7

Wordless Music and Abstract Art

from *Exploring the Invisible*, Lynn Gamwell, 2004

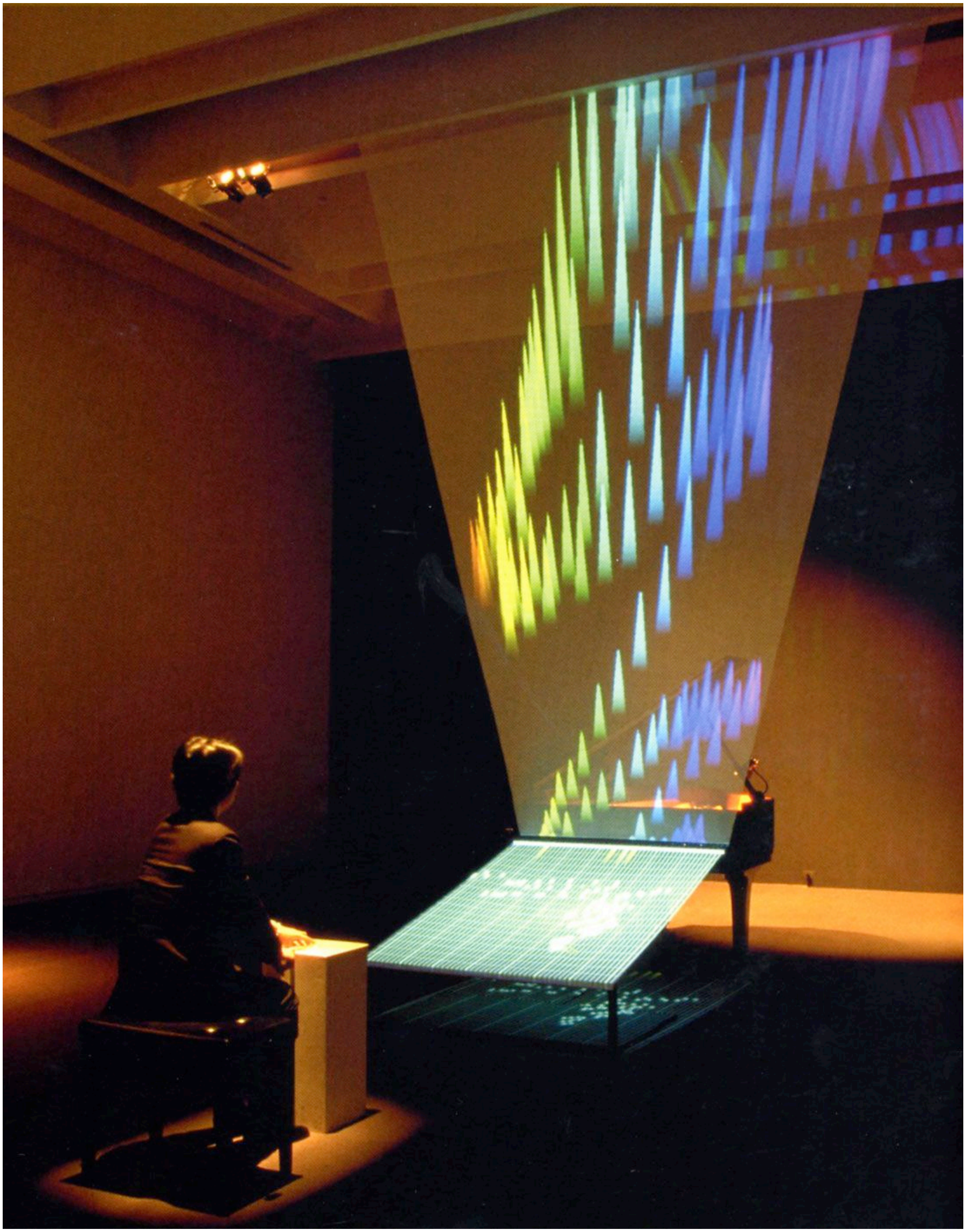
> ***We may regard all these colors, that is, all those based on numerical ratios, as analogous to the sounds that enter into music, and suppose that those involving simple numerical ratios, like the consonances in music, may be those generally regarded as the most agreeable.***
>
> **Aristotle, *On Sense and Sensible Objects*, fourth century B.C.**

Ever since Pythagoras expressed the conviction that the universe is governed by numerical relations, Western culture has held the deep belief that the essence of nature is revealed in mathematical equations. From the Pythagorean theorem to Einstein's $E=mc^2$, the laws of nature have carried an aura of certainty and timelessness, as well as aesthetic associations with harmony and symmetry, that have led artists and scientists to ascribe spiritual power to numbers. Pythagoras also discovered a mathematical basis to music: the main musical consonances—an octave, a fifth, and a fourth—are expressible in ratios of the smallest whole numbers—1:2, 2:3, and 3:4, respectively. For example, when one string is twice the length of another, plucking them both produces an octave, which creates an agreeable feeling of finality for the listener—a consonance. A combination of tones not in a ratio of whole numbers—a dissonance—is experienced by the listener as unresolved. In the fourth century B.C. Aristotle transferred this idea of ratios from hearing music to seeing color, in order to explain why some colors feel agreeable and others do not. Aristotle first hypothesized that there are only two fundamental colors, black and white.[1] He proposed the explanation that when looking at a pattern of tiny quantities of black and white—specks too small to be discerned as distinct units—the eye perceives a color. An agreeable color like crimson is produced by only certain ratios of black to white specks, just as harmonious sound is produced by only certain ratios of shorter to longer strings.

