformly the same and the critique of rationality that synesthetic abstraction proposes is resolved by its original context: The claim of “universality” for what are subjective responses constitutes a criticism of empirical claims.

As this brief sketch shows, the cultural uses of synesthesia in art around the end of the 19th and early 20th centuries can be correlated to the birth of abstraction, thus offering the potential for a taxonomy of abstract form independent of individual meanings. This outline suggests that the spiritual meanings of synesthetic abstraction result from its relationship to Romanticism; this taxonomy is, therefore, also a description of those forms that convey spiritual content.

TAXONOMY

Neurological and psychological studies have found that while different subjects

produce variable associations between specific sounds, colors and forms, there are constants in these associations that can be empirically described [22]. As William Wees has observed in his book *Light Moving in Time*, Heinrich Klüver’s study of mescal intoxication and the resulting visual and synesthetic hallucinations provides a listing of visual form constants (Fig. 1) that describe some of the visual forms employed in abstract movies:

[Klüver’s] analysis of hallucinatory phenomena appearing chiefly during the first stages of mescaline intoxication yielded the following *form constants* [emphasis in original]: (a) grating, lattice, fretwork, filigree, honeycomb, or chessboard; (b) cobweb; (c) tunnel, funnel, alley, cone or vessel; (d) spiral. Many phenomena are, on close examination, nothing but modifications and transformations of these basic forms. The tendency towards “geometrization,” as expressed in these form constants, is also apparent in the following two ways: (a) the forms are frequently repeated, combined, or elaborated into ornamental designs and mosaics of various kinds; (b) the elements constituting these forms, such as squares in the chessboard design, often have boundaries consisting of geometric forms [23].

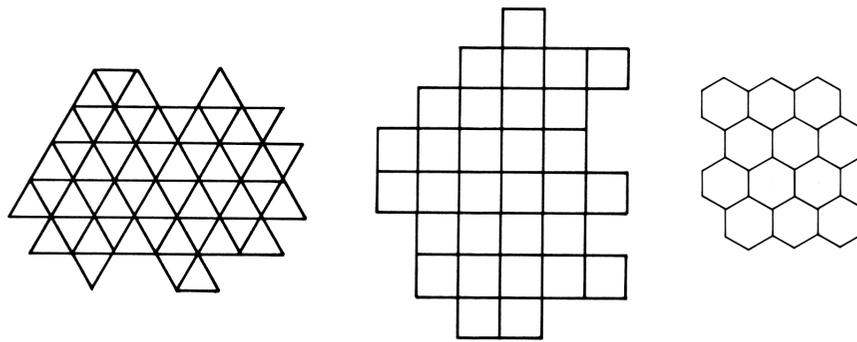


Fig. 4. A diagram of the three regular tessellations (tilings). (© Michael Betancourt)

While Klüver is concerned with perceptual distortions resulting from the drug mescaline, he notes that the forms of these images are derived from perceptual structures in the eyes and brain [24]. In Klüver's study "Mescal and Mechanisms of Hallucination," he makes a further series of observations about these form-constants: They evolve and become more complex, compounding their appearance over the course of the hallucination [25]; there is also a progression from organic to complex geometries [26]; and they are shared among a variety of visual disorders and do not result solely from use of mescaline [27].

Kevin Dann identifies a similar collection of forms as common to synesthesia: sparks, spots, lines, streaks and zigzags [28]. Both Dann's and Klüver's forms have either a linear character or the quality of objects in space. Klüver further observes that these forms become apparent to normal sight if one lightly presses and rubs the eyes; this action is often necessary to begin the visual hallucinations associated with mescaline intoxication [29]. Stan Brakhage in *Metaphors on Vision* (1963) has described this "closed eye" vision as the starting point for his

own development of non-optical film that culminates in his hand-painted films of the 1980s and 1990s:

The hand painting was always in a direct relationship to the particular kind of "closed eye vision" that comes only in dreams. The commonest type of "closed eye vision" is what we get when we close our eyes in daylight and watch the moving shapes and forms through the red pattern of the eyelid. . . . Painting was the closest approximation to it; so I painted, throwing down patterns and controlling them in various ways. Shapes emerge out of that kind of eye-nerve action and reaction [30].

Brakhage makes the point that "abnormal vision" exists as a liminal perception, and with careful observation, these unseen aspects of sight become visible. Brakhage's closed-eye forms appear in synesthetic abstraction and synesthesia, and as Wees has noted, these form constants describe a "breakdown of the basic elements of most abstract films!" [31].

