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# Correspondences and Complementarity in Visual Music

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**Abstract**: Visual music is an art form that implies intermodal connections between the senses but which has historically often failed to identify aesthetically satisfying correspondences. Artistic success does not automatically emerge in one medium when its elemental characteristics are mapped to those of an existing work from another medium. I offer examples from my own abstract animations with music, which draw upon John Whitney's concept of complementarity, a more intuitive correspondence at a higher level of aesthetic qualities, that of stasis and dynamism or tension and resolution.

Visual Music is a term that has gained currency in recent years to describe a variety of art forms, all of which have in common some actual or implied use of a correspondence or analogy between elements of different media, specifically sound and (usually abstract) images. Audiences can easily feel the powerful potential of intermodal connections between senses through, for example, the primal force of the articulation of sound through dance movement. Yet the precise nature of these connections and their utilities to artists have been open to centuries of debate. A varied vocabulary has emerged in writings describing these connections, and the diversity of these terms indicates different approaches and aesthetic choices: mapping, analogue, correspondence, metaphor, complementarity, accompaniment. Now that technology offers us unprecedented possibilities for artistic exploration of these connections, some clarity about these questions can inform new alloys of sound, color, and motion.

The term "visual music" first arose during the late nineteenth-century enthusiasm among painters and poets for the ability of music to directly reach our emotions without the filter of representation. Walter Pater published his famous dictum "All art aspires to the condition of music" in 1873, an ideal Baudelaire and Rimbaud were already exploring. James McNeil Whistler used the words "nocturne" and "symphony" in the titles of his paintings while the Orientalist Ernest Fenollosa was teaching his student Arthur Wesley Dow to approach the composition of paintings as "visual music" [1]. Wassily Kandinsky wrote in *On the Spiritual in Art*, "[A painter] naturally seeks to apply the methods of music to his own art" [2], and the English critic Roger Fry called Kandinsky's paintings at a 1912 exhibition "pure visual music" [3].

"Visual music" in this last sense is merely an evocative term to describe an approach to abstraction, and only later was it used to refer to a time-based art or specific correspondences between the senses. For this last phenomenon, artists soon appropriated a psychological term invented in 1892: synesthesia [4]. To psychologists, synesthesia is a rare condition in which a subject literally perceives colors when hearing music for

example. In the context of art, however, the word refers instead to works which present analogues for one sense within another art [5]. The substitution here of "analogue" is perhaps a little clearer, as it suggests a clear mapping or correspondence of elements between different arts or senses.

Two elements of perception which are central to their respective arts are color and pitch. Although many people have been convinced of the uniqueness of their independent proposal of a mapping of color and pitch, it was the classical Greeks, after all, who named their semitone scale "chromatic." Aristotle was drawing upon this traditional association when he first suggested that color and musical pitch could be a natural correspondence [6]. This idea gained new currency during the Enlightenment search for unifying principles of nature, especially following the discovery of the common wave nature of light and sound. This search for universality prompted Isaac Newton, for example, to arrive at his seven colors of the spectrum as an analogue to the seven-tone diatonic scale [7].

When a French Jesuit, Louis Bertrand Castel, read Newton's *Opticks*, he had the insight that this correspondence could be the basis for a new art form [8]. His "ocular harpsichord" was the first in a series of inventions that attempted to project colors in response to a musical keyboard. Some of these "color organists" sought to create a new art of abstraction (or "pure color") using music as a model, but others were convinced that the simultaneous mapping of live music to projected color portended a new and great art [9]. Searching for a term to cover time-based visual art, the color organist A. Wallace Rimington referred to this new art as "colour music," while Thomas Wilfred coined the term "lumia." For many of these artists, the term "visual music" is appropriate when, like Rimington, they explicitly reference musical analogues or propose a direct mapping of pitch to color.