The Harmony of the Spheres: Mathematics, Astronomy, and Music

Pythagoras proposed that the movement of the planets in the heavens generates a harmonic combination of sounds. The velocity of each planet determines its musical tone, and together the planets produce a chord, a harmony—the harmony of the spheres. No documents written by Pythagoras or his cult survive but the Greek astronomer Ptolemy recorded his views on astronomy. Ptolemy also wrote a summary of Greek views of music, *Harmonics*, which ends

134. Toshio Iwai (Japanese, born 1962), *Piano—As Image Media*, 1995. Installation with altered piano. Courtesy of the artist.



Our souls evidently experience the same effects as the melody, as if they recognize the kindred relationship of the ratios of each state and are modeled by some movements appropriate to the individual musical forms. . . . The heavenly hypotheses are perfected in accord with the harmonic ratios. . . . The periods of the celestial bodies are circular and ordered, and similar are the states of the harmonic systems.

Ptolemy, *Harmonics*,
second century A.D.

with praise for Pythagoras's view that music is the link between the microcosm and the macrocosm, between man's soul and the universe.

The seventeenth-century astronomer Johannes Kepler was taken with the idea that the motion of the planets produces musical tones. When he discovered that there is a constant ratio between the average radius of a planet's orbit and the time it takes to orbit the sun (radius cubed is proportionate to time squared), he named it his "harmonic law," because he believed that he had also discovered the score to celestial music. Pythagoras, believing that each planet moves in a circle at a constant speed, had thought that each planet intones one note. After Kepler determined that each planet moves in an ellipse, and that the planet speeds up and slows down as it approaches and then moves away from the sun, he declared that each planet has a range of notes, humming along at a pitch that gradually goes up the scale and then down again. Kepler believed that together the planets could produce a six-part harmony (plate 135).[2]

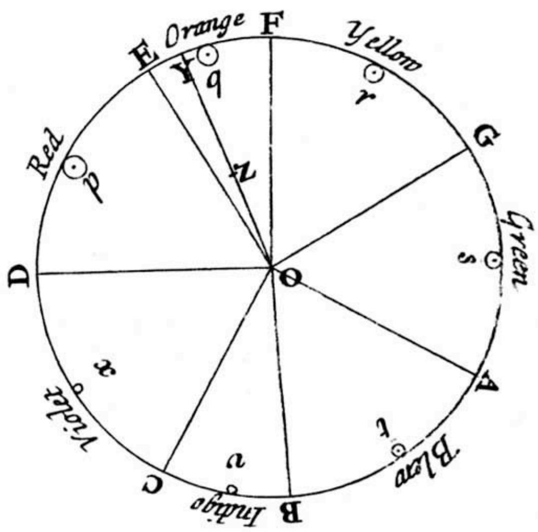
The Enlightenment inherited the attitude that music has an elevated status because of its inherently mathematical nature and because it is manifest in the celestial realm. Music, like mathematics, exists in immaterial forms that give mankind an intimation of timeless perfection: circles are formed in man's imagination, and harmonic consonants resonate in his immortal soul.

During the Enlightenment, music was still studied within mathematics, and the French philosopher René Descartes, looking for the geometric structure of harmony, organized the musical scale into a circle joined at the octave (*Compendium Musicae*, 1650). After Newton discovered the spectrum, he updated the ancient analogy of music and color by dividing the spectrum into seven parts, corresponding to the seven notes in the scale. He then arranged his seven colors on the scale of Descartes's musical circle to create the first color wheel (plate 136).

In the eighteenth century, musicians separated from mathematics, and composition began to be treated as a fine art, like painting or literature; harmony was written about in terms of aesthetics, not as a topic in mathematics and astronomy. Early in the Enlightenment polyphonic music (such as a Bach fugue) had been understood as a reflection of a divine, immutable,

135. Harmonic motions of the planets, in Johannes Kepler, *Harmonices mundi* (Harmony of the world) (Lincii, Austriæ: sumptibus Godofredi Tampachii excudebat Ioannes Plancvs, 1619), 207. Science, Industry, and Business Library, The New York Public Library. Astor, Lenox and Tilden Foundations.

Kepler scored a part for each of the planets known to him—Saturn, Jupiter, Mars, Earth, Venus, and Mercury—by calculating the high and low notes corresponding to their elliptical orbits. He also included the moon in his chorus: "Hicloeum habet etiam" (Here the moon too has a part). Earth's orbit is almost circular—only very slightly elliptical—so Kepler declared that its perihelion and aphelion are only one note apart, *mi* and *fa* in the medieval scale. Kepler thought this was a sad sound, like a moan, and a reminder of the corruption and imperfection of Earth, because of the symbolic association of the notes with misery and famine.



136. Isaac Newton, color circle, *Opticks; or, A treatise of the reflexions, refractions, inflexions and colours of light* (London: S. Smith and B. Walford, 1704), bk. I, pt. II, pl. III, fig. 11, following p. 144. Science, Industry, and Business Library, The New York Public Library. Astor, Lenox and Tilden Foundations.

cosmic order, and music had a primarily liturgical function. With the adoption of a more secular outlook in the mid-eighteenth century, music came to be seen as a reflection of irregular patterns of natural sound, as in program music, and hence less mathematical. With the rise of individualism at the time of the French Revolution, and as harmony-based melodic music developed (such as a Beethoven sonata), music was seen increasingly as an expression of the composer's spirit.

