“A Light in Sound, a Sound-like Power in Light”:

Light and/as Music in the History of the Color Organ

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ABSTRACT

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This dissertation examines the history of the relationship between light/color as an artistic medium and music. Looking at four artist-inventors from the eighteenth through to the mid-twentieth centuries, I consider how new arts of light and color arose from music, relied on music, and also distanced themselves from it. Drawing chiefly on published and unpublished primary sources, this dissertation compares artists' and inventors' conceptions of what this new art should be as it was continuously reimagined and reconstituted in their works, discourses, and technologies. I suggest a running tension throughout this history between the aspiration for a new and even autonomous art and its reliance on the music.

In Chapter 1, I investigate the work of the eighteenth-century French Jesuit monk Louis Bertrand Castel, who in 1725 proposed the first ever instrument for color music, his *clavecin oculaire* or ocular harpsichord. I note conflicting tendencies in his thought as he suggested two different avenues for color music: as a form of multimedia, and as a separate, silent medium capable of giving pleasure on its own. The next chapter turns to the color organ and color music of the late nineteenth-century inventor and artist Alexander Wallace Rimington. Drawing on contemporaneous theories of color, reception of Rimington's performances, and the inventor's own writings, I locate Rimington's organ at the intersection of a continuing tradition of analogizing music and color and late nineteenth-century attempts to theorize color independently

and systematically. I then demonstrate how Rimington's desire to use color music as means of improving color perception can be understood as part of a larger debates about sensing color and color education around the turn of the twentieth century. Chapters 3 considers Mary Hallock Greenewalt's instrument, the *sarabet*, and her art form, *nourathar*¸ while the final chapter looks at Thomas Wilfred's (usually silent) light art, *lumia*. I suggest that Greenewalt and Wilfred's relationship to music is a source of tension in their work, as they attempted to extricate and purify light art into an autonomous art form but display various forms of musical influence.

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Serdar için

Introduction

The desire to create a new art of color or light and a new media to realize it has a long history.[1] The French Jesuit monk Louis Bertrand Castel attempted in the eighteenth century to manufacture an ocular harpsichord for his *musique de couleurs,* the English painter Alexander Wallace Rimington made a color organ that played color music in a concert in 1895, the American concert pianist Mary Hallock Greenewalt spent the 1910s and 1920s developing her *sarabet* to perform *nourathar*, and during the same period the Danish-American artist and retired lutenist Thomas Wilfred invented his *clavilux* to realize his art, *lumia.* Despite their different appellations, these artists' instruments have often been referred to collectively as "color organs" and their work has been most frequently termed "color music." This dissertation examines the history of the relationship between music and light and color as an artistic medium. Looking at these four artist-inventors from the eighteenth through to the mid-twentieth centuries, I consider how new arts of light and color arose from music, relied on music, but also distanced themselves from music as a medium.

Drawing chiefly on published and unpublished primary sources, I compare artists' and inventors' conception of what this new art should be as it was continuously reimagined and reconstituted in their works, discourses, and technologies. This dissertation emphasizes music's importance to the light- and color-art tradition by emphasizing the complicated and conflicting relationship each of these artists and inventions had with music—understood both as sound and as an ideal. I therefore trace a running tension throughout this history between the aspiration for

[1] The quotation in this dissertation's title ("A light in sound, a sound-like power in light") is derived from: Samuel Taylor Coleridge, "The Aeolian Harp," accessed April 18, 2019, https://www.poetryfoundation.org/poems/52301/the-eolian-harp.

a new art and its reliance on the old, music. In this dissertation neither "color music" nor "music" are stable categories for the inventors and artists in question, but rather ones that were constantly redefined as different theorists and artists related, analogized, or dissociated light and color from music.

In this introduction, I used the terms "color organ" and "color music" for the sake of simplicity, and to situate these artists, creators, and theorists (and their inventions and works) within the disciplinary and discursive frameworks to which they have been generally affiliated. But, as will become obvious throughout the course of my chapters, the figures throughout this dissertation's case studies took different attitudes towards these terms. Many rejected or resisted them, often proposing their own neologisms and proprietary frameworks for contextualization and comprehension.

Framing Color Music

One intervention of this dissertation is to challenge and rethink the theoretical and historical framings into which the practices of color music have been collapsed in existing scholarship. Although the term "color music" (which, as I discuss in Chapter 1, arose from the theories of Louis Bertrand Castel) was once a common descriptor for color organs and light art more generally, more recent scholarship has tended to employ the term "visual music" instead. The term "visual music" can be traced to 1912, in the writings of the English artist and art critic Roger Fry; Fry used the expression to describe non-representational paintings, particularly by

Picasso.[2] Later, probably independently from Fry's influence, filmmaker Mary Ellen Bute and light artist Thomas Wilfred would also employ the term as a broad descriptor for their work.

Modern usages of the term encompass a constellation of practices. In one contemporary articulation of its meaning, the Director of the Los Angeles-based Center for Visual Music Cindy Keefer and media artist and scholar Jack Ox lay out four forms of visual music: music visualization "with the original syntax being emulated in the new visual rendition," which they also call "intermedia"; a "time-based narrative," either silent or with sound, that is "similar to the structure of a kind or style of music"; a "direct translation of image to sound or music" (as in the painted/drawn/etched soundtracks in certain films by the animators Oskar Fischinger, Norman McLaren, and Barry Spinello); and, lastly, a static work "serving as an artist's visual interpretation of specific music" (perhaps like Ox's paintings of Bruckner's Symphony no. 8).[3] Such a broad contemporary definition makes "visual music" something of a hold-all that would quite easily include the visual or audiovisual art produced through color organs, but is not atypical for the expression's application in the titles of university courses, galleries, and institutions as well as academic literature.

William Moritz, one of the founders of the Center for Visual Music and a widely cited film historian, must be credited with a large influence over the modern, broad definition of "visual music," and the inclusion of color organs within the category. His articles on the topic are less concerned with ontology and genre definition, and more invested in establishing a canon of

[2] Roger Fry, "Preface to Catalogue of second Post-Impressionist Exhibition, Grafton Galleries, 1912," in *Vision and Design* (London: Chatto & Windus, 1920), 157.

[3] Jack Ox and Cindy Keefer, "On Curating Recent Digital Abstract Visual Music," accessed April 7, 2019, http://www.centerforvisualmusic.org/Ox_Keefer_VM.htm.

visual music practitioners and works. Since Moritz's passion and academic interest lay firstly with the German animator Oskar Fischinger, Fischinger's work and animated film more generally holds center stage in Moritz's institutional and institutionalizing work. Like Fischinger, the filmmakers Moritz included in his canon embraced animation, abstraction, and tight coordination of effect between music and visuals; they include the avant-garde German "absolute film" makers of the 1920s (Hans Richter, Walter Ruttmann, and Viking Eggeling) and experimenters based in post-Second-World-War Los Angeles and San Francisco (John and James Whitney, Len Lye, Hy Hirsch, Harry Smith, and Jordan Belson) as well as some artists based elsewhere (such as Mary Ellen Bute and Norman McLaren). However, Moritz extended his history of the dream of a "music for the eye" back to the Ancient Greeks and forward to music videos on MTV, including color organs along the way. In Moritz's account, color organs play a largely transitional or preparatory role as part of visual music's *longue durée* that reaches its pinnacle with the works of Fischinger. Moritz's figuring of the history of color organs in relationship to film is rehearsed in various pieces of scholarship on the issue. [4]

The emphasis that color organ inventors put on color and/or light as a medium is, I find, undervalued in descriptions of color organists as visual music. Additionally, reducing their relationship to music as a vague aspiration to create a "music for the eye" obscures the complex

[4] William Moritz, "The Dream of Color Music and the Machines That Made it Possible," *Animation World Magazine* 2, no. 1 (April 1997), https://www.awn.com/mag/issue2.1/articles/moritz2.1.html; William Moritz, "Towards an Aesthetics of Visual Music," *Asifa Canada* 14, no. 3 (December 1986), http://www.centerforvisualmusic.org/TAVM.htm. Moritz's concept of color organs as precursors to visual music films reappears, for example, in Nick Fox-Gieg, Cindy Keefer, and Margaret Schedel, "Editorial," *Organised Sound* 17 (2012): 98; Holly Rogers, *Sounding the gallery: video and the rise of art-music* (Oxford: Oxford University Press, 2013); Aimee Mollaghan, *The Visual Music Film* (New York: Palgrave Macmillan, 2015); and Clark Farmer, "'Every Beautiful Sound Also Creates an Equally Beautiful Picture': Color Music and Walt Disney's Fantasia," in *Lowering the Boom: Critical Studies in Film Sound*, eds. Jay Beck and Tony Grajeda (Champaign, IL: University of Illinois Press, 2008), 183–200.

relationships these artists and inventors had with music and sound. It is not my aim to suggest that color organs be cast out of the visual music canon, nor to suggest that color organs held no influence over "visual music" filmmakers or any other artists. Rather my intention is to explore attempts by color organists and light artists to define their own art forms. Suggesting a more complicated place in the history than just a prefiguring of abstract animation, as well as a complicated relationship to these figures' contemporary contexts for media, technology, and art more broadly.

In the existing scholarly literature, color organs (and visual music more broadly) are also commonly written about in relationship to synesthesia.[5] During the early nineteenth century, synesthesia was first recognized as an object for scientific knowledge as a medical "condition," although the term itself only appeared late in the century.[6] From a modern perspective, the psychologists John E. Harrison and Simon Baron-Cohen define synesthesia as "when stimulation of one sensory modality automatically triggers a perception in a second modality, in the absence of any direct simulation to this second modality."[7] My first case study considerably predates any concept of "synesthesia," but I have additionally found little evidence of interest in synesthesia

[5] Simon Shaw-Millar, "Synaesthesia," in *The Routledge Companion to Music and Visual Culture*, ed. Tim Shephard and Anne Leonard (New York: Routledge, 2014), 19; Joshua Yumibe, *Moving color: early film, mass culture, modernism* (New Brunswick, N.J.: Rutgers University Press, 2012), 35; Polina Dimova, "Synesthesia," *Routledge Encyclopedia of Modernism*, ed. Stephen Ross (Taylor and Francis, 2016), accessed 6 April 2019, https://www.rem.routledge.com/articles/synaesthesia. doi:10.4324/9781135000356-REM1011-1; Kathleen Marie Higgins, "Visual Music and Synesthesia," in *The Routledge Companion to Music and Philosophy*, ed.Theodore Gracyk and Andrew Kania (New York: Routledge, 2011), 380–390; Kerry Brougher and Judith Zilczer, eds., *Visual Music: Synaesthesia in Art and Music Since 1900* (London: Thames and Hudson, 2005).

[6] Jörg, Jewanski, Sean A. Day & Jamie Ward, "A Colorful Albino: The First Documented Case of Synaesthesia, by Georg Tobias Ludwig Sachs in 1812," *Journal of the History of the Neurosciences* 18 no. 3 (2009): 293–303; Jörg Jewanski, "Synesthesia in the Nineteenth Century: Scientific origins," in *Oxford Handbook of Synesthesia*, ed. Julia Simner and Edward Hubbard (New York: Oxford University Press, 2013), 369–398.

[7] John E. Harrison and Simon Baron-Cohen, "Synaesthesia: an Introduction," in *Synaesthesia: Classical and Contemporary Readings*, ed. Simon Baron-Cohen and John E. Harrison (Oxford: Blackwell, 1997), 3.

by the later three figures of my case studies, let alone evidence that the term, concept, or condition served as any sort of paradigm or motivation for their work. Again, this commonplace scholarly association runs contrary to these artists' objectives, founded as it is in the assumption of a close association between light/color and music—a notion which was as often challenged as embraced by the figures that this dissertation analyzes.

As seen in Keefer and Ox's definition, another term often employed either in relation to visual music more broadly or to the work of specific artists in that canon is "intermedia." While Samuel Coleridge first used the word, the term was popularized by Fluxus artist Dick Higgins in the 1960s to describe art that did not conform to accepted medium-specific categorizations, such as "happenings."[8] Higgins described the concept thus in 1966:

> For the last ten years or so, artists have changed their media to suit this situation, to the point where the media have broken down in their traditional forms, and have become merely puristic points of reference. The idea has arisen, as if by spontaneous combustion throughout the entire world, that these points are arbitrary and only useful as critical tools, in saying that such-and-such a work is basically musical, but also poetry. This is the intermedial approach, to emphasize the dialectic between the media. A composer is a dead man unless he composes for all the media and for his world.[9]

Despite the apparent historically situated nature of the term, "intermedia" has since been applied more widely to describe medial intersections across different eras.[10] But even if the term retains its historical specificity, color organs might still be considered part of the genealogy of the

[8] Dick Higgins recognized Coleridge's earlier use of the term: Dick Higgins, "Intermedia," *Leonardo* 34, no. 1 (2001): 52.

[9] Dick Higgins, "Statement on intermedia," accessed April 6, 2019, http://www.artpool.hu/Fluxus/Higgins/intermedia2.html.