If Wees's rhetorical comment is taken literally, a taxonomy for synesthetic abstraction can be constructed based on Klüver's form-constants. They suggest

underlying constructive principles; identifying these principles creates the taxonomy:

- (a) grating, lattice, fretwork, filigree, honeycomb or chessboard;
- (b) cobweb;
- (c) tunnel, funnel, alley, cone or vessel;
- (d) spiral

Analysis of the form-constants yields a series of variables whose relationship and combination can generate synesthetic abstractions: *symmetry*; *repetition*; *form* (shape [appearance, curvature, organization]; surface [color (hue, saturation, value), luminosity]); and *motion*. Klüver's form-constants further suggest a fluid relationship between the overall image structure (the "frame") and the structure of individual forms.

Symmetry

Symmetry and regularity are constraints that apply to all levels of this visual construct—the overall construction as well as the forms. These issues are the central parameters that determine the relationships and structure of everything else in the taxonomy. They can describe the overall structure of the entire image as well as the specific shapes located within it. Because of this dual role, there is an unavoidable ambiguity in their description. Symmetry organizes individual forms and the overall structure of the image.

Regular structures and forms tend toward simplicity either in symmetrical shape or arrangement or as uniformity in motion (i.e. in a single direction). Irregular structures/forms are combinations of several regular structures/forms—i.e. an asymmetrical form may have symmetrical components.

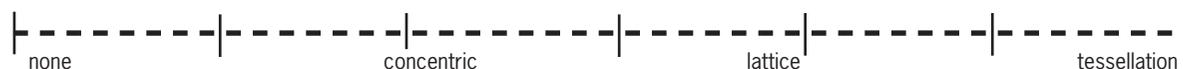
Whether the forms are 2D or 3D is irrelevant to this level of organization. The form-constants provide a framework for this consideration: Tunnels suggest a recession (symmetrical) into distance, the spiral implies the same monolithic form as the cobweb but recedes in the same way as a tunnel. Thus, the regular/irregular dynamic can be linked directly to a question of symmetry:

- Irregular:** asymmetrical (0 axes of symmetry)
- Regular:** symmetrical (1 axis of symmetry; bilateral symmetry radial (2 or more axes of symmetry))

Table 1.

0 axes	asymmetrical
1 axis	bilateral symmetry
2 axes	rectangle
3 axes	equilateral triangle
4 axes	square
5 axes	equilateral pentagon
6 axes	equilateral hexagon
etc.	infinite circle

Table 2.



However, the relationships of regularity and irregularity to symmetry are fluid, not rigidly defined. Where forms may be asymmetrical, the overall structure may be symmetrical; at another level, asymmetrical forms may be composed of symmetrical parts whose component sections are asymmetrical. Thus symmetries are a dynamic aspect of form and structure.

As the number of symmetrical axes increases, the symmetrical forms come closer to the infinite (perfect) symmetry of the circle (see Table 1 and Fig. 2).

Regular polygons are the simplest means for visualizing how multiple axes of symmetry look. Even-numbered symmetrical forms (4, 6...) present two types of "fold": through the corners of the form and through the mid-point of the sides; odd-numbered forms (3, 5...) present only one "fold," through a corner bisecting the flat side opposite. It is easy to recognize how increasing the number of axes of symmetry can produce the grid, lattice, honeycomb, etc. These are symmetrical forms repeated across a flat plane as a tessellation (or tiling).

Symmetries, especially those with large numbers of axes, tend to produce regular forms by their nature; at the same time, increased symmetry also suggests a lower level of complexity, favoring an increased tendency toward all-over patterning, particularly when the symmetry is at the level of the spatial arrangement of forms. The treatment of the frame as symmetrical or asymmetrical determines the visibility of forms in the image. The symmetrical frame results in a radically constrained set of potentials compared with an asymmetrical frame. In symmetrical constructions, it is much more likely that the overall organization will elide the demarcation between individual forms and create a singular structure that dominates the image. While this is also a potential in irregular compositions, it is much more common that overall image structures are also symmetrical (Fig. 3). Treatment of the frame determines whether the forms are visible as singular objects or are subservient to the overall composition.

Repetition

Related to the occupation of the frame is the repetition within that image. Repetition within the frame implies symmetry, but it is not necessarily a form of symmetry. The key difference is the reuse of a single constructive principle across the entire form/image that can describe the organization of individual forms within the frame (Table 2).

Repetition, however, is not the same as

symmetry. Forms repeated at irregular intervals, but forming a series of concentric rings, exhibit repetition but do not follow an all-over symmetry and are not a form of tessellation. Tessellations (see Fig. 4) are collections of forms that fill a geometric plane without leaving gaps. The difference between repetition and symmetry is that symmetrical forms are regular by necessity and repeated forms may be asymmetrical. Within this framework for repetition, forms can be repeated in any number of dimensions (or scales)—laterally, vertically or recursively (as in fractal geometries).