However, only the most generous of audiences could find any success with experiments along these lines. Rather than the essence of the musical expression automatically emerging visually from such a direct translation, audiences saw only an incomprehensible flashing of a wide assortment of hues. Some differences between these modes of perception help explain this failure. First, most people perceive pitch relatively (melodies are defined by the intervals between successive pitches, not by the absolute frequencies involved) whereas colors are perceived as absolutes.

Also, pitches may be combined into harmonies while still retaining their individual perceptibility while colors mix to create a new color. Colors may be juxtaposed in space, certainly, but attempts to define color harmonies with the same precision as musicians define a major triad have brought no consensus. A C major triad mapped to the spectrum would result in the combination of dark red, orange, and blue-green, a jarring combination which is hardly the equivalent of the smooth sound of a major triad. Paintings rarely have so large a palette, especially those corresponding in time and place to the major triad's supremacy in music [10]. Adjacent colors on the color wheel blend effortlessly -- not so adjacent keys on the piano.

Others have tried mapping pitch to spatial height, a correspondence which reflects the culturally based and arbitrary metaphor of large-number frequencies as "high" and small-number frequencies as "low." Kandinsky among others suggested the association of colors with musical timbre, another correspondence suggested by historical terms for musical timbre as "tone color" and different instruments having "bright" sounds.

Loudness and brightness seem to naturally correspond, based on the intensity of perception in their respective media, but does it follow that a sun-drenched impressionist landscape is the visual equivalent of a blaring brass band?

By breaking music down to its most elemental characteristics--pitch, timbre, loudness--each of these proposals is unable to reproduce the subjective experience of music: its drama, its subtlety, its journey of emotions. The hypothesis that these qualities at the heart of the musical experience would be naturally reconstructed in another medium, given the right mapping of elemental characteristics, has not resulted in any great art [11]. Most music visualization software follows only the most basic amplitude and spectral information but is unable to recognize repetition of themes, climaxes, or resolutions.

This state of affairs suggested to me and others that a correspondence, if one need exist, should be established at a higher level of aesthetic perception. Filmmaker John Whitney was trained as a musician, and traveled to Paris, hoping an immersion in modernism would light a path for abstract film that would produce the same direct emotional connection as music [12]. He sought the same kind of structure in his films that Arnold Schoenberg brought to music through his twelve-tone method.

However, Whitney gradually came to realize that the dramatic power he heard in music resulted from the complex interplay of tension and resolution inherent in the tonal harmonic system, a system that Schoenberg's method broke away from. He also saw that that system had a basis in the harmonic series that governs the vibration of string and wind instruments:

> ...The foundation of my work rests first upon laws of harmony, then in turn, upon proof that *the harmony* is matched, part for part, in a world of visual design....This hypothesis assumes the existence of a new foundation for a new art. It assumes a broader context in which Pythagorean laws of harmony operate....In other words, the hypothesis assumes that the attractive and repulsive forces of harmony's consonant/dissonant patterns function outside the dominion of music. Attractions and repulsions abound in visual structures as they become patterned motion. This singular fact becomes a basis for *visual harmony* with a potential as broad as the historic principles of musical harmony. [13]

Although Whitney speaks of musical harmony being "matched" in the visual domain, he resisted automatically mapping one characteristic to another across media, instead referring to this connection as a "complementarity" (in the subtitle of his book) [14]. He realized his application of "Pythagorean laws" to patterned motion through a technique he called "differential dynamics," a powerful method whereby a large number of elements are set into repetitive motion, the second traveling twice as fast as the first, the third three times as fast as the first, and so on. These speeds represent the same relationships found in the harmonic series of musical sounds identified by Pythagoras (among others) in ancient Greece.

Just as waves in the harmonic series create harmonic structures, so do elements in differential dynamics converge to create wonderful patterns (depending on the motion the artist defines) at harmonic or "resonant" points. In his films of the 1960s and 1970s, Whitney worked with lissajou figures (in *Matrix I*, 1971, and *Matrix III*, 1972), with rose curves in polar coordinates (*Permutations*, 1968), and linear motion wrapping around the edge of a frame (*Arabesque*, 1975). In each of these works, each point of resonance is, to

Whitney, analogous to the resolution of musical consonance. Now in place of a major triad, for example, we have images of arresting symmetry.