[10] E.g. Mary Simonson, *Body Knowledge: Performance, Intermediality, and American Entertainment at the Turn of the Twentieth Century* (New York: Oxford University Press, 2014).

concept; Holly Rogers traces a line between color organs and intermedia in the form of 1970s video art because the former trouble the boundaries of existing art forms.[11]

Another "hybrid" category into some of this art could fall is that of "multimedia," i.e. presenting multiple simultaneous media. However, this definition might be narrow: I am interested not only in music as a sound in these artists' work but in how music also functioned as an idea(l) that often structures and influences light and color art even in the absence of sounding music. Non-relationships and total dependence between media interest me equally. In Nicholas Cook's *Analysing Musical Multimedia*, the author's example of multimedia gone wrong comes from the field of color music: Scriabin's tone poem, *Prometheus*. This piece features a part for "light keyboard" or "*tastiera per luce*" (first realized at a performance in New York in 1915) which corresponds to harmonies and key areas in the music. Cook is mostly interested in multimedia for the extent to which the components productively differ from one another. He therefore believes *Prometheus* does not belong in the canon of multimedia; according to his interpretation, the light part merely doubles information already present in the music, rather than producing new meaning.[12] Unlike Cook, I do not find such "doubling" uninteresting, although I approach these relationships from a historical rather than hermeneutic point of view, asking how they reflect their creators' beliefs about sound, light, music, color, and nature.

More apt perhaps is philosopher Jerrold Levinson's category of "hybrid" art: "art forms arising from the actual combination or interpenetration of earlier art forms."[13] These hybrids may

[11] Rogers, 47–79.

[12] Nicholas Cook, *Analysing Musical Multimedia* (Oxford: Oxford University Press, 1998), 40–41.

[13] Jerrold Levinson, "Hybrid Artworks," *The Journal of Aesthetic Education* 18, No. 4 (Winter 1984): 6.

be, according to Levinson, "juxtapositional" (separate artforms presented side by side or simultaneously), "synthetic," (combined in such a way where the component arts lose their identity, as in opera), or "transformational" (one medium is pushed in the direction of another without losing its identity, as in kinetic sculpture).[14] Levinson distinguishes hybrid art forms from another category, "thoroughbred," which he reserves for art forms that do not feature "the interpenetration or inter-action of previously existing art forms."[15] For Levinson, "Art forms that have not so arisen, though they may be intellectually analyzable into various possible or actual structural or mediumistic components, are not hybrids in the primary sense."[16]

Levinson generally maps these categories onto specific (hybrid) arts, but the relationship between multimedia components of a "hybrid" can be interpreted differently by different artists, audiences, and historians, particularly when that "hybrid" is in its emergent stages. I therefore do not consider the relationship between color/light and music in color music to be classifiable under any one "type" of media relationship; rather, the relationship can be malleable: differing among practitioners, received differently than conceived, idealized differently than practiced, and changing over the course of an artist's life.[17] Thus, I base my readings of the relationship between various media components on historical sources (the artists' writings and their reception) that foreground their unfixed nature.

[14] Ibid, 8–10.

[15] Ibid, 8.

[16] Ibid, 6.

[17] Similar attempts to map out media relationships may be found in: Cook; and Daniel Albright, *Panaesthetics: On the Unity and Diversity of the Arts* (New Haven: Yale University Press, 2014).

In a later essay, Levinson turns specifically to "visual music," classifying it as a transformational hybrid. Although he employs a broad definition of visual music as "a structured organization of colored presentations in time," it is clear that he specifically means visual music films. As such the "transformation" is of film as a medium, in the direction of music.[18] Levinson's typology is of limited applicability to color organ inventors working with new media and attempting to make new art forms rather than hybridizing existing arts. For example, while one might explain color music as a combination of painting and music—as Louis Bertrand Castel, discussed in Chapter 1, did—the media and trappings of painting were absent.

Despite framings of colors organ art as a hybrid, or as intermedia, multimedia, or synesthesia, the figures discussed in this dissertation voiced a desire for *autonomy* (rather than hybridity or synthesis)—even if their practice was clearly not autonomous. This desire created a tension, underappreciated in the existing literature, especially in these artists' approach to music. Accompanying their arguments of autonomy were claims of novelty as they characterized their undertakings more as forms of new media, or even new art forms altogether. Indeed, this is one sense in which color organists and light artists may be distinguished from "visual music" filmmakers, whose medium, film, was an institutionally and historically recognized medium.

Considering color-organ art as new media suggests another theoretical model, which may help to understand their relationship to existing art forms and media: remediation. This concept, as described by media scholars Jay Bolter and Richard Grusin, builds on the classic media theory

[18] Jerrold Levinson, *Contemplating Art* (Oxford: Clarendon Press, 2006), 109. Levinson's description of visual music is odd and reductive. In fact, his definition would make for a better definition of color or light art, since he concentrates so squarely on color alone. None of the "canon" of visual music filmmakers ever fully renounced spatial form and this may explain the lack of examples in Levinson's essay. Furthermore, just as Levinson's concept of the "visual" is reduced to color, his definition of "music" here almost entirely circulates around a (Eurocentric) concept of pitch. His fascination with these two specific elements is in fact reminiscent of color organ inventors like Rimington (not being mentioned in Levinson's essay), who concentrated on this specific mapping.

of Marshall McLuhan, who wrote that "the 'content' of any medium is always another medium. The content of writing is speech, just as the written word is the content of print, and print is the content of the telegraph."[19] In a similar vein, Bolter and Grusin define remediation as "the representation of one medium in another."[20] They also observe that while some forms of new media revel in the multiplication of mediation ("hypermediacy"), other forms seek mediation's erasure ("immediacy" or "transparency"). In relation to the latter type, they point out that "although transparent technologies try to improve on media by erasing them, they are still compelled to define themselves by the standards of the media they are trying to erase."[21] While Bolter and Grusin associate remediation particularly with new digital media, they note its pan-historical applicability and suggests a similarity between their concept of remediation and the Ancient concept of ekphrasis, wherein a work of art in one medium depicts a work in another medium.[22]

The concept of remediation could therefore describe the work of color organists who translated music into arrangements of colored light, representing the former in their new medium. "Immediacy" is a particularly attractive framework for considering the work of Mary Hallock Greenewalt and Thomas Wilfred, who consciously sought to "erase" both music and the preceding color music tradition in their work—while nevertheless constantly referring to those

[19] Marshall McLuhan, *Understanding Media* (Cambridge, Mass.: MIT Press, 1994), 8.

[20] Jay Bolter and Richard Grusin, *Remediation: Understanding New Media* (Cambridge, Mass.: MIT Press, 1998), 45.

[21] Ibid, 54.

[22] Ibid, 45. On ekphrasis and music, see: Lydia Goehr, "How to Do More with Words. Two Views of (Musical) Ekphrasis," *British Journal of Aesthetics* 50, no. 4 (October 2010): 389–410. Some color music might be considered what Goehr describes as "modern" ekphrasis, although ekphrasis usually describes the representation of an absent artwork instead of their co-presentation.

older media in the process of distinguishing their work. One possible dissimilarity with Bolter and Grusin's conception is that the translation of instrumental music into a visual representation is more opaque and arbitrary and the remediation cannot be reverse engineered, while in the examples they provide the representation of the old medium in the new is often clear and obvious—for example in a cinematic adaptation of a novel. Furthermore, Bolter and Grusin discuss music little beyond descriptions of the "hypermediated" experience of rock concerts.[23] Nevertheless, the authors allow for an expansive definition of their term; they briefly mention Disney's 1940 film *Fantasia* (a classic case of visualizing instrumental music) as an example of remediation, and cite the combination of "rock and music and elaborate lighting effects" (a sort of offshoot of the phenomena described in this dissertation) as "experiments in hypermediacy."[24] Mathias Bonde Korsgaard has also adopted Bolter and Grusin's theorization in relation to musical visualization, writing of "audiovisual remediation" as essential to music video, as videos remediate pre-existing pieces of music. Simultaneously, the visuals of a music video are remediated by music, in as far as sound structures the visual component (particularly with regard to editing).[25]

André Gaudreault and Philippe Marion, looking to the history of early cinema, suggest—similarly to Bolter and Grusin—that new media necessarily imitate and integrate existing forms of media before they can gain distinction as separate entities:

[23] Bolter and Grusin, 42–43 & 71–72.

[24] Ibid, 102 & 171.

[25] Mathias Bonde Korsgaard, "Music Video Transformed," in *Oxford Handbook of New Audiovisual Aesthetics*, eds. John Richardson, Claudia Gorbman, and Carol Vernallis (Oxford: Oxford University Press, 2013), 509. Peter Weibel describes music video as the "contemporary popular form of visual music": Peter Weibel, *Musik und Medien: vom Klang in Technischen Zeitalter* (Berlin : Hatje Cantz, 2016), 74.

> After mimetically relaying its surrounding genres, a medium then unfolds along the path of its singularity. This is the emergent phase. The possibility of autonomy is connected to the evolution and potential of the medium. Its second birth, or constitution, will appear when its quest for identity and autonomy coincides with institutional recognition and a decisive improvement in the economic resources devoted to its production.[26]

Like Bolter and Grusin, Gaudreault and Marion's conceptualization gives an account of changing relationships between media. While the figures discussed in this dissertation might never have reached the telos in the narrative Gaudreault and Marion outline, trajectories from initial integration and attempted separation exist both within the work of individuals and across their work collectively.

Color Musicology

This dissertation also intervenes in the field of musicology, as musicologists have not given much attention to visual music more broadly and to color organs in particular, probably as the artworks can seem predominantly or even exclusively visual and because, in the case of color organs, the objects may seem obscure.[27] For example, in the collection of essays *Visual Music: Synaesthesia in Art and Music Since 1900*, the sole musicologist author, Olivia Mattis, stays on conventional musicological terrain, confining her consideration to reputedly synesthetic composers and works featuring colors in their titles—leaving color organs, light art, and films to the other contributors to the volume.[28] In similar veins, musicologists have expressed interest in

[26] André Gaudreault and Philippe Marion, "The Cinema as a Model for the Genealogy of Media," *Convergence* 8, no. 4 (2002): 16.

[27] A notable exception to this characterization is Jörg Jewanski. See, among other things: Jörg Jewanski, *Ist C=Rot?: eine Kultur- und Wissenschaftsgeschichte zum Problem der wechselseitigen Beziehung zwischen Ton und Farbe: von Aristoteles bis Goethe* (Sinzig: Studio, 1999).

[28] Olivia Mattis, "Scriabin to Gershwin: Color Music from a Musical Perspective," in *Visual Music: Synaesthesia in Art and Music Since 1900*, eds. Kerry Brougher and Judith Zilczer (London: Thames and Hudson, 2005), 211–227.

the history of color lights and music with relation to canonic composers, particularly Scriabin's *Prometheus*, but also Schoenberg's opera *Die Glückliche Hand*, which includes directions for specific colored lighting. In the literature on Scriabin in particular, the names of some of this dissertation's case studies are occasionally mentioned in passing as part of a pre-history or context for his inclusion of colored light.[29]

While this dissertation draws attention to figures less familiar to the discipline of musicology, it is motivated by directions in the field, including new interest being placed on organology and the study of musical media and technologies more broadly. Spearheading this direction, Emily Dolan has contended that technologies could even supplant musical works as the focus of musicology.[30] The ascent of seemingly obscure "things" in music studies has been met with some skepticism: Mary Ann Smart and Nicholas Matthew call this trend "quirk historicism" and bemoan that the accumulation of marginal objects and anecdotes can

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As Simon Shaw-Miller points out in his review of the collection, Mattis gives a jumbled account that mixes together echt and ersatz synesthetes (and indeed composers who never claimed to be synesthetes at all) along with works with merely colorful titles, including Gershwin's *Rhapsody in Blue*, the title of which refers to the blues rather than the color: Simon Shaw Miller, "Visual Music and the Case for Rigorous Thinking," *Art Book* 13: 1 (February 2006): 5.

[29] On Scriabin and Schoenberg in comparison see: Cook; and Barbara Kienscherf, *Das Auge hört mit: die Idee der Farblichtmusik und ihre Problematik, beispielhaft dargestellt an Werken von Alexander Skrjabin und Arnold Schönberg* (Frankfurt am Main: P. Lang, 1996). On *Prometheus*, see: Lincoln Ballard, Matthew Bengtson, and John Bell Young, *The Alexander Scriabin Companion: History, Performance, and Lore* (New York: Rowman & Littlefield, 2017), 131–157; Baker, James M. "Prometheus and the Quest for Color-Music: The World Premier of Scriabin's Poem of Fire with Lights, New York, March 20, 1915." In *Music and Modern Art*, edited by James Leggio, 61–95. New York: Routledge, 2002; Danuta Mirka, "Colors of a Mystic Fire: Light and Sound in Scriabin's Prometheus," *The American Journal of Semiotics* 13 (1996): 227–48; Anna Gawboy, "Alexander Scriabin's Theurgy in Blue: Esotericism and the Analysis of 'Prometheus: Poem of Fire' Op. 60" (PhD diss., Yale University, 2010); and Anna Gawboy and Justin Townsend, "Scriabin and the Possible," *Music Theory Online* 18, no. 2 (2012). Gawboy (2010), opposing Cook's assessment, is emphatic on the importance of Scriabin's lighting scheme to understand the work both formally (i.e. the lighting scheme helps parse the piece's elusive structure) and in terms of its relationship to wider cultural history.