When Kant declared that knowledge is a product of the organizing activity of the mind applied to the givens of experience, it became clear that any melody or musical composition is a synthesis—carried out in the listener's mind—of scattered sounds into a musical whole. As we saw in terms of the art of Jugendstil and Kandinsky (chap. 4), Kant's view of cognition was one of the key catalysts in the development of abstract art. Under its influence, musicians took the first steps into total abstraction and autonomy much earlier than painters. By 1800 musicians had developed and given primacy to "absolute music"—wordless instrumental music without reference to a divine order or to sounds in nature—and by midcentury Eduard Hanslick had written the fundamental text of musical formalism, *The Beautiful in Music* (1854), declaring music to be a self-sufficient realm.

The final step toward music's new expressive role was taken by the Naturphilosophen. In his *Critique of Judgment*, Kant had described aesthetic judgment as knowledge that is incapable of being put into words: "an aesthetic idea cannot become a cognition because it is an intuition (of the imagination) for which an adequate concept cannot be found"; therefore, an aesthetic judgment is inexpressible in language.[3] While the Romantics' suspicion grew that reason could not articulate many areas of reality—emotions, irrational impulses, intuitions—the Naturphilosophen proclaimed that music could say the "unsayable." Words are the language of reason, but music is the language of the heart. In *Aesthetics* (1835) Hegel maintained that

The work of the painter or poet is a continual copying or reproducing (drawn from reality or the imagination), but it is impossible to copy music *from Nature. Nature knows of no Sonata, no Overture, no Rondo. . . . Music consists of successions and forms of sound, and these alone constitute the subject.*

Eduard Hanslick, *The Beautiful in Music*, 1854

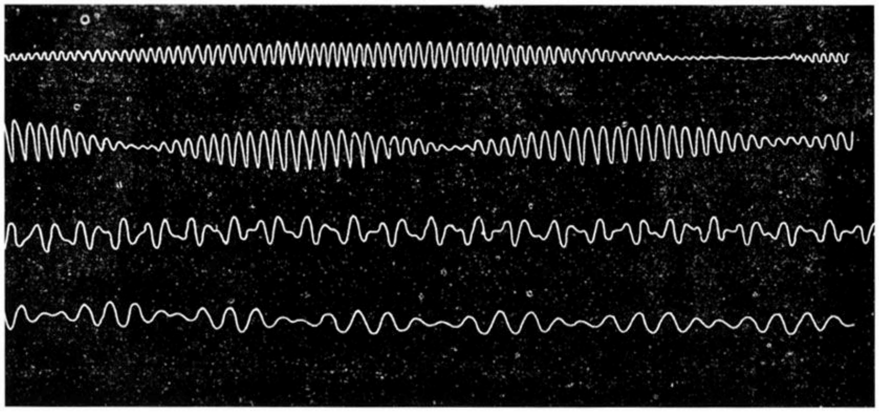
wordless instrumental music is the highest form of art precisely because it does not represent anything in the external world but expresses only the "subjective life"; melodies are "the immediate expression of the inner life . . . which, while being obedient to the necessity of harmonic laws, yet at the same time lift the soul to the apprehension of a higher sphere."[4] And, in an echo of the Pythagorean view of music as the link between the microcosm and the macrocosm, Schelling declared that music is an embodiment of spirit, uniting the individual with the cosmos (*Philosophy of Art*, 1802–3).

Thus by the opening of the nineteenth century it had been firmly established in German culture that absolute music was the language of the spirit. The Romantic painter Philipp Otto Runge designed *The Nightingale's Music Lesson* (1804–5; Kunsthalle, Hamburg) like a fugue, allowing the painting's musical subject matter to appear in different variations. He planned a cycle of four paintings based on the times of day—but completed only two versions of *Morning* (for example *Morning*, 1808; Kunsthalle, Hamburg)—with the idea that the cycle would be displayed together with a performance of music appropriate to the hour, in order to convey his vision of a harmonic universe. Runge also described colors in musical terms. In his spherical model of pigments with the primary and secondary hues arranged around the equator and white and black at the poles (plate 55), the colors located opposite each other, such as red and green, were "harmonious"; primaries such as red and blue, "dissonant"; and adjacent colors, "monotones."[5]