Form

While the regularity or irregularity of a form depends on its symmetry, it is not the only factor in the determination of the form as a separate entity from the frame itself. Symmetry produces regular form, while asymmetry produces irregular form. The issue of regularity and irregularity is no different with individual forms than it is with the entire image.

However, because all particular values of forms can be manipulated separately and independently, they can be treated as a secondary set of values within the taxonomy, thus forming a parallel set of parameters. These potentials are nevertheless deeply connected to the visual structure of the image, since that structure only appears through the organization of form. It constitutes the graphic nature of the visual space within the frame. *Forms* are the units that *symmetry*, *repetition* and *motion* act upon to create the image (frame).

Shape

Form is described by a series of independent ranges that enable apparently contradictory forms to emerge, and this

relationship suggests the possibility for transformation of the character of forms over time.

Appearance

The distinctions between linear and solid forms are more a matter of degree. Because every form inevitably has some degree of width, even linear forms can be treated in the same way as solid forms (Table 3).

Curvature

This range is determined by the number and degree of curved (arabesque/baroque) contour lines, providing a sliding scale between the wholly curved and the wholly linear (Table 4). The tendency toward geometrization that Klüver notes appears in this schema as a steady movement toward straight lines (see Fig. 5). The distinction between organic/geometric forms emerges as a direct result of the degree and character of the curvature of the form. This distinction also describes both the extreme ends of a spectrum describing the character of the outline qualities of forms displayed in the image. However, there are intermediary stages that are neither and both.

Organization

The organization of the form describes the apparent overall shape of the form (Table 5), rather than the particular character of individual parts of the form. This is akin to the overall arrangement of the frame but is limited to a singular form.

Surface

The qualities of the forms, when differentiated from their shape, symmetry and motion, can be described by two variables: *color* and *luminosity*. These are linked to the relationship between the

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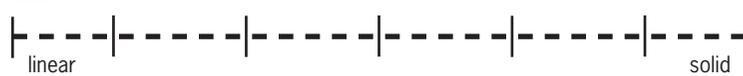


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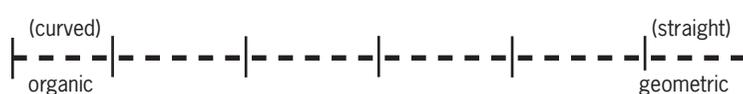
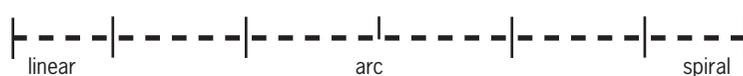


Table 5.



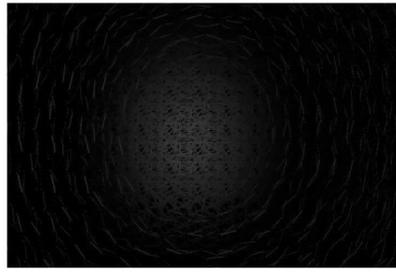
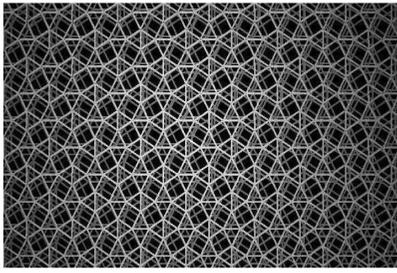


Fig. 5. Two stills from Bill Alves, *Aleph*, 2002. (© Bill Alves) (left) Tessellation composed from individual lines in motion. (right) Central circular mass formed from individual lines, while other lines move concentrically around it.

individual forms, the areas around those forms, and in the case of motion pictures, what precedes and follows a given form temporally.

Color

Color is conventionally described by hue, saturation and value. However, as a value, “color” can be understood differently. Single forms may display either one color or several colored areas. When a form is broken into colored areas, each of these parts can be treated as an individual colored form in itself, subject to all the same variables as single-color forms. Additionally, the colors within a form can be animated within the form itself (i.e. what animated film calls “a color cycle”) or used in a combinatory fashion for building up solid areas, thus allowing alternations between figure-ground relationships.

Luminosity

Luminosity is both an absolute value (the actual luminosity of a form) and a relational one (apparent luminosity). It is generated by the contrast with surrounding forms both physically adjacent in a particular image and temporally adjacent in preceding and succeeding frames. Apparent values are often more important to the encounter with a form than actual values. Apparent luminosity

can also alter the perceived color(s) of a specific form. This conception of luminosity is identical to “value” in color.