[30] Emily Dolan, *The Orchestral Revolution: Haydn and the Technologies of Timbre*, New York: Cambridge University Press, 2014, 20. See also Dolan, Toward a Musicology of Interfaces," *Keyboard Perspectives* 5 (2012): 1–13; and John Tresch and Emily I. Dolan, "Toward a New Organology." *Osiris*, 28 (2013): 278–298.

overwhelm "larger critical goals."[31] However, as Dolan writes, attention to musical technology and instruments can fruitfully disrupt disciplinary boundaries: between art and machine and between art and science. This dissertation gives considerable attention to the relationship between color organs as machines and color music as an art, as well as investigating how color music discourses intersect with, complement, or reject contemporaneous scientific knowledge on the relationship between light and sound, color and pitch, and the seen and the heard. Despite the apparent marginality of the historical figures in this dissertation's case studies, the story presented in this dissertation—of how color organ inventors emulated or avoided emulating music—is intended, in part, to draw musicological attention to discourses and aesthetic objects that can complement and complicate historical narratives about music's place amongst the arts.

Scope

As mentioned, I concentrate on four case studies in this dissertation. I do not attempt to give a complete account of the color organ during this period; such an account would include not only Scriabin's *Prometheus* but also: the Australian Alexander Hector; the Russian painter Baranoff-Rossiné; and in Germany Alexander László, Ludwig Hirschfeld Mack, Wilhelm Ostwald, Raoul Hausmann, and others around the Bauhaus movement.[32] By concentrating on four figures often

[31] Nicholas Mathew and Mary Ann Smart, "Elephants in the Music Room: The Future of Quirk Historicism," *Representations* 132, no. 1 (Fall 2015): 62.

[32] On Hector, see: James Wierzbicki, "Shedding Light on the 'Colour Music' of Sydney 's Alexander B. Hector," *Musicology Australia* 34, no. 1 (2012), 81–99. László's manifesto for what he called "Farblichtmusik" is published as: Alexander László, *Die Farblichtmusik von Alexander László* (Leipzig, Breitkopf & Härtel, 1925). A collection of László's writings with accompanying essays on László and color music and synesthesia more generally can also be found in Jörg Jewanski and Natalia Sidler, eds. *Farbe, Licht, Musik: Synästhesie und Farblichtmusik* (Bern: Peter Lang, 2006). On Hirschfeld-Mack and László, see: Anne Hoormann, *Lichtspiele: zur Medienreflexion der Avantgarde in der Weimarer Republik* (Munich: W. Fink, 2003), 159–176.

included in lists of color organists, and by concentrating on primary sources that articulate these figures' intentions, I attempt to be attendant to the specific aesthetics and practice of each, and to allow disjunctures as well as connections to appear in the history I draw. Through this limitation, I also endeavor to surpass the summary nature of much of the previous literature on this subject, particularly in histories that posit color organs as the origin of some later artistic form.[33] Although Chapters 2, 3, and 4 concentrate on a narrower time frame (from the 1890s to 1950s), the first chapter on Castel considerably expands the historical scope of this study. However, Castel was understood then as now to be an originating figure in color music and I discover unexpected discursive parallels between him and his successors in Rimington, Greenewalt, and Wilfred; furthermore, the theories from which Castel drew and the responses to his work articulate problems and contradictions about color music that would continue to haunt later inventors and artists. This dissertation's historical chronological endpoint also precedes the popularization of light shows in the 1960s, although the case studies may be considered a genealogy of 1960s light show culture.[34]

[33] Broad histories of this nature can be found in the visual music literature cited above and also in: Kerry Brougher, "Visual Music Culture," in *Visual Music: Synaesthesia in Art and Music Since 1900,* ed. Kerry Brougher and Judith Zilczer, (London: Thames and Hudson, 2005), 89–166; and Judith Zilczer, "'Color Music': Synaesthesia and Nineteenth-century Sources for Abstract Art," *Artibus et Historiae* 8, no. 16 (1987): 101–126.

[34] On the relationship between music and light in these shows see: Philip Auslander, "Sound and Vision: The Audio/Visual Economy of Musical Performance," in *Oxford handbook of new audiovisual aesthetics*, eds. John Richardson, Claudia Gorbman, and Carol Vernallis (New York: Oxford University Press), 603–619. For a short history of the phenomenon, see: Edwin Pouncey, "Laboratories of Light: Psychedelic Light Shows," in *Summer of love: psychedelic Art, social crisis and counterculture in the 1960s*, eds. Christopher Grunenberg and Jonathan Harris. Liverpool: University of Liverpool Press, 2005, 155-162.

Chapter Summaries

In Chapter 1, I investigate the work of the eighteenth-century French Jesuit monk Louis Bertrand Castel, who in 1725 proposed the first ever instrument for color music, his *clavecin oculaire* or ocular harpsichord. Although Castel proposed the instrument initially as a sort of thought experiment, he later spent roughly twenty years of his life constructing different models, using a multitude of different colored materials in the process. Castel's idea of a new art of color music playable on his *clavecin* arose from a long history of associating color and harmony from Ancient Greece to Isaac Newton, although different thinkers employed this concept to mean different things both musically and coloristically. Castel found justification in these precedents for his own 12-tone color scale that mapped each pitch class onto a specific color. I argue that Castel's search for a color scale was less about mapping musical features onto color, and more about demonstrating the divine, universal harmony of existence. Despite his emphasis on harmony and holism, I note conflicting tendencies in his thought, as he suggested two different avenues for color music: as a form of multimedia, and as a separate, silent medium capable of giving pleasure on its own. I conclude by considering two forms of response to Castel's instrument: firstly, in the form of proposals for new, "improved" instruments and, secondly, in aesthetic theory, noting that Castel was both an inspiration for further color instruments and cited as an example of the dangers of transgressing medial boundaries.

Chapter 2 turns to the color organ and color music of the late nineteenth-century inventor and artist Alexander Wallace Rimington. Rimington's organ was used for a series of concerts in London and the north of England in 1895. The instrument largely conformed to the standard set by Castel: each pitch class had its own color that was played via a keyboard interface, although in Rimington's case, the colors took the form of projected colored lights. Referring to other

realized and theorized instruments for color from the nineteenth century, I ask why Rimington called his instrument a "color organ" and why it took the form it did.

The second part of the chapter turns to conflicting currents in nineteenth-century color theory: on the one hand, the old arguments in favor of an analogy were perpetuated and deepened by new scientific findings; on the other hand, other color theorists increasingly devised systems of colors that were consciously independent of music, believing the analogy to be imprecise and outmoded. These contradictory attitudes both shaped Rimington's work itself and responses to it. Accompanying pre-existing musical works, the color organ mapped musical features very directly onto colors: each pitch class corresponded to a hue, chords were translated by color mixture, and these mixtures moved at the tempo of music. For his critics, by staying so close to musical structures, Rimington's work tended to emphasize medium difference, and was rejected as a failure as a result. At the same time, Rimington described an independent color art as the best future direction for color music, positing musical translation as only a step in that direction.

The next part of the chapter concerns itself with Rimington's argument that color music would improve the "color sense" of those exposed to it. I trace the term "color sense" through late nineteenth-century arguments about perception and language through biology, linguistics, psychology, and anthropology, detailing ways that Rimington's use of the term does or does not conform to these pre-existing conceptions. I suggest that Rimington's project be understood as part of a larger push towards color education for the masses around the turn of the twentieth century. I conclude by considering the irony that Rimington's work was at intended as an independent art form that catered to the "color sense," but for later artists (such as those considered in Chapters 3 and 4) it epitomized the subjugation of color and light to music.

Chapters 3 and 4 consider two near-contemporaries in early- to mid-twentieth-century America, Mary Hallock Greenewalt and Thomas Wilfred. I suggest that the relationship with music was a source of tension in for both artists, as they attempted to create light art independent from its historical reliance on music, but continued to demonstrate music's influence.

Concert pianist Greenewalt created her *sarabet* for light performances she referred to as *nourathar*. Working with pre-existing pieces of music, she created new forms (based on all-encompassing light) and a different multimedia relationship than either Castel or Rimington had articulated, based on more slowly changing lights that were based on an emotional rather than a (pseudo-)scientific correspondence. I trace the development of this aesthetic in her technologies and her scores for light settings. Despite her multimedia practice, Greenewalt began to define *nourathar* as an autonomous art of light, but I suggest that music continued to define what she thought that art should be like. The last section of the chapter addresses Greenewalt's attempts to exploit her claims to autonomy and novelty through patents and in the law courts. While her legal endeavors were unsuccessful, the work of the groups she sued demonstrate a wider context of color music experimentation in contemporaneous America.

Concentrating on Wilfred in the fourth chapter, I look at his attempts to create a fully autonomous light art, *lumia*. Wilfred criticized the color music of his predecessors on both scientific and aesthetic grounds and distinguished his activities sharply from this tradition. The art form he proposed in color's music stead included not just colors, but visual shapes, moving at a slow pace. More avant-gardely, he insisted on silence for his performances. Nevertheless, I demonstrate that Wilfred did sometimes compromise on this ideal; music affected his *lumia* even when silent, as an ideal to which *lumia* might aspire or even supplant. I further consider how the

very things that identified Wilfred's work as "not (color) music" allowed it to be integrated into art galleries, resituating light art as a form of visual art comparable to painting.

Chapter 1: The Harmony of the Senses and Louis Bertrand Castel's Color Music

Cat torture may not seem like the most auspicious start for a new art form, but when a Jesuit monk named Louis Bertrand Castel (1688–1757) first raised the possibility of an instrument to produce color music (a "*clavecin oculaire*" or "ocular harpsichord") in the November 1725 edition of the *Mercure de France*, it was in a device for cat torture that he found a precedent.[1] The instrument in question was fronted by a musical keyboard, a sort of "cat piano" that had been described by the German Jesuit polymath Athanasius Kircher in his 1650 *Musurgia Universalis*. According to the story, the grotesque instrument was constructed to divert a melancholy prince. Cats of different sorts and sizes were arranged to create a musical scale. When the keys of the keyboard were pressed the mechanism caused the appropriate cat's tail to be stabbed. When the instrument was finished and the prince given a performance, he laughed and his melancholy was cured. If you could make a melody from the shrieks of cats, Castel pondered, could you not also make one out of colors?

Castel was born in Montpellier in 1688 and joined the Jesuits at the age of 15. After finishing school, he continued teaching in the south of France and writing on topics in mathematics and physics. His writings impressed the author Bernard de Fontenelle and the Jesuit theologian and philosopher René-Joseph de Tournemine and, on their request, he was sent to Paris. There Castel continued to teach mostly mathematics and physics and to publish on a variety of subjects, while he also became an editor for the Jesuit journal *Mémoires de Trévoux*. He made a number of famous acquaintances, including Jean-Jacques Rousseau and the composer

[1] Louis Bertrand Castel, "Clavecin pour les yeux, avec l'art de Peindre les sons, et toutes sortes de Pièces de Musique," *Mercure de France*, November 1725, 2571.

and music theorist Jean-Phillipe Rameau. As Thomas Christensen states, Castel became a "propagandist" for Rameau's music theory.[2] Rameau in turn encouraged Castel to publish the 1725 article proposing the *clavecin oculaire*, a hypothetical keyboard instrument that would play colors as the normal harpsichord played sounds.

According to Jörg Jewanski, this is the earliest piece of writing to deal exclusively with the relationship between music and color.[3] The article stirred a number of responses and Castel elaborated and defended the idea in further articles, but it was another ten years before he turned to the concepts he had outlined in greater depth. In a series of six of essays in the form of a letter entitled "New Experiences of Optics and Acoustics," Castel laid out a series of correspondences between pitches and colors. In 1740 he gave his lengthiest and deepest account of the topic in his book, "The Optics of Colors," while the *clavecin* was also the centerpiece of a manuscript he never published—his "Historical and Demonstrative Journal of the Color Harpsichord."[4]

A substantial gap also came between the 1725 article and any realization of the instrument he had proposed. Indeed, Castel suggested that he had never intended to build his *clavecin*; later in this life, he wrote that he was "an architect," not "a mason," who was "made to

[2] Thomas Christensen, *Rameau and Musical Thought in the Enlightenment* (New York: Cambridge University Press, 1993), 109.

[3] Jörg Jewanski, *Ist C=Rot?: eine Kultur- und Wissenschaftsgeschichte zum Problem der wechselseitigen Beziehung zwischen Ton und Farbe: von Aristoteles bis Goethe* (Sinzig: Studio, 1999), 274.