The association of symmetry, an aspect of visual form, with consonance is significant first of all because it is a property which, like consonance exists in many varieties and degrees. Musical consonance can be defined by the closeness of the constituent tones of harmony to the integer ratios found in the harmonic series. However, the term refers more generally to musical resolution, repose, or satisfying fulfillment of expectations that occurs when consonance follows dissonance. Symmetry also suggests a stasis but to the eye.

Working with John Whitney during the last decade of his life, I developed a "scale" by which patterns of differential motion could be translated directly into their musical equivalent pitches. The simplest form of symmetry (aside from the circle) is bilateral symmetry, which would correspond to frequency ratio of 2:1, or the musical octave. Radial symmetry in thirds would give musical pitches of 3:2:1, would add the perfect fifth, or next most consonant interval, and so on. In my work *Static Cling* (2000), for example, I used these ratios, known in music as just intonation, sometimes in coordination with symmetrical patterns derived from Whitney's method of differential dynamics, but extrapolated into three dimensions (Figure 1).

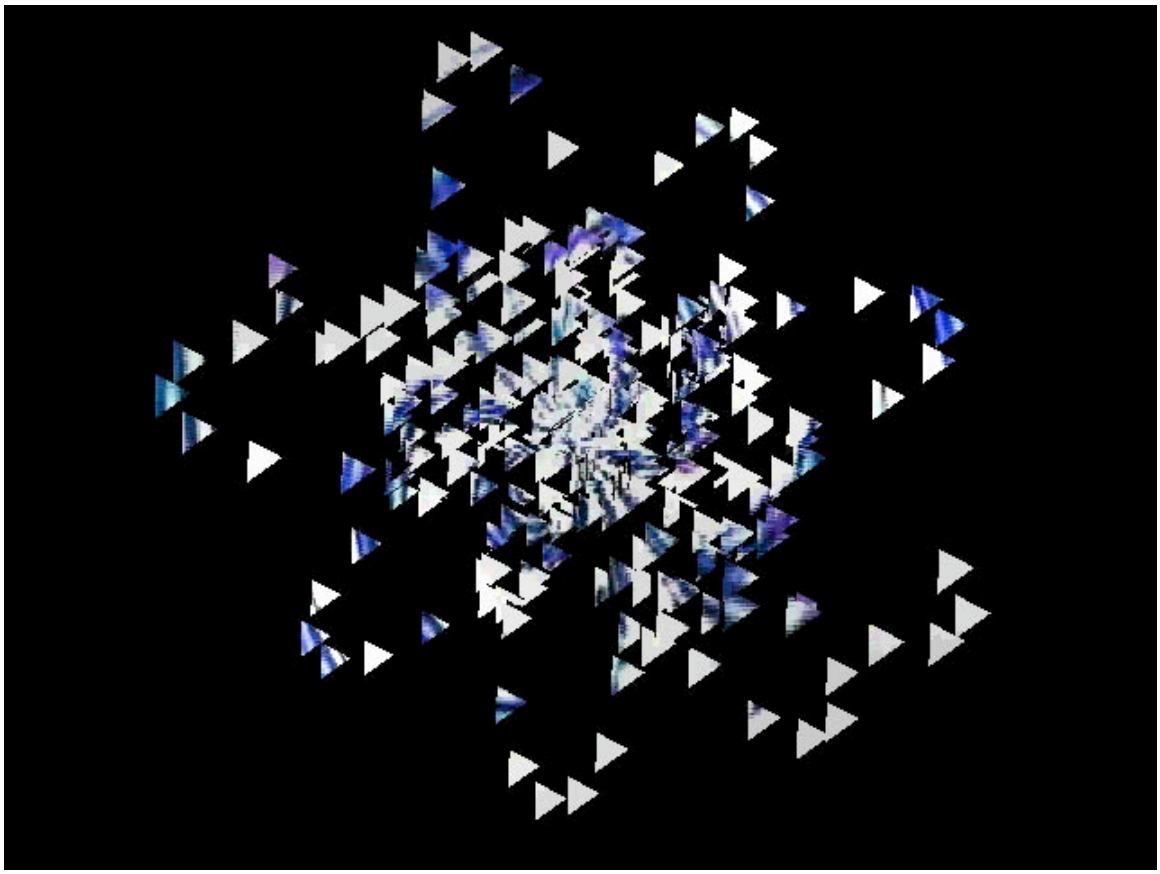

Figure 1: Image from *Static Cling*

But even though such correspondences are much more successful at directly translating the architecture of tension and resolution so central to tonal harmony, even this correspondence could suffer from the same shortcomings as other automated mappings. Consonance and dissonance are relative concepts, and a sonority that would provide a resolution in one context would sound dissonant in another [15]. Like Whitney, I sought a complementarity based on a structure in which points of musical stasis would correspond to relative visual symmetry and coherence.

*Stellation* (2008) coordinated differential dynamics to sliding tones of melodies to create a delicate choreography of shape and proportion (Figure 2). *Stellation* combines a string quartet with electronics in the soundtrack, tuned to the just intonation ratios as the proportions in the symmetries in the images.