The texture of a form is a composite value relating to the interaction between color and luminosity across the expanse of the colored form’s area (Table 6). Texture in a form becomes apparent in the same ways and for the same reasons as in everyday life: Subtle nuances and changes in luminosity give the appearance of shadows (inflections) on the surface of the form.

Irregular luminosity produces both textural effects at small scales and shading effects at larger scales. It is possible for multiple shading effects to be in use at the same time within a single form.

Motion

“Time” appears within this taxonomy as “motion.” A motion picture consisting of a single, unchanging frame would be as immobile as a traditional painting, especially if it were a continuous loop without an end. Thus, “motion,” by necessity, requires and implies both time and a volumetric space. (Any animation textbook would contain much of this information on motion.) The apparent depth of this space is either two-dimensional (flat) or three-dimensional (moving within a volume). The type of space determines the variety of forms and the motions available to those forms within that space:

planar (along x, y axes creating a 2D, flat [graphic] space)
spatial (along x, y, z axes creating a 3D, “realistic” space)

Planar motion implies an orientation of the plane to the surface of the frame (i.e. the “picture plane”). Any divergence of planar motion from this orientation introduces an illusory space via foreshortening while still confining the abstraction to two dimensions.

Motion can be divided into the same paired categories of regular/irregular. However, “irregular motion” is simply a complex series of regular motions. Regular motion can be broken into movement along the same axes (x, y, z) that define 3D space: vertical; horizontal; oblique; curved (arc [follows a curve], concentric [moves in circle or spiral] and rotational [the form spins]); scale (growing larger or smaller, i.e. z-axis motion). Complex, compound motions may become irregular simply through the degree of their complexity. Also, sudden shifts from one type of motion to another may appear irregular.

The character of the motion describes how the motion appears in the sequence, whether it is a constant, continuous movement or not. Discontinuous motion is necessarily irregular simply because it appears suddenly, without previous indicators for its presence.

The character of motion exhibited is a continuum stretching from constant, continuous motion through increasingly interrupted kinds that exhibit an increasing discontinuity up to simple “jumps” from one position to another (Table 7).

CONCLUSION

What is significant about this taxonomy is the subordination of the whole framework to issues of symmetry; the interrelationship of motion and form within the regularity/irregularity opposition; and the connection of these issues to the overall image (see Color Plate F). Klüver’s form-constants provide a useful model; however, while it is possible to separate the hallucinatory visions into components, this separation is artificial. The reality is a multifaceted visual experience wherein, although each part can be described, it is their action together that is significant.

The taxonomy this paper proposes, while limited only to synesthetic abstraction, has suggestive possibilities when compared to other forms of non-synesthetic abstraction such as Islamic art, the

Table 6.

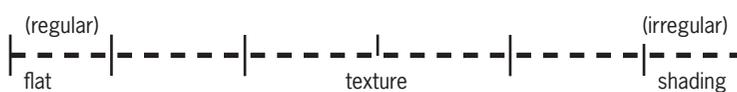
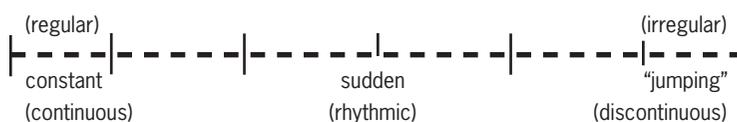


Table 7.



geometric forms found on classical Greek vases and other kinds of decorative abstract patterns. The choice of synesthetic abstraction as focal point for this discussion of a taxonomy is logical given the foundation of the taxonomy in the psychological study of both hallucination and cross-modal synesthesia.

This proposed taxonomy for synesthetic abstraction should not be regarded as a negation of the historical idiosyncrasies of individual artworks or artists who make abstract art. The irrational referents of Romantic ideas of synesthesia-as-critique of rationality might appear to argue against the usefulness, or even the validity, of such a taxonomy for anyone except a researcher. The connection to Romanticism suggests that artists might be likely to resist a taxonomy in favor of subjective, intuitive approaches. For artists working in traditional ways, this may be the case; however, for artists working with computer-driven “generative” systems, a taxonomy might provide a framework for greater variety and complexity of form in works that are only partially determined by intuitive approaches or direct human commands.

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Manuscript received 28 November 2005.

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DEADLINES

1 October 2007: Brief proposals sent to Nicolas Collins <ncollins@artic.edu>.

1 January 2008: Final texts and all materials to the LMJ Editorial Office.

Contact Nicolas Collins <ncollins@artic.edu> with any questions.

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