[4] In order: Castel, "Nouvelles expériences d'optique et d'acoustique," *Mémoires de Trévoux*, August 1735, 1444-1482; August 1735, 2nd part, 1619-1666; September 1735, 1807-1839; October 1735, 2018-2053; November 1735, 2335-2372; December 1735, 2642-2768. Castel *L'optique des couleurs, Fondée sur les simples Observations, et tournée sur-tout à la pratique de la Peinture, de la Teinture et des autres Arts Coloristes* (Paris: Briasson, 1740). Castel, "Journal historique et démonstratif de l'exécution pratique du clavecin en couleurs avec les découvertes et machines qui l'ont fait et perfectionné depuis 27 ans. Lettre du P. C[astel] J[ésuite] à M. de M[aillebois]," 1752, MS 20753-56, Royal Library of Belgium, Brussels.

believe" that he "had to make this machine."[5] That he proposed the instrument more idealistically than realistically is demonstrated in his first article on the topic, which not only contains no word on how such an instrument would work, but also explicitly claims to be the work of a philosopher.[6]

Nevertheless, Castel dedicated himself to making the *clavecin* a reality during the 1730s. The author of the English pamphlet *The Explanation of the Color Harpsichord* claimed that "everyone ran to see" a prototype finished in 1730, although Castel himself dated his "first model" to 1734.[7] The famous German composer Georg Philipp Telemann visited Castel's studio during a stay in Paris from 1737 to 1738 and encountered some version of the instrument. Telemann recounted that Castel was experimenting with different colored materials: "Just as the key opens a valve to make a sound by pressing or by pulling a bolt, a screw, or a plectrum, so did Father Castel use silken strings, brass wires, or tongues of wood, which being pulled or pushed by the back or the front of the key, open a colored box, a compartment, or a painting, or a lantern lit up in colors."[8] Castel later described assembling transparent sheets, candles, colors, lights,

[5] Castel, "Journal historique," folio 2r.

[6] Castel, "Clavecin pour les yeux," 2561. On the *clavecin* as thought experiment, see: Thomas L. Hankins and Robert J. Silver, *Instruments and the Imagination* (Princeton: Princeton University Press, 1995), 72–85.

[7] Compare: *Explanation of the Ocular Harpsichord upon Shew to the Public* (London: S. Hooper and A. Morley, 1757), 3; and Castel, "Nouvelles expériences d'optique et d'acoustique," *Mémoires de Trévoux*, December 1735, 2645.

[8] This comes from the French version of Telemann's description reproduced in Castel *L'optique des couleurs,* 482: "Comme la touche en pressant ou en tirant une targete,une pilote, ou un talon ouvre une soupape pour operer un son, de même le P. Castel s'est servi de cordons de soye,de fils d'archal, ou de languettes de bois , qui, étant tirés ou poussés par le derriere ou le devant de la touche, ouvrent un coffre de couleurs , un compartiment , ou une peinture, ou une lanterne éclairée en couleurs." Telemann's description was also published in German and is available as: Georg Philipp Telemann, *Telemanns Beschreibung einer Augen-Orgel (1739): Dokumentation*, (Blankenburg/Harz: Kultur- und Forschungsstätte Michaelstein, 1982).

screens, valves, and even drums, hammers and rattles, in order to perform.[9] Other descriptions of the instrument suggest that he might have employed ribbons or colored tapes or pieces of paper that were raised above the top of the instrument when a key was pressed.[10] Some accounts even mention representational elements like pictures or shapes.

Apart from the difficulties producing color, Castel also described encountering problems in constructing an instrument that could at once produce sounds and colors from a single keyboard. Although Telemann's description implies that the instrument was able to produce sounds and colors,[11] Castel claimed years could have been shaven off the production time without this difficulty, and that he at one point contemplated the use of foot pedals for the "sound music" to avoid giving his keyboard this double function.[12]

Castel claimed the birth of the Duke of Burgundy, an heir to the throne, on 13 September, 1751, gave him new impetus to finish the harpsichord in celebration, but this implies seventeen years after his "first model," he was yet to execute the idea to his satisfaction.[13] In 1755 he wrote to the *Mercure de France* to counter a claim that he had failed to realize his instrument, stating that he had performed on December 21, 1754 before fifty people who demanded four encores, before playing before 200 people at the beginning of the next year.[14] Even then he apparently

[9] Castel, "Journal historiques," 8r, repeated 37v-38v.

[10] *Explanation of the ocular harpsichord*, 2–3 & 13. Castel wrote about difficulties in using colored light but, presaging later color organs and light art did perceive it as an avenue worth investigating (Castel, "Nouvelles expériences," December 1735, 2747).

[11] Telemann in: Castel *L'optique des couleurs*, 483.

[12] Castel, "Journal historiques," 17r.

[13] Ibid, 7v. The Duke of Burgundy (Louis-Joseph Xavier) died at the age of ten and never inherited the throne.

[14] "Lettre du Père Castel, à M. Rondet, mathématicien, sur sa Réponse au P. L[augier] J[ésuite] au sujet du *clavecin* des couleurs," *Mercure de France* (July 1755), 144–145. Castel is responding to: M. Rondet, "*Clavecin* Oculaire,

assured the audience "that this was not even a sketch, a beginning of it, so far was it from perfect," and, despite the audience number he mentioned, no independent accounts of this performance exist.[15] Some sources claim that Castel was never capable of finishing his instrument; the elegy for him in the Jesuit *Journal de Trévoux* claimed that he "had no success" in executing his plans.[16] The question of whether he ever "completed" the instrument is perhaps unanswerable. In the 1753 article on the *clavecin* in the *Encyclopédie*, Denis Diderot warned the public not to complain that the instrument "is always being made and is never completed."[17]

A considerable critical literature has amassed on Castel. Variously he has been considered in the context of sensibility, the changing aesthetics of instrumental music in the later eighteenth century, the emergence of the concept of timbre, combinatorics, and eighteenth-century linguistic theory.[18] I approach him rather from points of view of aesthetic ontology and media. Castel first

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Lettre de M. Rondet, Maître de Mathématiques, sur un article de la réponse du R. P. Laugier, dans le Mercure d'Octobre dernier, aux remarques de M. Frezier, dans celui de Juillet 1754," *Mercure de France* (April 1755), 160-163. As the title shows, Rondet's article is itself a response to an earlier article in the *Mercure*. Rondet argued that color music existed regardless of whether Castel succeeded in realizing the instrument.

[15] *Explanation of the Ocular Harpsichord*, 13.

[16] "Éloge historique du P. Castel," *Journal de Trévoux*, April 1757, 1110.

[17] Denis Diderot, "*Clavecin* oculaire" in *Encyclopédie ou Dictionnaire raisonné des Sciences, des arts, et des métiers,*Vol. 3, ed. Denis Diderot and Jean Le Rond d'Alembert (Paris: Briasson, 1753), 512.

[18] On Castel and sensibility, see: Carolyn Purnell, "Instruments Endowed with Sensibility: Remaking Society Through the Body in Eighteenth-Century France," (PhD Diss., University of Chicago, 2013). On Castel's reception and the aesthetic of instrumental music, see: Corrina Caduff, "Fantom Farbenklavier: Das Farbe-Ton-Verhältnis im 18. Jahrhundert oder Vom Einspruch gegen das *clavecin* oculaire und seinen ästhetischen Folgen," *Zeitschrift für deutsche Philologie* 121, no. 4 (2002): 481–509. On Castel and the emergence of timbre (*Klangfarbe*) as a concept, see: Emily Dolan, *The Orchestral Revolution: Haydn and the Technologies of Timbre* (New York: Cambridge University Press, 2014). On Castel and combinatoric thought, see: Sebastian Klotz, *Kombinatorik und die Verbindungskuenste der Zeichen in der Musik zwischen 1630 und 1780* (Berlin: Akademie Verlag, 2006). On the relationship to theories of language, see: Joachim Gessinger, "Visible Sounds and Audible Colors: The Ocular Harpsichord of Louis-Bertrand Castel," in *Languages of Visuality: Crossings Between Science, Art, Politics, and Literature*, ed. Beate Allert (Detroit: Wayne State University Press, 1996), 49–72. On Castel and color-tone relationships, see Jewanski, *Ist C=rot?*. The most thorough investigation of Castel's aesthetics can be found in:

coined the term "color music" ("musique de couleurs") in his essays of 1735.[19] Elsewhere he talked of a "music for the eyes," or a "truly chromatic music." In this chapter I ask what these terms meant for Castel. Firstly, I consider Castel's forerunners in comparing music and color, noting their reference to (differing) concepts of harmony. I argue that Castel's own notion of harmony (as universal, mathematical, and divine) forms the basis for his attempts to construct a color scale, as well as his belief that pleasure can be afforded by a new color music. However, despite his emphasis on harmony and holism, I note conflicting tendencies in his thought, as he suggested two different avenues for color music: as a form of multimedia, and as a separate, silent medium capable of giving pleasure on its own. Lastly, I turn to responses that sought to improve or disprove color music in Castel's wake.

Color Harmony Before Castel

Although "color music" was a new coinage of Castel's, there was already a long intellectual lineage of equating color and sound. Most frequently, going back to Aristotle, these analogies arose from a belief that color and music shared the feature of "harmony." Modern definitions of harmony mostly refer to chords, i.e. pitches in simultaneous combination, while "color harmony" most frequently denotes the relationship between different colors presented simultaneously. However, these definitions are historically limited. In the Ancient Greek context, the word "harmony" merely implied agreement between sounds and was not dependent on their sounding simultaneously. The application of the word "harmony" to colors likewise was not limited to

Corinna Gepner, *Le Père Castel et le clavecin oculaire: Carrefour de l'esthétique et des savoirs dans la première moité du XVIIIe siècle* (Paris: Honoré Champion, 2014).

[19] Castel, "Nouvelle Expériences," *Mémoires de Trévoux*, August 1735, 1640.

simultaneous contrast. Throughout the discourse on harmony in color a strong Pythagorean strain dominates, that is to say, that many of the thinkers who applied the concept to color believed that harmony could be expressed in numerical ratios and that such ratios undergirded the cosmos, with music and color merely manifesting this larger reality.

In his treatise on the senses, "Sense and Sensibilia" (also known as "De Sensu"), Aristotle compared individual colors to musical intervals because he believed that all colors existed in a spectrum from white to black and were made up of a combination of light and shadow. Individual colors could therefore be represented as proportions or ratios, he reasoned, and, furthermore, these color ratios might be the same as the ratios of musical harmony:

> they may be juxtaposed in the ratio of 3 to 2, or of 3 to 4, or in ratios expressible by other numbers; while some may be juxtaposed according to no numerically expressible ratio, but according to some incommensurable relation of excess or defect; and, accordingly, we may regard all these colours as analogous to concords, and suppose that those involving numerical ratios, like the concords in music, may be those generally regarded as most agreeable; as, for example, purple, crimson, and some few such colours, their fewness being due to the same causes which render the concords few. The other compound colours may be those which are not based on numbers. Or it may be that, while all colours whatever are based on numbers, some are regular in this respect, others irregular; and that the latter, whenever they are not pure, owe this character to a corresponding impurity in their numerical ratios.[20]

Aristotle's examples were drawn from the Pythagorean tetracyts, i.e. numbers from one to four, believed to make consonances; specifically mentioned are the intervals of a fifth (3 to 2) and a fourth (4 to 3). From a later perspective, Aristotle's theorization stands out because the harmony is innate to a single color and does not imply the combination of hues, although he still employs the concept to distinguish between the agreeable (such as purple and crimson) and the

[20] Aristotle, "Sense and Sensibilia," *The Complete Works of Aristotle (Volume 1)*, trans. J.I. Beare (Charlottesville, Virginia, InteLex Corporation, 1992), 698, http://pm.nlx.com.ezproxy.cul.columbia.edu/xtf/view?docId=aristotle/aristotle.01.xml;chunk.id=div.aristotle.v1.55;toc.depth=1;toc.id=div.aristotle.v1.9;brand=default.

disagreeable (impure colors). Incidentally, his theory of the harmonies of nature did not stop with color: he suggested that tastes too were formed by harmonic ratios, in blends of sweet and bitter.