Sound and Light, Hearing and Vision

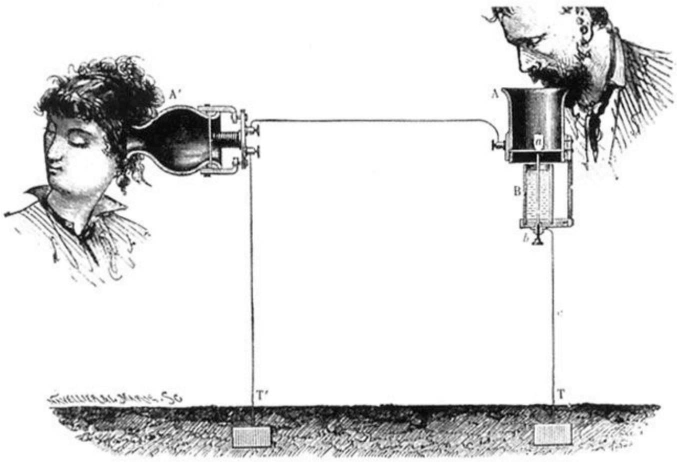
The analogy between music and color was reinforced in the public mind in the early nineteenth century by Thomas Young's demonstration that light, like sound, travels in waves. When physiologists also confirmed that hearing sound and seeing color are, from the brain's point of view, the same thing—electrical nerve impulses—sound and light came to seem interchangeable. As neurology expanded in the second half of the nineteenth century, many expressed the desire to hear colors and see sounds—which seemed possible because, as Paul Gauguin put it, "All our senses reach the brain *directly*."[6] The public was also made aware of the patterns made by sound waves, which were widely printed in the popular press after the invention of the telephone (1876; see plates 137 and 138). Since all waves make similar patterns, the public could see for themselves the striking similarity in the appearance of sound waves and light waves, and the analogy was also encouraged by science journalists who published optical figures that were produced by sound vibrations, in other words, literal visualizations of sound (plate 139).

In 1862 Helmholtz laid bare the physical basis of the analogy of music to color in his general theory of hearing, in which he described the ear, like the eye, as a sensory organ that transforms waves into nerve impulses. He first described the physical basis of harmony. It had been known for centuries that the cochlea, the bony spiral in the shape of a snail shell, is the site of hearing, but no one knew how sound was perceived. Helmholtz showed that curled inside the cochlea is a ribbon-thin piece of tissue—the basilar membrane—that vibrates in



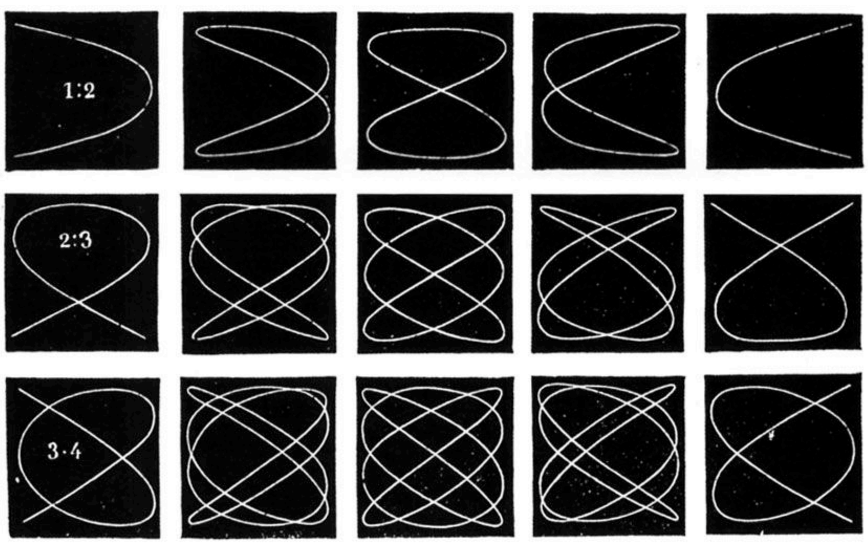
ABOVE

137. Patterns made by sound waves, in Amédée Guillemin, *Le Monde physique* (The physical world) (Paris: L. Hachette, 1882), 656.



LEFT

138. Telephone, in Louis Figuier, *Les Nouvelles Conquêtes des sciences* (The new conquests of science) (Paris, 1883), 1:352.

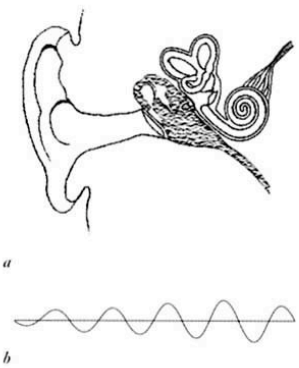


BELOW

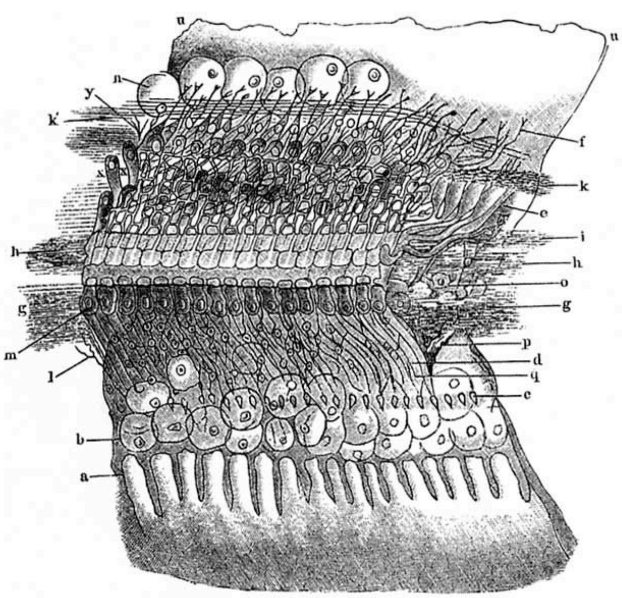
139. Patterns produced by vibrations of two tuning forks, set at 1:2 (octave), 2:3 (fifth), and 3:4 (fourth), in Camille Flammarion, *Astronomie populaire* (Popular astronomy) (Paris: C. Marpon and E. Flammarion, 1881), 287.