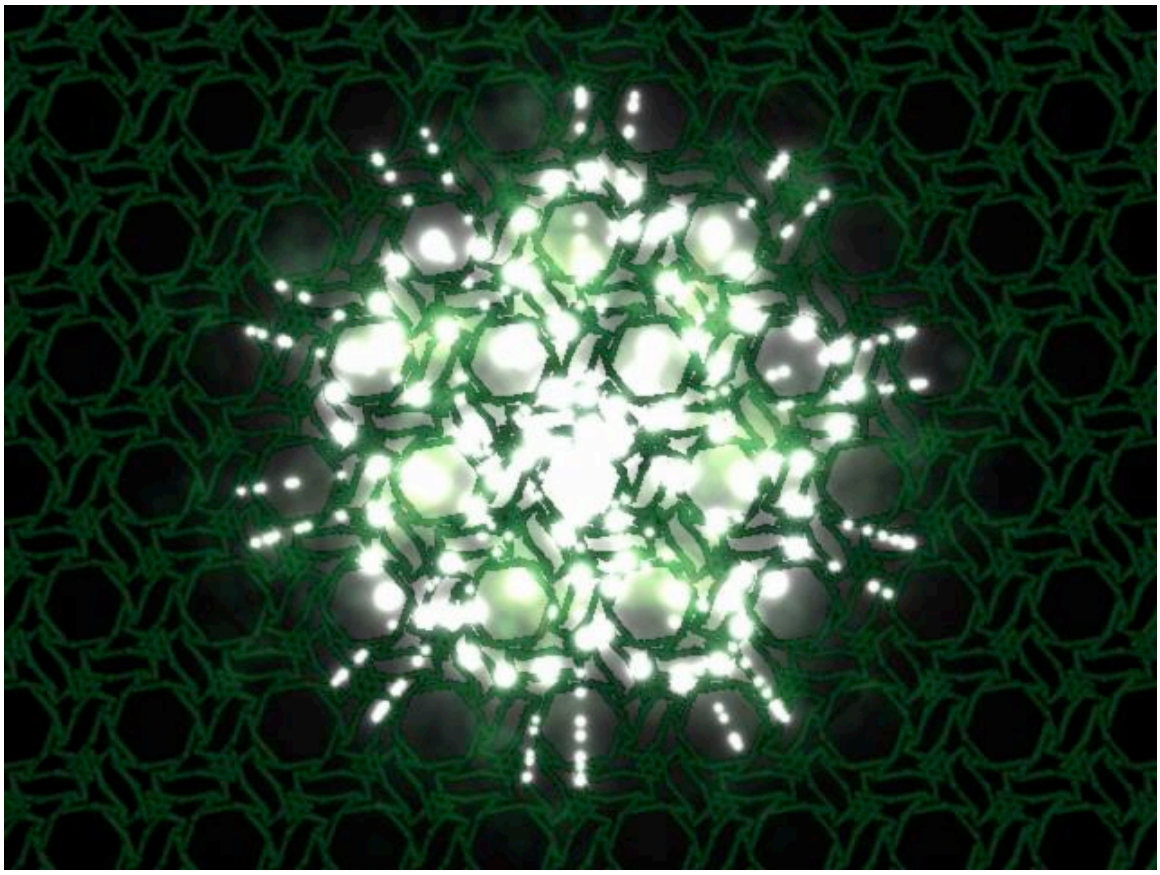

Figure 2: Image from *Stellation*

Whitney's differential dynamics are not the only method I have used to achieve this correspondence, though [16]. Inspired by the dynamic symmetries of Islamic geometric abstraction, I have "unfrozen" such