Aristotle's influence loomed over the seventeenth-century descriptions of color harmony by Athanasius Kircher and Marin Cureau de La Chambre, a philosopher, scientist, and physician to King Louis XIV. In his enormous *Musurgia Universalis,*[21] Kircher found the analogy well founded because of the shared emotional effect of colors and music, writing that "indeed, colors also have their harmonies, which enliven exactly as music does. These analogous harmonies possess a very great power in exciting feelings in the heart."[22] As with Aristotle, "harmonies" denoted intervals and therefore ratios for Kircher, but, in contrast to the Greek philosopher, he was specific in allocating the colors to individual intervals, with the exception of the unison, which he does not mention. Kircher assigned the semitone to the color white, because, he argued, just as all intervals may be broken into semitones, white was the basis upon which all other colors were built. His assignment of further colors to musical intervals was inconsistent: he presented both a text and a table (figure 1.1), but the two do not fully conform.[23] In both table and text, Kircher separated consonances from dissonances, and laid out one octave of consonant

[21] Kircher's Latin text is, as far I am aware, not available in English translation. A German translation can, however, be found online: Athanasius Kircher, *Musurgia Universalis*, trans. Günter Scheibel, https://www.hmt-leipzig.de/home/fachrichtungen/institut-fuer-musikwissenschaft/forschung/musurgia-universalis/volltextseite. An abridged older German translation also exists: Kircher, *Musurgia Universalis*, trans. Andrea Hirschen (Basel: Bärenreiter Kassel, 1988 [1662]).

[22] Kircher, *Musurgia Universalis*, trans. Günter Scheibel, Buch IX, 43: "Auch die Farben haben nämlich ihre Harmonien, die genauso wie die Musik erquicken. Diese Analogie der Harmonien besitzt eine sehr große Kraft bei der Erregung von Affekten im Herzen." The 1662 translation (Kircher, *Musurgia Universalis*, trans. Andrea Hirschen, 186) reads instead: "Zu dem haben auch die Farben ihre sonderbare Harmony damit sie nicht weniger als die Music ihre Kraft haben die Affekten zu erregen und zu recreieren."

[23] Kircher, *Musurgia Universalis*, trans. Günter Scheibel, Buch VII, 60.

Figure 1.1 Kircher's table of colors and musical intervals (Kircher, Musurgia Universalis*, trans. Günter Scheibel, Buch VII, 60).*

colors and one octave of dissonant colors with a corresponding color range from white to black. Midway between the extremes he placed the interval of the octave and the color green, which Kircher followed Aristotle in believing the most pleasing of all colors, therefore assigning it the most perfect interval. In both the chart and text among the consonances we find yellow as the minor third and red as the major third, gold the perfect fifth, purple the minor sixth, as well as the green octave. Among some of the other colors there is more confusion—for example the perfect fourth may be either "saffron" (*luteus*) or "fire red" (*flameus*)—but he consistently considered blue, grey and black to be dissonances, the last as the major second.

Cureau's analogies followed not only from Aristotle's influence, but, like Kircher, also from a belief that, because the sensations received through different senses could equally lead to pleasure and displeasure, they must have had a common basis. In his *New Observations and Conjectures on the Iris* he expressed his confidence in this thesis:

> it is, in my opinion, not difficult to prove that agreement and disgust have the same principle in all the senses, for they are movements of the soul, which being one in all the organs in all bodies, must be touched in the same way by all sensible objects, since it

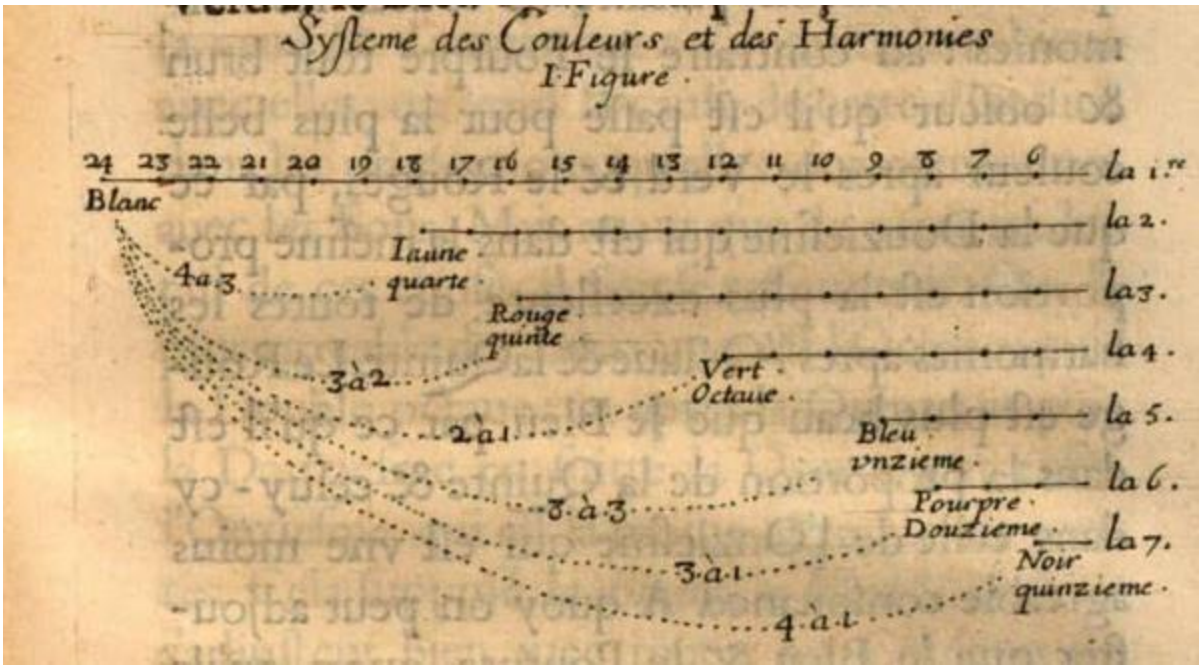

Figure 1.2: Cureau's diagram of color intervals (Cureau, 215).

> feels an equal alteration in receiving them: one same effect can only come from one same cause.[24]

Like Kircher, Cureau mapped his color scale over two octaves and matched specific colors to specific intervals (figure 1.2). In order to do so, he proposed a 24-degree color measurement system; white he placed at 24 degrees, black at 6 degrees, and the other colors fell somewhere in between the two. The degrees assigned to each color were based on musical proportions in relation to white: yellow at 18 degrees yielded a 4:3 (perfect fourth) relationship, red at 16 degrees yielded a 3:2 (perfect fifth) relationship, green at 12 degrees was the octave, blue and purple yielded a compound fourth and fifth (8:3 and 3:1 respectively), while black finally completed the double octave span. Some of these allocations were explicitly made on aesthetic

[24] Marin Cureau de La Chambre, *Nouvelles Observations et Conjectures sur l'iris* (Paris: Chez Jacques d'Allin, 1662), 186: "Or il n'est pas a mon advis difficile de prouver que l'Aggreement & le Degout ont un mesme principle en tous les sens; par ce que ce sont des mouvements de l'ame, laquell etant une dans tous les organes, doit ester touché d'une mesme façon de tous les objects sensibles, puis qu'elle sent une egale alteration en les recuent; un mesme effect ne pouvant venir que d'une mesme cause." [In quotations from the original language I preserve the original orthography of the sources.]

grounds: yellow is described as the least pleasing color and is therefore assigned the less pleasing consonance (the fourth), while, like Kircher, Cureau favored green and assigned it to the octave as a consequence.[25] He followed the texts cited above in ascribing harmony to individual colors, arguing that a color may be pleasant (ergo harmonious) in isolation. However, he also suggested that harmonies may exist between colors. All colors depend on light to be seen, he argued, and since he understood light to be white, it made sense to consider all harmonies as numerical relationships to white. White light he compared to the bassline in music as something always present.[26] Using the numbers he assigned to the colors based on his 24-degree scale, he also deduced harmonies between other colors. Blue and yellow, for example, existed an octave (2:1) apart in his system, and were therefore beautifully compatible. Cureau's color harmonies thus existed between different concepts of color and harmony: on the one hand colors were discrete entities to be considered as harmonious portions of light and dark; on the other hand, harmonies existed between distinct colors to explain why colors clashed or coordinated.

The Aristotelian notion that color arose from the mixture of light and dark was challenged by Isaac Newton's highly influential *Opticks*, published in 1704. After carrying out experiments with spectrums, Newton instead proposed that all colors exist within white light. However, in spite of this, and in spite of Newton's rejection of a wave theory of light in favor of theory that light was made up of molecules or "corpuscules," Newton returned to the musical analogy to explain the relationship between colors. Famously, in *Opticks,* Newton delineates

[25] Cureau reverses the causation I describe: yellow is the least pleasing for him *because* it corresponds to a fourth, while green is the most pleasing *because* it corresponds to an octave.

[26] Cureau, 220.

seven hues in white light (red, orange, yellow, green, blue, indigo, and violet), a spectrum of colors that has featured prominently in school classrooms ever since.

In the classroom, it is less often mentioned that Newton chose seven divisions on musical grounds. Newton in fact wrote of the correspondence between musical space and colors in his earliest writings on his spectrum experiments from the years 1670 to 1672. Here Newton emphasized the hypothesis that octave relationships existed in color as the basis for his analogy. He explained, referring to color mixture, that "indigo tempered by mixture with the extremity of red became purple, and vermillion mingled with a touch of extreme purple turned out scarlet, just as if there was an affinity between the extremities of the colors as there is in the sounds between the termini of an octave."[27] Extending the similarity, he represented the color spectrum after the manner of a monochord. He wrote that he projected the color spectrum onto a piece of white paper and had a friend draws lines to distinguish between color zones and found that these corresponded to the divisions of the string on a monochord. In this representation specific pitch names are not given, but the fractions are given that correspond to a major second, minor third, perfect fourth, perfect fifth, major sixth, minor seventh, and octave above the tonic (i.e. the intervallic content of the Dorian mode). The monochord representation showed extreme violet to be in a 2:1 (octave) relationship with extreme red at the opposite end of the spectrum.

[27] Isaac Newton, *Optical Papers*, Vol. 1, ed. Alan Shapiro (New York: Cambridge University Press, 1984), 507–508. Summaries of Newton's thoughts on light and color and his relation to the wider debates on these topics can be found in: Peter Pesic, *Music and the Making of Modern Science* (Cambridge, Mass: MIT Press, 2014); Olivier Darrigol, *A history of optics: from Greek antiquity to the nineteenth century* (New York: Oxford University Press, 2012); A. Rupert Hall, *All Was Light: An Introduction to Newton's Opticks* (Oxford: Clarendon Press, 1993); and (in more of popular non-fiction vein) Bruce Watson, *Light: a radiant history, from creation to the quantum age* (New York: Bloomsbury, 2016).

In *Opticks*, Newton presented his seven-part color division in the form of a circle with musical pitches denoted along the way (figure 1.3). The colors start from red, the least refrangible. The pitches start from D and going through E, F, G, A, B, C, and return to D. Jewanski suggests that Newton only drew the color spectrum in the form of a circle because of the musical analogy, as the form implies octave equivalence and precedents existed for representing musical pitch space this way.[28] Although Newton established a "center of gravity" for each color (represented by the letters p, q, r, s, t, u, and x), it is significant that these do not correspond with his placement of letter pitch names because it proves that he did not mean to establish a correspondence between individual colors and individual pitches. For example, he described "F" as the "mean between orange and yellow" and stated that "all degrees of yellow" fell between F and G.[29] The intervals of the scale thus corresponded to the breadth of each color in the visible spectrum. That orange and indigo may be particularly hard to distinguish in the

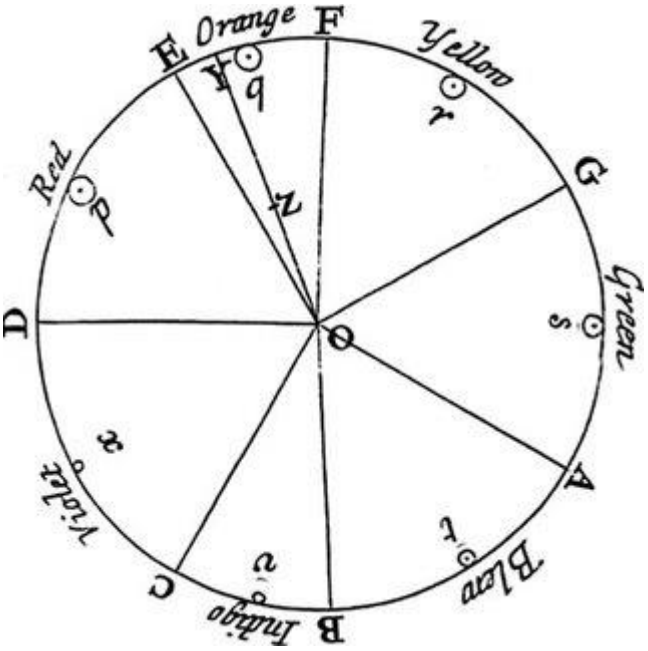

Figure 1.3: Newton's color circle (from Opticks, 155).

[28] Jewanskii, *Ist C=rot?*, 257. Newton's color circle was a first, but Descartes, for one, had created a circular representation of the musical scale.