response to the frequency of the amplified sound entering the inner ear (plate 140). The membrane is lined with three rows of nerve cells, which have a hairlike fiber that senses the vibration and transmits it to the auditory nerve, which carries the impulse to the brain (plate 141). Helmholtz proposed that there is one hair cell for each pitch that can be discriminated. (It is known today that it is rather groups of some twenty-four thousand nerve cells lining the basilar membrane that are associated with the fifteen hundred pitches that the ear can discriminate.) Helmholtz also proved that a listener's subjective experience of harmony is based ultimately in the structure of the ear itself. He demonstrated that when a hair cell on the basilar membrane is stimulated, it triggers a sympathetic vibration—an overtone—in the hair cells that corresponds to the pitches of the octave, the fourth, and fifth, a pattern of resonance that occurs in music. In other words, hearing an octave, a fifth, and a fourth as a consonance and the perception of overtones are innate features of the human ear.

Helmholtz described hearing and vision as analogous because nerve impulses play a significant role in both, but he also stressed that the analogy is limited by the dissimilarity of the physical structure of the ear and the eye. When a complex sound wave, such as that produced by a three-note musical chord (plate 142), strikes the ear, the nerve cells lining the basilar membrane perform an analysis of the sound wave and send the brain separate, simultaneous nerve impulses for each of the three tones—the ear hears a three-note chord. The nerve cells lining the retina are unable to perform such an analysis on complex colors; when a mixed color such as a bluish green strikes the retina, the eye sends only one impulse to the brain—the eye does not distinguish the component wavelengths and the viewer sees one mixed color, bluish green. As Helmholtz stated: "The eye is unable to decompose compound systems of luminous



ABOVE
140. *(a)* The outer ear and cross section of the cochlea. *(b)* The basilar membrane of the cochlea is shown uncoiled; the membrane at rest (straight line) and the membrane vibrating in resonance with a sound wave (wavy line).



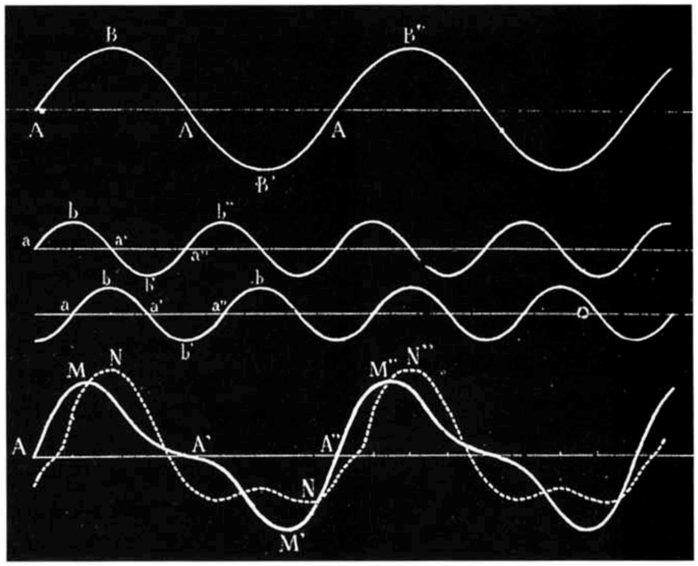
BELOW
141. Rows of nerve cells lining a section of the basilar membrane, in Hermann von Helmholtz, "The Physiological Causes of Harmony in Music" (1857), in *Popular Lectures on Scientific Subjects*, trans. E. Atkinson (New York: D. Appleton and Co., 1891), 84.

Why do I understand the musician better, why do I see the raison d'être of his abstractions better?

Vincent van Gogh
to Theo van Gogh,
probably September 1888

waves, that is, to distinguish compound colors from one another. It experiences them as a single, unanalyzable, simple sensation, that of a mixed color. It is indifferent to the eye whether this mixed color results from a union of fundamental colors or with non-simple ratios of periodic times. The eye has no sense of harmony in the same meaning as the ear. There is no music to the eye."[7]

Thus from a physiological point of view, even though music and color are analogous in the sense that perception of them is the result of nerve impulses, the comparison ends there because of the dissimilar sense organs. This may help to explain why abstract art—despite a century of educating the public about the ability of color and line to evoke their feelings—attracts smaller audiences than wordless instrumental music (symphonies, jazz improvisations, violin concertos, and so on).



142. Pure and mixed sound waves, in Amédée Guillemin, *Le Monde physique* (The physical world) (Paris: L. Hachette, 1882), 1:635.

Above are "pure" sounds produced by tuning forks: one with long waves (a low tone) and two with shorter waves (higher pitches). At the bottom, the three pure sound waves are combined into a complex wave pattern.

Visual Music

In England, the adoption of a scientific perspective in the 1860s was stalled in part by the association of science with technology, whose blighting effects could be seen in the belching smokestacks, urban crowding, and health hazards of the industrial revolution. With the pessimism of soldiers who fight a losing battle, artists and writers of the Aesthetic movement resisted the encroachment of science into all areas of life by defending the territory of art and asserting their dominion over the cult of beauty. The belief in the autonomous value of aesthetic qualities such as color and form prompted the leading artist of the movement, James McNeill Whistler, to adopt the analogy of music and color in his work. At the 1863 Salon des Refusés, he exhibited the first of his four Symphonies in White, *Symphony in White, No. 1: The White Girl* (1861; National Gallery of Art, Washington, D.C.), and thereafter he gave his paintings musical titles, such as his *Arrangement in Grey and Black, No. 1: Portrait of the Artist's Mother* (1873; Musée d'Orsay, Paris).