patterns and arranged for them to emerge together with points of musical stasis, often based on the same rational proportions, in such works as *aleph* (2002, Figure 3) and *Celestial Dance* (2006, Figure 4).

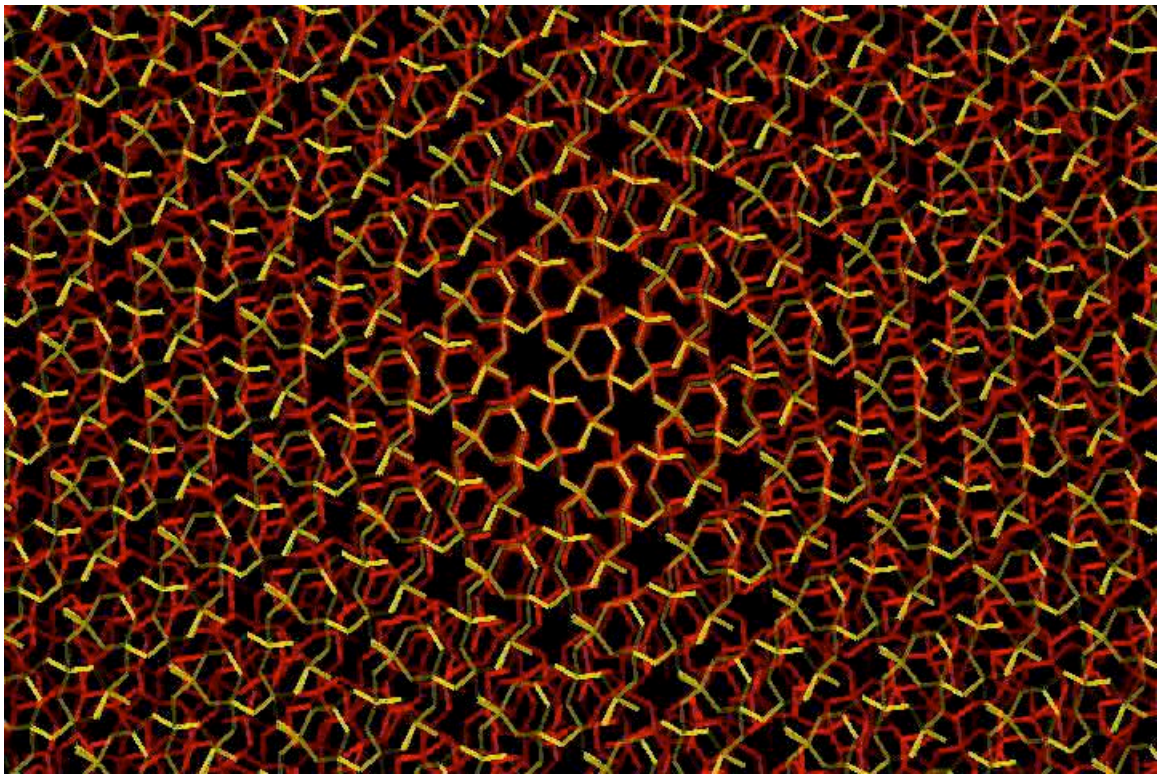

Figure 3: Image from *aleph*.