[29] Newton, *Opticks* (New York: Dover Publications, 1952), 155.

spectrum he acknowledged by assigning them to semitones while the other five colors correspond to whole tones.[30] Although the pitches named once more make up a D Dorian scale, Newton's own description does not use the word "Dorian" but rather follows a form of solmization method to give the intervals of a tone, semitone, tone, tone, tone, semitone, tone. [31] The use of solmization again suggests his attachment to interval and ratio above absolute pitch correspondence. As Penelope Gouk suggests, the appeal of the Dorian mode was probably the symmetrical nature of its interval structure (tone-semitone-tone-tone-tone-semitone-tone or 1/9, 1/16, 1/10, 1/9, 1/10, 1/16, 1/9 in fractions) rather than any strictly musical or affective reason.[32]

Later color-pitch mappings and scales often differed in their assumptions from Newton, but his equation of colors with the musical scale would be highly influential. As with Aristotle, Cureau, and Kircher, Newton's invocation of musical concepts did not imply a direct analogy between color and sound, but rather that numerical relationships were manifested in both. In Newton's case, these relationships existed within the color spectrum rather than within individuated colors. He did, however, also postulate that harmony might exist between specific colors outside the context of the spectrum, when he asked tentatively in the "Queries" section of

[30] In his early writings, Newton acknowledged that indigo and orange were later inclusions in order to assure "elegant" apportionment: Newton, *Optical Papers*, 543.

[31] The method in question is "fasola," which employs only the syllables fa, sol, la, and mi for the description of pitches with mi occurring only once in each scale. This system, commonly employed in England in the seventeenth and eighteenth centuries and surviving into the twentieth century even, was essentially tetrachordal rather the hexachordal. On English solemnization of this period, see Gregory Burnett, "Tonal Organization in Seventeenth-Century Music" in *The Cambridge History of Western Music Theory*, ed. Thomas Christensen (Cambridge: Cambridge University Press, 2002), 435–441; and Bernarr Rainbow, "Fasola," *Grove Music Online*, 11 Mar 2019, http://www.oxfordmusiconline.com.ezproxy.cul.columbia.edu/grovemusic/view/10.1093/gmo/9781561592630.001.0001/omo-9781561592630-e-0000009349. Although Jewanski (Jewanski, *Ist C=rot?*, 245–246) considers Newton's solemnization outdated, fasola remained common in music pedagogy in England long after Newton.

[32] Penelope Gouk, "The Role of Harmonics in the Scientific Revolution" in *The Cambridge History of Western Music Theory*, 237. Gouk gives Newton's colors in reverse order so that "purple" covers D to E and indigo covers E to F etc.

his *Opticks*, "[m]ay not the harmony or discord of Colours arise from the proportions of the Vibrations propagated through the Fibres of the optick Nerves into the Brain, as the harmony and discord of Sounds arise from the proportions of the Vibrations of the Air?"[33] He went on to write that gold and indigo, for example, made a good (harmonious) pairing.

In the same period as Newton was carrying out his experiments from prisms, the metaphor of color harmony can be found in the writings of the French painter and writer Roger de Piles and the historian and art writer André Félibien. The former wrote of a "music for the eyes" ("*une musique pour les yeux*") more than 50 years before the same words appeared in Castel's first article on the subject: "All those who have understood the agreement of colors well…have used modified or mixed colors, of which they have made a music for the eye, by mixing those that have some sympathy with each other to make a whole, which is unified with nearby colors."[34] Félibien also turned to music theory and the concept of harmony in order to explain the power of color.

> If one makes a shade (*nuance*) from all the colors, gently uniting them with each other, it forms a harmony as in music… [A beautiful arrangement of colors] forms a concert as sweet to the sight as a harmony (*accord*) of voices is pleasant to the ears…Just as there are only a certain number of consonances in music from which one can make a diversity of modulations and harmonies by assembling them, by mixing a small number of colors one can make innumerable types.[35]

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[33] Newton, *Opticks*, 346.

[34] Roger de Piles, *L'Art de peinture de Charles-Alphonse Du Fresnoy, traduit en François avec des Remarques nécessaires et très-amples* (Paris: Nicolas Langlois, 1668), 130: "Tous ceux qui ont bien entendu l'accord des Couleur…se sont servis de Couleurs rompues et composées, dont ils ont fait une Musique pour les yeux, en melant celles qui ont quelque sympathie les unes avec les autres, pour en faire un tout qui aye l'union avec les couleurs qui luy sont voisines."

[35] André Félibien, *Entretiens sur les vies et sur les ouvrage des plus excellents peintres anciens et modernes*, Vol. 5 (Paris: J.-B. Coignard, 1679), 28: "De sorte que si de toutes ces couleurs l'on en forme une nuance, les unissant doucement les unes ave les autres, il s'en forme une harmonie comme dans la musique...étant vrai qu'il y a un si grande resemblance entre les tons de musique et les degrés des couleurs, que du bel arrangement qu'on peut faire de celles-ci, il s'en forme un concert aussi doux à la vue, qu'un accord de voix peut être agréable aux oreilles… Car de

De Piles and Félibien employed the metaphor of harmony primarily in a way similar to Aristotle, Kircher, and Careau: to describe individual colors. However, their understanding of colors as combinations was more concrete than the previous theorizations; they thought about mixtures of pigment on the palette and canvas rather than hypothetical ratios of light and shadow. At the same time their application of the idea was more in the form of a vague metaphor whereas Aristotle, Kircher, Cureau, and Newton had thought harmonic proportions to be real aspects of color.

In constituting color music, Castel therefore had a relatively wide range of associations he could draw from—and he did, referencing both Newton and Kircher in his first article on the subject, and Félibien elsewhere.[36] The overriding theme of such analogies was harmony and relations either within individual colors, between separate colors, or within the color spectrum.

Harmony and Order in Color

Aware of the prevalent analogy and believing light and sound to both consist of "imperceptible tremblings," Castel believed he could establish a real relationship between music and colors, founded on physical reality.[37] Establishing this physical basis was a necessary precursor if color music and an ocular harpsichord were to be established. As I will show, the relationship Castel

même qu'il n'y a qu'un certain nombre de consonances dans la musique dont on peut en les assmeblant, faire une diversité de modulations et d'harmonies; aussi par le mélange d'un petit nombre de couleurs, il s'en peut faire des espèces sans nombre."

[36] On Castel and Félibien, see Gepner, 62–63.

[37] Castel, "Clavecin pour les yeux," 2557.

attempted to substantiate was mediated by a concept of harmony that was not specifically musical.

While Castel's predecessors had correlated colors with musical intervals and ratios in various ways, he made a color scale in which each color corresponded to a precise pitch class. As Jewanski notes, in order to make his scale, Castel followed a certain numerical progression, 1-3-5-7-12, representing the tonic, the three notes of the triad, the five whole tones of diatonic scale, the complete seven-note diatonic scale, and the twelve-note chromatic scale.[38] This mode of systematization is hierarchical, i.e. the color triad was secondary to the tonic, the five colors were found by mixing together the three primaries, the seven by further mixture etc.

Castel initially reversed Newton's color spectrum, starting with violet, the color that in fact has the highest frequency, rather than red. Later, however, he reported that violet had become "suspect" as a tonic, because it was not a primary color and could be reproduced by mixing red and blue.[39] He ultimately replaced violet with blue even though the latter does not appear at either extreme of the color spectrum. However, blue, Castel reasoned, is the color closest to black, and, because he still adhered to the Aristotelean tradition of believing all colors to exist between black to white, he made blue his starting point. One form of evidence for this claim was the colors that an iron turns in fire: from black to blue, rising gradually rising towards red, purple, and white. He also noted that the color blue was also nature's dominating color, and thus the natural universal tonic; blue is the color of the sky and when rainbows—the natural manifestations of Newton's spectrum—appear, they do so against a blue background.[40] This

[38] Jewanski, *Ist C=rot?,* 307.

[39] Castel, "Nouvelles Expériences," *Mémoires de Trévoux,* August 1735, 1454.

[40] Castel, "Journal historique," 49r.

notion of a universal "tonic" explains some of the confusion that results from Castel's attribution of blue to the pitch "ut," which means in French the English pitch "C" as well as "do" or the tonic. In what amounts to a largely unacknowledged disanalogy, any pitch in music may function as a tonic, but blue is always the color tonic for Castel, and seemingly always also the pitch class "C."[41]

The center of Castel's analogies between colors and music was the triad. The number three, also ringing with Christian overtones, was shared by the primary colors, which Castel understood to be red, blue, and yellow. The music theory of his acquaintance Rameau justified the tonal system, including the triad, as grounded in nature. Under this influence, Castel described the musical triad not as a pleasant combination of pitches but a naturally occurring phenomenon based on the overtone series, made up of the intervals of a tenth and a seventeenth rather than on stacked thirds.[42] That he chose a major triad rather than a minor one, is unsurprising given the overtone series; as Rameau discovered, finding a natural explanation of the minor chord in nature via the overtone series is no easy task.[43] As blue was already the tonic "ut," he assigned red to "sol" and yellow to "mi." In this plotting, the primaries were placed unevenly apart (a major third, then minor third) but he did not attempt to justify this apart from asserting the musical analogy.

As with the triad, Castel assumed the Western system of chromatic and diatonic scales to be natural. Just as the pitches of the triad are unified in a single pitch or tonic (through the

[41] Castel, "Nouvelles Expériences," *Mémoires de Trévoux*, September 1735, 1836.

[42] Ibid.

[43] Christensen, 95.

harmonic series) so are all twelve pitch classes locatable within the harmonic series of the three notes of the triad. Similarly, all colors could be produced by mixing the primaries. Following this principle, the twelve-tone color scale became: blue, celadon, green, olive, yellow, fauve, nacarat, red, crimson, violet, agate, violet-blue.[44] Castel acknowledged that more hues than twelve were possible, for example between blue and celadon, but he compared these with quarter tones, and, considering them indistinct and nameless, he concluded that the semitone (of color or pitch) is indivisible.[45] While several colors in the scale are made of mixtures of two colors, Castel declined to admit mixtures of three, producing as they do white, black, grey (i.e. not genuine hues) or "impure" ("*sales*") colors.[46] Although he noted that painters use these impure colors, and that they are also found in nature, he considered that they function in these contexts only to highlight the "true" colors he had identified.[47]

Naturally, this form of systemization only served to produce a single "octave" of colors. Newton's circle already implied repetition and octave equivalence but Castel wanted differentiation too. Rather than a circle, he asserted that pitch space was more like the three-dimensional shape of a spiral, each rising parallel loop of which represented a single octave.[48] In color, he equated this rising pitch space with a greyscale that rose from black to white. While musical pitch space rises gradually and continually, his greyscale only changed every octave, i.e. each higher octave starting on *ut* was one degree higher on the greyscale than the twelve hues of

[44] Castel, *L'optique des couleurs*, 139.

[45] Castel, "Nouvelles Expériences," *Mémoires de Trévoux*, August 1735, 1460; *L'optique des couleurs*, 130.

[46] Ibid, 143–144.

[47] Ibid, 152 & 155.

[48] Ibid, 165.

the previous octave. In working through this idea, Castel reportedly convinced an organ builder that twelve sonic octaves (ranging in pipe lengths from 64 feet to one sixty-fourth of a foot) would be possible and encompass the span of audible perception.[49] He deduced that there must also be twelve degrees on his greyscale, made up of different admixtures of black, white, and grey (for example, the first "octave" is pure black, the second octave is two parts black to one part "grey-black," the third octave is one part black to two parts "grey-black" etc.).[50] The resulting gambit endowed Castel's system with the satisfying square number of 144 possible colors. This constituted a major advance in establishing the absolute analogy for Castel: "The diversity of pitches responds exactly, as can be seen, to that of colors; and that moreover this analogy is incontestable: pitch is to color, as high-low [i.e. musical range] is to light-dark [i.e. chiaroscuro]; then the low responds to the dark, and the high to the clear."[51]

The form of the *clavecin* or harpsichord embodied these visions of a color scale. While Castel claimed there could be an array of color instruments, he considered some musical instrument analogs more suitable than others; color violins, color flutes, and color drums were cast out as inauspicious notions, while not only the color harpsichord but also the color organ, i.e. another keyboard instrument, was presented as a felicitous proposal.[52] The belief in a twelve-

[49] Ibid, 288. Jewanski (Jewanski, *Ist C=rot?*, 489) notes that organs of this time had a range of five or six octaves and that a twelve-octave keyboard would be two meters in length.

[50] Castel, *L'optique des couleurs*, 224. See also the diagram in: Anne-Marie Chouillet-Roche, "Le *clavecin* oculaire du Père Castel," *Dixhuitième Siècle* 8 (1976): 152.

[51] Castel, *L'optique des couleurs*, 298–299: "la diversité des tons répond juste, comme on voit, à celle du coloris : & d'ailleurs cette analogie est incontestable: le ton est à la couleur, comme le grave-aigu est au clair-obscur; puisque le grave répond au sombre, & l'aigu au clair."

[52] Castel, "Nouvelles Expériences," *Mémoires de Trévoux*, December 1735, 2719. The latter ("orgue de couleur") was a neologism, but it is unlikely that any of those who later employed the term were aware of this early coinage.

"note" color scale is one explanation for his choice of the keyboard interface, on which that scale is transparent, and on which it is impossible to play intervals smaller than a semitone. The multi-octave range is clearly visualized by the keyboard interface, although the 12-octave range he proposed was well beyond any instrument available.