Given the art-for-art's-sake ideology of the Aesthetic movement,[8] it is not surprising that Whistler would make the analogy between music and color, but why did he keep the girl in white and his mother in his art rather than making the leap to abstraction? I would argue that for artists to fully adopt the analogy of painting to music—pure color to pure sound—they first had to embrace the abstract, invisible realms that science was revealing—the microscopic realm, evolutionary biology, and experimental psychology. Because they resisted the impact of technology, and by association science, Whistler and his Aesthetic colleagues turned their backs on the imperceptible and hence on abstract art. Clinging to an old-fashioned view of nature, Whistler continued to describe its outward appearance. Nostalgia for preindustrial

An artist who sees that the imitation of natural appearances, however artistic, is not for him, the kind of creative artist who wants to express his own inner world, sees with envy how naturally and easily such goals can be attained in music, the least material of the arts.

Wassily Kandinsky, *On the Spiritual in Art*, 1912 society manifested itself in Aesthetic architecture and interiors, which Whistler also designed, and in the handcrafted, floral patterns of Aesthetic furniture, ceramics, metalwork, and textiles designed by William Morris, leader of the British Arts and Crafts movement.

Unlike members of the British Aesthetic movement, Art Nouveau and Jugendstil artists embraced science, especially biology, and their interest in experimental psychology also brought them in contact with research on the similar spiritual (psychological) impact of music and color. Theodor Lipps wrote on the psychology of harmony in music, and August Endell used the music/color analogy frequently in his writings.[9] When, in 1911, Kandinsky first heard a performance of atonal music by the Austrian composer Arnold Schoenberg, he felt an immediate sympathy with the composer's rejection of traditional rules for consonance and dissonance in order to achieve a new form of musical expression of the soul: "Schoenberg combines in his thinking the greatest freedom with the greatest belief in the ordered development of the spirit!"[10] Within a year Kandinsky was associating specific hues with musical sounds; in the same way that someone who reads music can "hear" a score, so, in theory, a viewer who knows the artist's color language can "hear" the painting. Once he started painting totally abstract works, he gave them musical titles (plate 143). The analogy of music to color became commonplace among abstract artists; in reference to the legendary Greek poet and musician Orpheus, Apollinaire gave the name "Orphists" to artists in the Cubist circle such as František Kupka, who moved into abstraction with that analogy in mind (*Amorpha: Fugue in Two Colors*, 1912; Národní Galerie, Prague). The American painters Stanton Macdonald-Wright and Morgan Russell collaborated on the development of a style of painting with color harmonies, which they called Synchromism (plate 144).

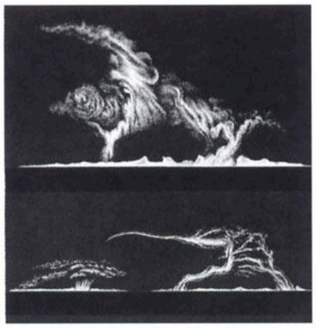
The Lithuanian artist Mikalojus K. Čiurlionis studied musical composition and art in Warsaw before creating a series of paintings entitled *The Zodiac*, which shows a band of the sky that includes the paths of the principle planets, the sun, and the moon. He was very interested in astronomy and read *Popular Astronomy* (1881) by the French popularizer Camille Flammarion,[11] which had stunning celestial images, as did the German popular science press (plate 146). Evoking the theme of the harmony of the spheres, Čiurlionis gave each painting a musical title, such as *Sonata No. 6 (Sonata of the Stars) Allegro* (plate 147); planets, stars, and light beams fill the composition, which surges upward. He moved to Saint Petersburg in 1909 and was associated there with the experiments combining music and light that were being done by the Russian composer Alexander Skryabin.[12] In the score for *Prometheus: The Poem of Fire* (1911), Skryabin included a part for a color organ, an instrument that makes no sound but projects colored lights that are coordinated to the musical scale. Such instruments