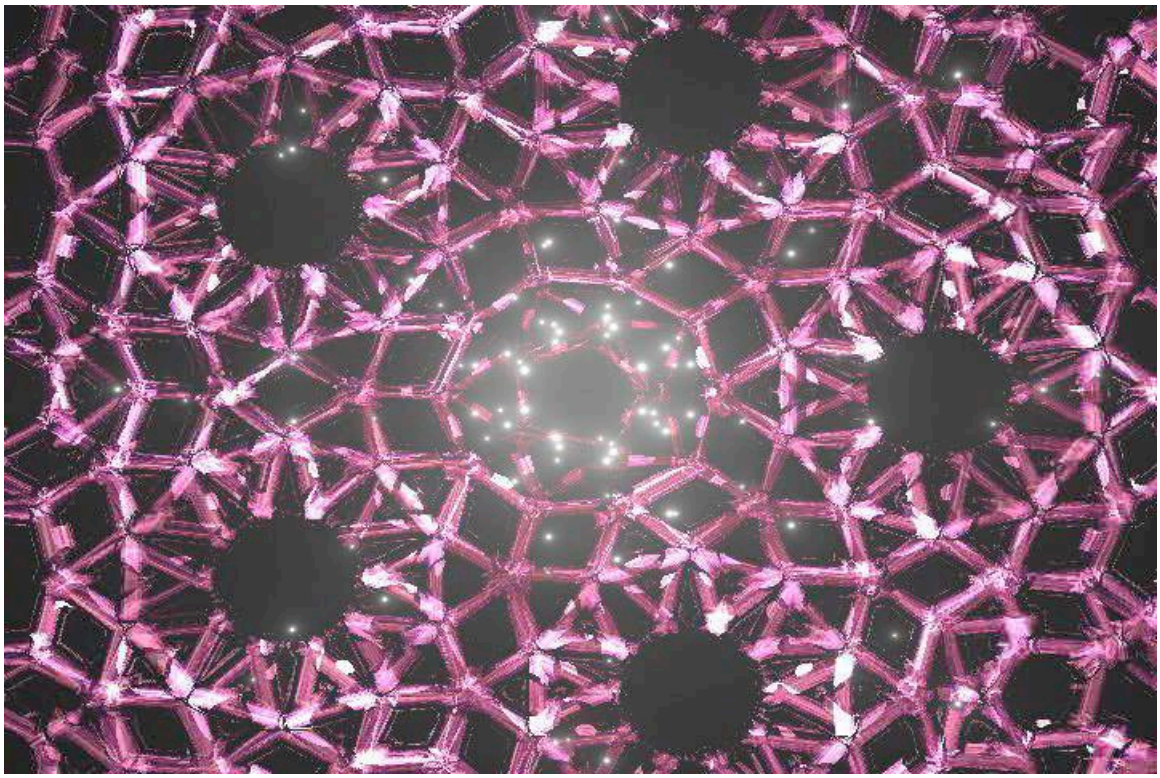

Figure 4: Image from *Celestial Dance*.

I created *Breath of the Compassionate* (2009) for the combination of live gamelan orchestra with an electronic soundtrack and video projection (Figure 5) [17]. It is named for a type of pattern in Islamic geometric abstract art in which adjacent tiles alternately expand and contract into one another. This sense of visual inhalation and exhalation is known as the "breath of the compassionate" (*al-nafas al-rahmânî*) after the teachings of Ibn al'Arabi, who named this universal principle of creation, joining the elements of fire, air, water, and earth [18]. The breathing cycle is evoked by the complementarity of gentle back and forth alternation of just intonation pitch sets, alternating color hues, and the motion of the small flexible cylinders that form the Islamic-inspired patterns of the images.