Castel's concept of the relationship between pitch space and color differed from prior manifestations because he concentrated on individual pitch classes and on the chromatic scale. This distinction is embodied in the difference between Newton's monochord (an instrument for measuring intervals) and Castel's keyboard (which presents pitch discontinuously). Furthermore, in a way that presages early 20th-century color systems like that of Albert Munsell, he incorporated two different color features, hue and value (lightness/darkness) into his scale. Nevertheless, like his predecessors, he returned repeatedly to the concept of a "harmony" that music and color shared.

In music, Castel understood harmony to be any relationships between pitches. Supporting this definition, Castel wrote that harmony could be "successive" (i.e. inclusive of melody) and that the Ancient Greeks, from whom the concept is derived, knew no counterpoint.[53] Castel's "harmony" therefore has little to do with the simultaneous presentation of sounds despite the importance of the triad to his tone-color mapping. He did not write concretely of musical harmony by discussing color equivalents to specific sonic consonances and dissonances, for example. With regard to harmony in color, although he suggests that the *clavecin* will provide a "great school for painters" as a means of learning color matching, Castel rarely discussed the topic definitively in the way that nineteenth-century color theorists would, i.e. he never lists pairs

[53] Castel, "Nouvelles Expériences," *Mémoires de Trévoux,* August 1735, 1645–1646.

or groups of complimentary colors.[54] On the issue of whether harmony existed within or between colors, he resided in the latter camp. Practically, this manifested itself in his instrument, which in no iteration could mix colors together; it could merely present them separately. Instead, color harmony was ensured by having the colors properly proportioned, as assured by a scale.

For Castel, this topic was less about how best to paint or render musical harmony in color, and more about how to expose the greater harmony of existence to the eye as music rendered it audible to the ear. He defined the concept of harmony as a set of numerical relationships not exclusive to music, that simultaneously demonstrated multiplicity and unity: "harmony exists in number and the relationship of things, in their variety and agreement, in their singularity and togetherness, disunion and union, multitude and unity."[55] He explicitly referred to the Ancients and specifically to Pythagoras to defend this broad definition, but ultimately associated harmony with God: "In God Himself the Trinity is in agreement with the model of unity and the principle of all our subaltern and created harmonies."[56] Making the association between the instrument and the harmony of creation, Castel sometimes used the image of his instrument as a metaphor for the harmony and beauty in the natural world. For example, he wrote: "I had seen a Parterre strewn with flowers: a sweet Zephyr had breathed, and, as it was

[54] Castel, "Nouvelles Expériences," *Mémoires de Trévoux*, December 1735, 2725.

[55] Castel, "Journal historique," 4v.

[56] Ibid, 46v.

shaking that moment, I had seen the harpsichord (*clavecin*)."[57] Elsewhere, Castel described the rainbow as the "cradle" of the ocular harpsichord and also as god's *clavecin*.[58]

In Castel's 1725 article, he wrote of "painting sounds"; later, however, he renounced this definition of his work in favor of "music of colors."[59] To understand this distinction, we might look to his description of music (in a review of Rameau's *Treaty of Harmony*) as a "totally mathematical science."[60] Hence, Castel saw no need to measure color using any other method or device, because music (epitomized by the keyboard) was itself a means of measurement. By virtue of the mathematical nature it shared with universe, music had privileged access to divine, universal harmony, which a mathematically-sound color music could likewise reveal. Color and music were therefore related for Castel in as far as they related to this wider sense of "harmony."

Castel's Pleasure Principle

As I have described it so far, Castel's *clavecin* might be classified as a scientific instrument: intended as a way to expose the hidden relationships of the natural world. However, that was not its only function: Castel intended it to be the basis of an art and, as such, to give pleasure to its viewers. Dieter Daniels has described Castel's instrument as a "hybrid" in the sense of Bruno

[57] Castel, "Nouvelles Expériences," *Mémoires de Trévoux*," December 1735, 2699: "j'avois vû un Parterre jonché de fleurs: un doux Zephire avoit souflé, & sa fissant cet instant, j'avois vû le Clavecin."

[58] Castel, "Journal historique," 2r.

[59] Castel, "Nouvelles Expériences," Mémoires de Trévoux, August 1735, 1640. This was a turnaround as, in his 1725 announcement, Castel included the term "painting sounds" in his title ("l'art de peindre les sons"): Castel, "Clavecin pour les yeux."

[60] Castel, review of *Traité de l'harmonie* by Jean-Philippe Rameau, *Journal de Trévoux*, October 1722, 1714.

Latour, i.e. a "chimera" between nature and culture, both scientific and aesthetic, combining the natural and the artificial.[61] Latour considers these hybrids to be typical of a premodern worldview in which "translation" between nature and culture dominates over "purification" (i.e. the separation of the natural and cultural) which dominates in the "modern" paradigm. In Castel's hybridized thinking, the scientific and artistic functions of the instrument were not separable: he believed that if the *clavecin* brought pleasure, the analogy between color and music would be proven.

To establish a principle of color-music pleasure, Castel first explained the cause of musical pleasure. In his understanding, this arose firstly from the division of the membrane in the ear into numerical proportions through vibration.[62] The vibrations received through these moving membranes were conducted to the soul, which was the origin of pleasure and passion (Castel explicitly opposed trends in contemporaneous science that would locate the source of the affects in the brain).[63] In addition to correct harmony, rhythm and movement were just as important for music, and therefore color music, to depict and pleasurably provoke the human soul for Castel, as "movement," he wrote, is "the true painting of the soul," and, deliberately recalling Descartes, "I move ("*je me remue*"), therefore I live, therefore I am human."[64]

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[61] Dieter Daniels, "Hybrids of Art, Science, Technology, Perception, Entertainment and Commerce at the Interface of Sound And Vision," *See this sound: audiovisuology essays 2: histories and theories of audiovisual media and art*, ed. Dieter Daniels, Sandra Naumann, and Jan Thoben (Cologne: Verlag der Buchhandlung Walter König, 2011), 10; Bruno Latour, *We Have Never Been Modern* (Cambridge, Mass: Harvard University Press, 1993), 10–12.

[62] Castel, "Démonstration géométrique du *clavecin* pour les yeux et pour tous les sens, avec l'éclaircissement de quelques difficultés, et deux nouvelles observations, par le R. P. Castel, jésuite." *Mercure de France*, February 1726, 282.

[63] Castel, "Nouvelles Expériences," *Mémoires de Trévoux*," December 1735, 2664.

[64] Castel, "Journal historique," 30r.

Since color music was also made up of harmonious relationships and also mobile it would create the correct impression to cause pleasure. The human body was capable of receiving this pleasure because, Castel believed, the retina, as the membrane of the eye, was capable of being vibrated and conducting vibrations through the nerves to the soul, as much as the parts of the ear. He described the process thus:

> 1) All sensory pleasures consist of moderate shaking of the nerves by objects. Indeed, the eye is capable of this shaking like the ear and all the senses and in fact visual objects have never been thought of as producing anything other than these shakings of the optic nerve.
>
> 2) Speaking properly, it is the soul, which feels these pleasures by the means of the nerves. The soul responds to the optic nerve as to auditory nerve and it feels the affection of one like the other and always produces a pleasure so long as the shaking is moderate, it has no fear for the well being of the body, and there is some education to be gained or at least some satisfaction of curiosity.[65]

His conceptualization resembled the *musica humana* of the Roman philosopher Boethius, that is to say that he understood the human body and soul to be musical, made up of the same proportions that governed music and the cosmos. According to this concept, when sounding music reflects universal harmony, the human soul responds too, like a sympathetic string, producing pleasure.

Any mobile and "harmonic" art form seemed bound in Castel's worldview to produce pleasure in its onlooker, as music did. As harmony could be perceived through any human sense, he theorized the possibility of not only an ocular harpsichord, but also olfactory, gustatory, and

[65] Castel, "Nouvelles Expériences," *Mémoires de Trévoux*," December 1735, 2753–4: "1. Tous les agrémens des sens, consistent dans l'ébranlement moderé des Nerfs par les objets; Or l'oeil est capable de cet ébranlement comme l'oreille & tous les autres sens; & effectivement les objets visuels n'ont jamais éte censés produire autre chose que ces ébranlemens du nerf optique./ 2. C'est l'ame, à proprement parler, qui sent ces agrémens par le moyen des nerfs. Or l'ame repond au nerf optique comme au nerf auditif; & elle sent l'affection de l'un de l'autre: & pourvu que l'ébranlement soit moderé, & qu'elle n'en rien à craindre pour le bien être de son corps, qu'il y ait même quelque instruction à gagner pour elle, quelque satisfaction de curiosité au moins, ell s'en fait toujours un plaisir."

tactile instruments.[66] It was also to demonstrate these principles that he had cited Kircher's cat piano in his 1725 article. The sounds of the cat piano, although hardly conventionally musical, were harmonically ranged according to mathematical proportion, and they were mobile, changing according to which cat was being stabbed by the keyboard. Combining these two features ensured the instrument worked. The king was inevitably moved because the cat's pained meows touched his soul in Castel's understanding.

The exchangeability of sensory information in Castel's model explains his claim that his instrument could render music visible to the deaf and color audible to the blind. If he played a piece of music on *clavecin* (say, "L'Entretien des Muses" from Rameau's *Pièces de Clavecin*, which Castel cited as a colorizable piece),[67] the colors and the sound would represent the same harmonies through their respective media; the colors that appeared were less a representation of the piece than a repetition of the piece that, in employing the same harmonies, ought to induce similar or the same sensations. In this regard, we might consider Castel's theories as foreshadowing the later identified condition of synesthesia (particularly chromesthesia or "colored hearing"). Supporting such a connection is Castel's statement that, after working on the *clavecin*, he enjoyed music twice as much because his ear "now makes true account to his eye."[68] However, in contrast to modern understandings of synesthesia, it was the soul rather than the brain in which these connections were made. Also, as Jewanski notes, the correspondences that Castel proposed, despite their relatively flimsy basis, were not meant to represent his

[66] Castel, "Difficultés sur le *clavecin* oculaire, avec leurs réponses," *Mercure de France*, March 1726, 459.

[67] Castel, "*Clavecin* pour les yeux," 2576.

[68] Castel, "Journal historique," 31v.

spontaneous response to music, but were rather worked out on a logical basis.[69] I would add that, in Castel's worldview, perceiving sound as color or color as sound was less important than perceiving the harmony in both.

Castel's disinterest in sensory distinctions was criticized in 1726 by a writer in the *Mercure de France*, who identified himself merely as a native of Gascony. The anonymous *philosophe* wrote that: "You confuse two things that all philosophers distinguish and which are as effectively distinguished as the spirit and the body; you confuse the sensations that the soul feels with the causes of those sensations; the former are in the soul and spiritual like the soul; the latter are bodily and different among themselves…from the different arrangement of material."[70] The Gascon philosopher understood that our perceptions of the world are modified by the senses. These, he noted, are essentially different in their physical construction regardless of any similarity between the natures of light and sound. Therefore, we might say that he understood that the senses are media, as they mediate the outside world rather than passively producing a true reproduction of it. For Castel, however, the unified soul matters more than the apparent difference between the senses or sensory stimuli, enabling immediacy. If he had shared the Gascon's belief in the senses as media, he would never have proposed a color-music art in the first place.

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[69] Jewanski, *Ist C=rot?*, 418.

[70] "Lettre d'un Philosophe Gascon au R. P. Castel, Jesuite , sur son Clavecin oculaire," *Mercure de France* (May 1726), 933: "vous confondez deux choses que tous les Philosophes distinguent, & qui sont effectivement aussi distinguées, que l'esprit l'est du corps; vous confondez les sensations que l'ame éprouve avec les causes occasionnelles de ces sensations; celles-là ſont dans l'ame, & spirituelles comme l'ame ; celles ci sont corporelles, & ne different entre-elles que comme tous les corps different entre-eux, je veux dire, par le different arrangement des parties de la matiere." Castel later responded to this letter but largely decried the writer's anonymity rather than countered his arguments: Castel, "Lettre du P. Caſtel, jesuite, à M. de la Roque, écrite à Paris le 9. Juin 1725," *Mercure de France* (July 1726), 1537–1543.