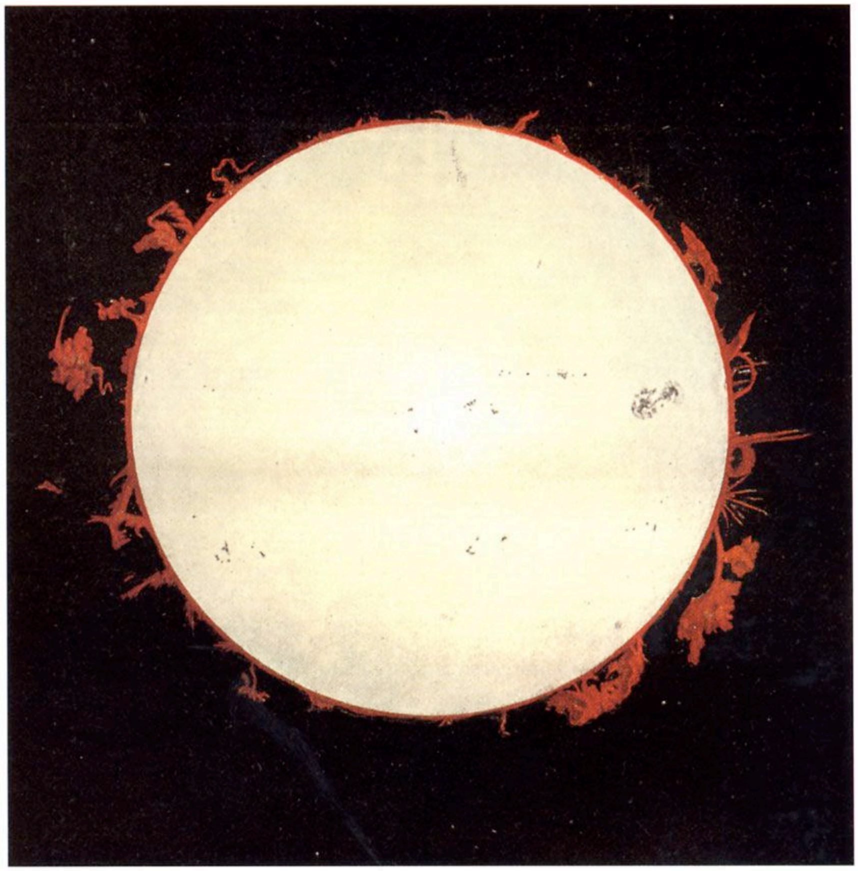
OPPOSITE

143. Wassily Kandinsky (Russian, 1866–1944), *Fugue*, 1914. Oil on canvas, 51 7/8 x 51 7/8 in. (129.5 x 129.5 cm). Fondation Beyeler, Riehen/Basel.

BELOW

144. Stanton Macdonald-Wright (American, 1890–1973), *Conception Synchromy*, 1914. Oil on canvas, 36 x 30 1/8 in. (91.4 x 76.5 cm). Hirshhorn Museum and Sculpture Garden, Smithsonian Institution, Washington, D.C. Gift of Joseph H. Hirshhorn, 1966.





ABOVE

145. "Solar Flares," in Amédée Guillemin, *Le Monde physique* (The physical world) (Paris: L. Hachette, 1882), 2: opp. x.

RIGHT

146. Sun showing sunspots and corona, in Hans Kraemer, *Weltall und Menschheit* (Cosmos and humanity) (Berlin: Deutsches Verlaghaus Bong & Co., 1902–4), 2: opp. 236.

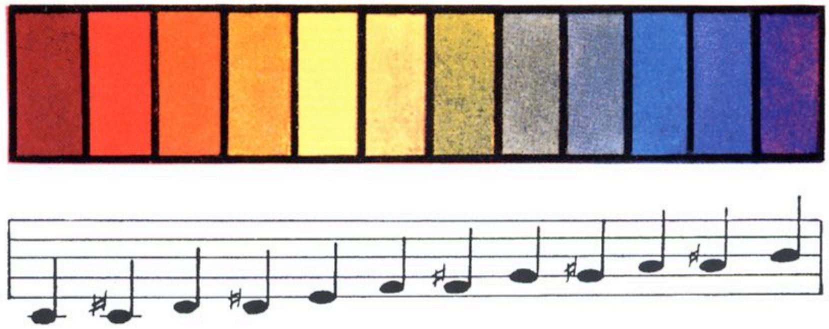
OPPOSITE

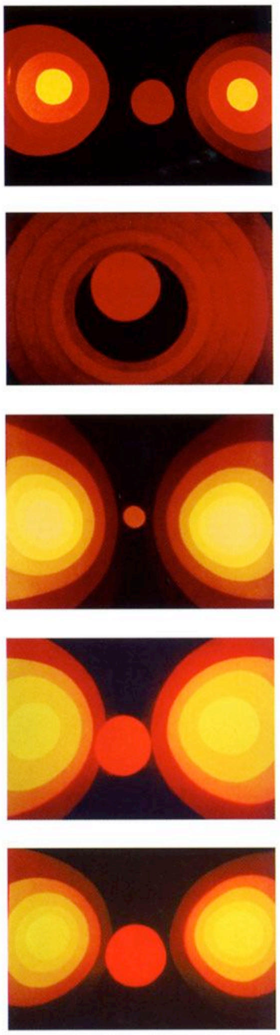
147. Mikalojus K. Ciurlionis (Lithuanian, 1875–1911), *Sonata No. 6 (Sonata of the Stars) Allegro*, 1908. Tempera on paper, 28⅞ x 24½ in. (72.2 x 61.4 cm). M. K. Ciurlionis National Museum of Art, Kaunas, Lithuania.

had been in use since the seventeenth century and were a popular form of entertainment in the first decade of the twentieth (plate 148).

After being disappointed with the dim flashes of color they attained with a color organ they designed, the Italian Futurists Arnaldo Ginna and Bruno Corra invested in a few hundred feet of film and began applying color by hand, frame by frame, in processes already well known to early animators. Happy with the brilliant colors they produced by projecting with an arc lamp into a darkened room, they produced five abstract films between 1910 and 1912, which Corra described in his manifesto "Abstract Cinema—Chromatic Music" (1912).[13] Of *The Rainbow* Corra wrote:

> *The colors of the rainbow constitute the dominant theme, which appears occasionally in different forms with ever increasing intensity until it finally explodes with dazzling violence. The screen is initially grey, then in this grey background there gradually appears a very slight agitation of radiant tremors which seem to rise out*