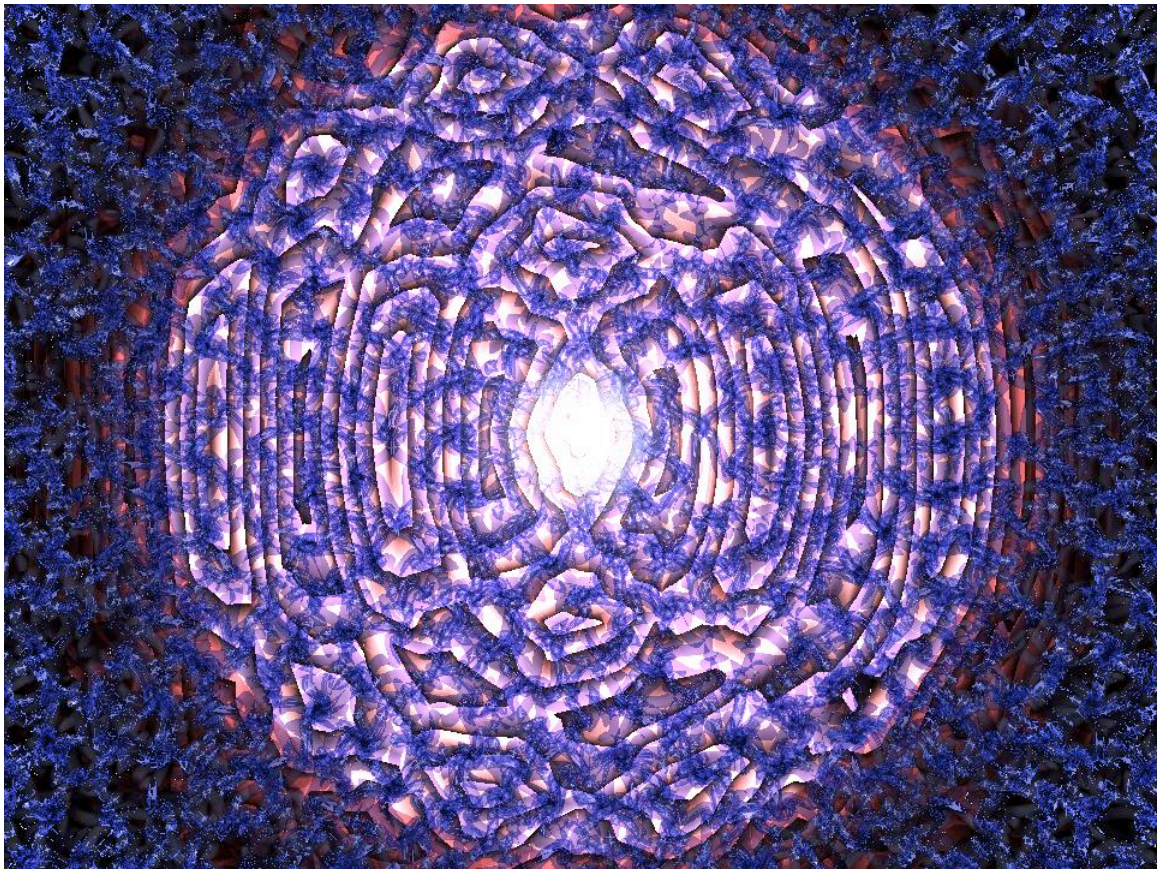

Figure 5: Image from *Breath of the Compassionate*.

Works such as these are yet another category of art which has been collected under the term "visual music." Here the term is misleading, because these works are combinations of both images and music, which I conceived to have a relationship of complementarity. Nevertheless, it has achieved some respect through the Center for Visual Music in Los Angeles, for example, and the 2005 Visual Music exhibition organized by the Museum of Contemporary Art in Los Angeles and the Smithsonian [19]. It is also a more evocative and readily recognizable term than alternatives such as "abstract animation" or "lumia," each of which have their own limitations.