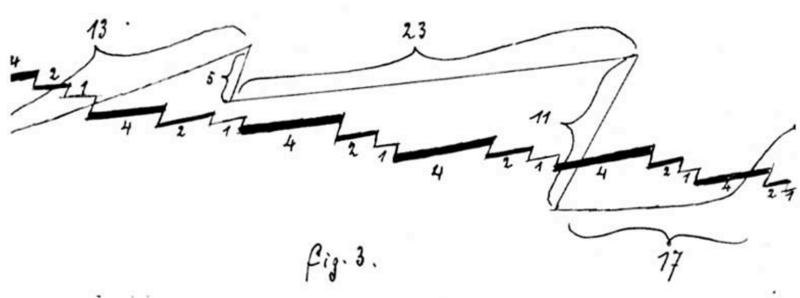
of the grey depths, like bubbles from a spring, and when they reach the surface they explode and disappear. The entire symphony is based on this effect of contrast between cloudy grey of the background and the rainbow, and the struggle between them. The struggle increases; the spectrum, suffocated beneath the ever blacker vortices which roll from the background to foreground manages to free itself, flashes, then disappears again to reappear more intensely close to the frame. Finally, in an unexpected dusty disintegration, the grey crumbles and the spectrum triumphs in a whirling of catherine-wheels which disappear in their turn, buried under an avalanche of colors.[14]

In the 1920s the Swedish-born filmmaker Viking Eggeling created *Diagonal Symphony*; throughout the eight-minute silent film, white abstract shapes and lines move slowly against a black background. The first public showing of the film was in Berlin in 1926, together with an abstract film by Hans Richter of the Bauhaus.[15] Richter described his vision of color music on film: "The complete works will be realized on film. The process itself: creative evolutions and revolutions in the realm of the purely artistic (abstract forms); roughly analogous to the sounds of music in our ears. As in music the action (in a totally theoretical sense) is presented by pure material."[16] Oskar Fischinger, whose abstract projections were incorporated into Alexander László's *Colored Light Music* performance of around 1926, emigrated to America during World War II. While working as an animator in Hollywood, he encouraged underground filmmakers to create abstract colors in motion (plate 149).

At the Bauhaus, Gertrud Grunow taught a class in "harmonization," using a grand piano and a chromatic wheel that assigned a body part and a musical note to each color. The Bauhaus catalogue description of Grunow's class reads, "During the entire duration of study, practical harmonization classes on the common basis of sound, color, and form will be taught with the aim of creating a balance between the physical and mental properties of the individual."[17] Another Bauhaus artist, Paul Klee, had a lifelong close association with music; the son of a music teacher in Bern, he learned to play the violin and considered a concert career before turning to art. For his students at the Bauhaus, Klee demonstrated the linear translation of a musical composition by diagramming a three-part passage from a Bach sonata (1921–22; Paul Klee Foundation, Kunstmuseum, Bern), and he developed linear counterpoint in his *Drawing in Two Voices* (plate 150).

The link between music and color has persisted in the visual arts, especially in works that entail an element of performance. An enchanting recent example was created by Japanese video artist Toshio Iwai. The viewer enters a dark, silent room; in the center of the room is a grand piano with its lid lifted to reveal dimly lit strings. A trackball sits on a stand about ten feet in front of the keyboard. By moving the ball, the viewer triggers a pattern of lights on a scrim stretching to the piano, movement of the keys, and bursts of sounds and lights from the keyboard (plate 134). As the room returns to still darkness, the viewer is left with an echo and an afterimage.

As visual artists continue to be inspired by the analogy of music and color, so musicians and astronomers pursue the harmony of the spheres. The German composer Paul Hindemith wrote an opera based on the life of Kepler in which melodic lines, associated with planets and the moon, repeat at regular intervals to suggest the rhythmic orbiting of the spheres around the tonal center, which the composer identified with the sun (*Die Harmony der Welt* [Harmony of the world], 1957). According to the American Minimalist composer George Crumb, his 1974 piece for two amplified pianos and percussion, *Makrokosmos III*, "might be interpreted as a kind of 'cosmic drama.'"[18] Intrigued as much by the silence of the spheres as by their sound, Crumb has noted that the third movement of this composition, "The Advent," "is associated with a passage from French Enlightenment mathematician Blaise Pascal: 'The eternal silence of infinite space terrifies me.'"[19] For their part, astronomers are today attempting to detect ripples in the fabric of outer space—gravity waves—that are caused by the motion of massive bodies. Conventional astronomy records radiation (such as visible light) at high frequencies; the range of gravity waves would be much lower. This has suggested to some that if gravity waves, which were predicted by Einstein, can be detected, then scientists will be able to convert them into audible sound.[20] Most intriguingly, one might be able to hear an echo of the Big Bang; in Australia and America there are observatories in operation today that are dedicated to detecting gravitational waves, and a satellite observatory is scheduled for launch by NASA in 2009.



OPPOSITE, TOP

148. "Chromatic scale in music and color," in A. W. Rimington, *Colour Music: The Art of Mobile Colour* (London: Hutchison and Co., 1912), opp. 21.

OPPOSITE, LEFT

149. Oskar Fischinger (American, 1900–1967), *Radio Dynamics*, 1945. Color film. Iota Center, Los Angeles.

BELOW

150. Paul Klee (Swiss, 1879–1940), *Drawing in Two Voices*, 1921–22. Paul-Klee-Stiftung, Kunstmuseum, Bern.