Whitney recognized that technology now allows artists to modulate light in time with ease comparable to that enjoyed by music composers [20]. Beyond the empty synesthesia of music visualizers and other naive or direct intermodal mappings lies the potential for a genuinely expressive and powerful art of music, form, and motion.

# References


1. Arthur Wesley Dow, *Composition: A Series of Exercises in Art Structure* (Garden City NY: Doubleday, 1899, 1913): 5.

2. Wassily Kandinsky, *Concerning the Spiritual in Art*, trans. Hilla Rebay and Howard Dearstyne (New York: Solomon R. Guggenheim Foundation for the Museum of Non-objective painting, 1947; rpt. New York: Dover Publ., 1979): 19.

3. Roger Fry, "The Allied Artists," *The Nation* 13 (1913): 676-77, rpt. in *A Roger Fry Reader* (Chicago: University of Chicago Press, 1996): 150-153.

4. The term synesthesia, also spelled synaesthesia, was coined by Jules Millet in his *Audition Coloreé* (Paris: 1892).

5. Bulat M. Galeyev argues for this clear distinction in several articles, including "What is Synaesthesia: Myths and Reality," *Leonardo Electronic Almanac* 7/6 (1999) <http://prometheus.kai.ru/mif_e.htm>.

6. Aristotle, *On Sense and the Sensible,* trans. J.I. Beare (Oxford: Clarendon Press,1908/1931): III 439b-440a.

7. See the discussion in Tom Douglas Jones, *The Art of Light and Color* (New York: Van Nostrand Reinhold, 1972).

8. Maarten Franssen. "The Ocular Harpsichord of Louis-Bertrand Castel," *Tractrix: Yearbook for the History of Science, Medicine, Technology and Mathematics* 3 (1991): 15-77.

9. The best historical summary of the color organists is in Adrian Bernard Klein, *Coloured Light, an Art Medium* 3rd ed. (London: Technical Press, 1937): 1-30.

10. Fred Collopy, "Color, Form, and Motion: Dimensions of a Musical Art of Light," *Leonardo* 33/5 (2000): 355-360. Also W. Garner, "The Relationship between Colour and Music," *Leonardo* 11/4 (1978), 225-226.

11. I would partially except the fascinating work of Stephen Malinowski, whose "Music Animation Machine" software has, in various versions, represented relationships of tonality and harmony, in addition to pitch and timbre. The software creates charming and fascinating illustrations of musical events but is not as successful as visual art.

12. John Whitney, *Digital Harmony: On the Complementarity of Music and Visual Art* (Peterborough NH: Byte Books, 1980): 21-27.

13. Whitney, 5.

14. For a fuller explanation, see Bill Alves, "Digital Harmony of Sound and Light," *Computer Music Journal* 29/4 (Winter 2005): 45-54.

15. For a historical survey of the many changes to the concepts of consonance and dissonance, see James Tenney, *A History of Consonance and Dissonance* (New York: Excelsior, 1988).

16. Among the other artists to have arrived at this correspondence of symmetry and musical consonance are Ronald Pellegrino, *The Electronic Arts of Light and Sound* (New York: Van Nostrand Reinhold, 1983) and G. Monro and J. Pressing, "Sound Visualization Using Embedding: The Art and Science of Auditory Autocorrelation," *Computer Music Journal* 22/2 (1998): 20–34. However, Whitney's approach is a more general principle which can be applied artistically in many ways, rather than an algorithm for visualization.

17. A gamelan is an orchestra of metallophones and gongs from Java, Indonesia. The gamelan I direct plays non-traditional music (such as in this case) and is tuned to just intonation versions of traditional Javanese scales.

18. Daud Sutton, *Islamic Design: A Genius for Geometry* (New York: Walker, 2007): 8.

19. *Visual Music: Synaesthesia in Art and Music Since 1900*, Thames and Hudson, 2005.

20. Whitney, 15.