Castel's views do not seem to have been widely accepted as the concept of sensory difference became a recurring theme in how his work was received. For example, Voltaire, who accepted Newton's musical divisions of the spectrum and praised Castel's "genius" in his 1738 version of his *Elements of Newton's Philosophy*, wrote that the application of musical rhythms to color would result in a confusing and disagreeable effect:

> This rapid Passage of a great many Colours before the Eyes, it is to be feared, will be more likely to astonish, dazzle, and fatigue the Sight. Our Eyes, perhaps, may have need of Repose, in order to enjoy the Agreeableness of Colours. It not enough to propose a Pleasure to us. Nature must have made us capable of receiving that Pleasure.[71]

Perhaps it was to explain away these critiques that Castel, who generally described pleasure as the assured result of harmony and movement on the grounds of physics and biology, sometimes described color music as an acquired taste—acquired by experience of the instrument. He made this argument, of course, by analogy, this time comparing the relationship between sonic and color musics to the relationship between national styles in music: "A Frenchman can taste Italian music only with the help of the French music, the music of the colors that with the help of the music of the sounds; and until one finds in this one the air of this one and their secret relations, the secret analogies of feeling and even of sensation, one will persist in saying, that it is not the music."[72] Pleasure therefore was also something learnable (i.e. a form of taste); Italian music followed the same "universal harmony" as French and yet the French listener must learn to appreciate it through familiarity. Elsewhere he wrote that "the public demands to see this

[71] Voltaire, *Elements of Newton's Philosophy*, trans. John Hanna (London: Stephen Austen, 1738), 150. A similar criticism appears in Diderot's article for the *Encyclopédie* (Diderot, "Clavecin Oculaire," 512).

[72] Castel, "Nouvelles Expériences," *Mémoires de Trévoux*," December 1735, 2682: "Un François ne peut gouter la musique Italienne qu'à l'aide de la Françoise, la musique des couleur qu'à l'aide de la musique des sons; & jusqu'à ce qu'on trouve dans celle-là l'air de celle-ci & leurs secrets rapports , les secretes analogies de sentiment & même de sensation, on s'obstinera de dire, que ce n'est pas de la musique."

clavecin in order to believe it, but I have always thought that [the public] must believe it in order to see it."[73] One way of interpreting this aphorism is that Castel believed that the instrument could only be appreciated, once the public had learned to perceive the harmonic relationships found in color.

The Color Medium/Media

If color music was an art, what was its medium? The answer might seem self-evident, and Castel too would have resoundingly answered "color." Color, however, can manifest in many different forms and materials, and, as I described, Castel experimented with varied colored materials from ribbons to painted boxes to colored glass and more besides. How color was substantiated was a matter of secondary importance to Castel and the ontology of his art.

On the issue of materiality, Castel also had a musical parallel, comparing the materials on which color were found and those materials' textures with the sounds of musical instruments.[74] Although Dolan refers to Castel as epitomizing the view that color is comparable to pitch rather timbre, she does not note that he also found this counterpart for timbre in the world of colors.[75] Castel recognized that different metals and woods produce characteristic sounds and posited that they also produce different color effects. However, pitch (understood as an unfolding of

[73] Castel, "Journal historique," 9r: "Le Public demande à voir ce *clavecin* pour le croir, et moi je de tout tems pensé qu'il devoit le croir pour le voir."

[74] Castel, "Nouvelles Expériences," *Mémoires de Trévoux*," December 1735, 2719.

[75] Dolan, *The Orchestral Revolution*, 23–52. Dolan calls this period the "time before timbre" (Dolan, 54) since the term "timbre" (in French and English) nor "Klangfarbe" (German) had yet assumed their modern meaning. Dolan does not cite Castel's "Nouvelles Expériences."

harmony) and rhythm (understood as mobility) remained Castel's primary musical references. As a result, the analogy with timbre reinforces that the material on which colors stood was secondary to the colors.

In contrast to later light artists and color organ inventors, Castel was keen to emphasize the material nature of color, which he understood not so much as an aspect of light but a characteristic embodied in objects. He claimed that he first attempted to make his *clavecin* with prisms but that it did not take long to "disabuse" himself.[76] He described himself as "attached to the substantial and ordinary colors of painters, dyers, and colorists" in contrast to which Newton's prismatic light was "accidental" and "incorporeal," aiding "speculation" but not common usage.[77] Castel failed to see why the highly artificial conditions of Newton's experiments produced more truthful knowledge of color than what one could learn in the ordinary world. Owing to this preference for the quotidian, he turned to painters and dyers as the sources of knowledge on color, particularly on matters of mixture, rather than physicists; of the two, dyers were in fact preferable to the painters because color was their entire métier. In turn he promised his systemization of color would service painters and dyers practically.[78] The *clavecin* itself could be "a great school for painters."[79] This attachment to "real" colors embodied in paints and dyes is strange given the highly idealized and abstracted colors of scale, which he contrasted them with the "impure" colors of reality, but it might explain some of Castel's material choices.

[76] Castel, "Nouvelles Expériences," *Mémoires de Trévoux*, November 1735, 2566.

[77] Castel, *L'optique de couleurs*, 2 &100.

[78] Ibid, 105.

[79] Castel, "*Clavecin* pour les yeux," 274.

As mentioned earlier, there is some evidence that Castel experimented with depictive elements. The German scientist Johann Gottlob Krüger wrote that Castel, contrary to his ambitions, introduced "various painted signs on the strings," a claim later repeated by the philosopher Moses Mendelssohn.[80] While Krüger did not witness the *clavecin*, Castel's *Journal* does provide some evidence in support of this claim: here he referred to "butterflies" as a medium of color in his instrument, writing in 1751 or 1752: "With their beating wings, my butterflies are mistaken for real butterflies."[81] These artificial butterflies, presumably rendered in paper or fabric, were, he claimed, "better designed" than true butterflies because of the "precious" and "exquisite" colors that they displayed rather the impure colors found on their living counterparts, while their beating wings were ideal could well "paint music's vibrations."[82] Another piece of possible evidence is Castel description of his works, in language that anticipates cinema, as "little moving pictures."[83] Castel's commitment to color as a medium was such that debates on color versus form or design do not seem to have fazed him. It would logically follow from Castel's views on the immediacy of perception, discussed in the previous section, that color's substantiation was relatively unimportant. As with the cat piano, harmony mattered more than the materials that made up the harmony.

[80] Johann Gottlob Krüger, "Abhandlung, Joh. Gottlob Krüger D. der Phil. Und Medic. Von einer neuen Art des Farbenklaviers," *Physicalische und medicinische Abhandlungen der Königlichen Academie der Wissenschaften zu Berlin* (Gotha: Ettinger, 1781), 408. Jewanski writes that Krüger knew Castel's instrument through lectures given on the subject by Georg Wolfgang Krafft in St Petersburg in 1742. These lectures, available only in Latin and Russian, are discussed in Jewanski, *Ist C=rot?*, 470–474.

[81] Castel, "Journal historique," 30r: "Mes papillons par leur battement d'ailes se font prendre pour de vrais papillons." Chouillet-Roche (Chouillet-Roche, 158) mentions the butterflies but they are not cited in other historical accounts of Castel's instrument, including those that reference Castel's unpublished *Journal*.

[82] Ibid, 34r.

[83] Ibid, 30r.

Amid the ambivalence or confusion about what should be inside the instrument, the keyboard interface was, however, a constant. As mentioned before, the keyboard embodied Castel's concept of a harmonically divided pitch space, but the attraction of keyboard instruments was also perhaps their "machine-like" nature, something Castel frequently acknowledged in referring to this instrument as a "machine". The complexity of parts in keyboard instruments makes certain elements substitutable: the keyboard may be connected to any manner of further devices and media (including cats). Before Castel keyboard interfaces were obviously already attached to different mechanisms that produced sound from different materials; a keyboard could enable strings to be plucked in the harpsichord or air to enter the correct pipe of an organ. His instrument, however, might have been the first to employ the keyboard interface for the production of something other than sound. Later instrument designers—not just the other color instruments inventors described later in this chapter—cited the *clavecin* as an inspiration, including the Abbé Bertholon de Saint-Lazare, who made the magnetic piano, and Polycarpe Poncelet who proposed a keyboard instrument for combining flavors.[84] This suggests that Castel played a role in the transformation of the keyboard interface into a "universal" medium, one that could contain other media, even including non-sounding ones—a trend that Emily Dolan refers to as the "keyboardification" of culture, by which "the keyboard served to regulate the very idea of invention and innovation."[85] With a keyboard, as a

[84] M. l'Abbé Bertholon, 'Du Clavecin magnétique – extrait de La nature considérée sous ses différents aspects, ou Journal d'histoire naturelle' (Paris 1789), trans. Simon Crab, accessed April 8, 2019, http://120years.net/the-clavecin-magnetique-m-labbe-bertholon-france-1785/; Polycarpe Poncelet, *Nouvelle chymie du goût et de l'odorat, ou l'Art de composer facilement et à peu de frais les Liqueurs à boire et les Eaux de Senteurs, nouvelle édition* (Paris: Pissot, 1774).

[85] Emily Dolan, "Toward a Musicology of Interfaces," *Keyboard Perspectives* 5 (2012): 7.

container of other media, one could manipulate tapes, or lights, or painted boxes, or any number of materials Castel used.

Color Music Among the Arts

Castel consciously constructed color music as a hybrid art form in the sense of Jerrold Levinson, i.e. as a merger of two pre-existing art forms, in this case painting and music.[86] In situating color music in relation to these, Castel articulated critiques of both to argue that color music could perfect their defects. Although the connection with music is obvious by virtue of the scale and keyboard instrument, the connection with painting might seem more tenuous. However, as with his own instrument, Castel did not concern himself with distinctions between design and color, and so, as Corinna Gepner notes, he tended to define painting only as consisting of color and not of form or representation.[87] He only mentioned painterly design to note that, while geometry and arithmetic had entered artistic discourse in relation to design and particularly in relation to perspective, they had not yet been applied to color.[88] By concentrating solely on color, he made the comparison more viable.

For all that Castel hybridized and troubled artistic boundaries, he drew strong, essentialist distinctions between music and painting's relation to time, noting the permanence of color in the latter and the fleeting nature of sound in the former. He considered the fugue the compositional method par excellence because in it music most clearly embraces its true, fleeting nature: "this

[86] Jerrold Levinson, "Hybrid Artworks," *The Journal of Aesthetic Education*, 18, No. 4 (Winter, 1984): 6.

[87] Gepner, 37.

[88] Castel, "Nouvelles Expériences," *Mémoires de Trévoux*," August 1735, 1451; Castel, "Journal historique," 5v.

fugitive character is so essential to this art… the greatest beauties of music consist in fugues which make its fleeting and fugitive character even more sensible."[89] Painting, on the other hand, Castel disdained as "inanimate" and "dead" music, able to present the harmonious nature of color but not to make those harmonies, and thus the viewers' passions, move.[90] He was probably thinking of painting too when he wrote that "rest in colors is the *requiescat in pace* of the soul."[91] Elsewhere, he called the experience of viewing a painting "tiring" because, he argued, the eye must move when the colors do not.[92] The mobility of sound made music superior to painting for Castel, both more interesting and more affecting. The solution to painting's deadness, the means to vivify color, was of course the *clavecin*: "The principal advantage of this new harpsichord is thus to give to the colours, alongside their harmonic order, a certain vivacity and lightness which they never have on an immobile and inanimate canvas."[93] Castel thus endowed his instrument with dual powers: the power to reveal the pre-existing musicality (i.e. harmony) of color and the power to musicalize those colors through movement.[94]

If color music could bring movement to color, what could it bring to music? Castel's answer was the medium of color. As Emily Dolan accentuates, he repeatedly claimed that while individual tones are meaningless, this is not the case for individual colors.[95] Colors in isolation

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[89] Castel, "*Clavecin* pour les yeux," 2563.

[90] Castel, "Nouvelles Expériences," *Mémoires de Trévoux*, December 1735, 2709.

[91] Castel, "Journal historique," 30r: "le repos dans le couleurs est le requiescat in pace de l'ame."

[92] Ibid, 22r.

[93] Castel, "*Clavecin* pour les yeux," 2573: "Le principal avantage de ce nouveau *Clavecin*, est donc de donner aux couleurs, outre l'ordre harmonique, une certaine pointe de vivacité & de legereté qu'elles n'ont jamais sur une toile immobile & inanimée."

[94] Castel frequently describes the power of the *clavecin* to "reveal" things, e.g. Castel, "Journal historique," 20r.

[95] Dolan, *The Orchestral Revolution*, 31.

each have an individual character, but musical tones must be combined into melody and harmony, he proclaimed. One piece of evidence he marshalled for this is nomenclature: colors had expressive names in comparison to the dry, scientific names of musical pitches. In his words:

> Color are beautiful in themselves and all colors are beautiful to sight, and joyful (*riantes*) for the spirit. They are attached to nature, to beautiful nature, whose ideas are all joyful. Sky blue, azure, green, the color of fire, the color of gold, daffodil, orange, aurore, marigold, violet, amaranth, purple, rose, flesh color, agate, columbine etc. The names alone are rich and precious, they are the names of flowers, of rich metals, of jewels, of all things nice.
>
> […] The names of sounds are vague, abstract, dry, Greek and do not awaken in themselves any idea of, I do not say of nature in general, but of the nature of the things they designate.[96]

Since individual colors are themselves more expressive than individual musical tones, Castel presumed that a music of color combining the medium of painting (color) with the processes of music (namely rhythm, melody, and harmony) will in fact be superior to sonic music, which he sometimes called "vulgar" or "common music" ("*musique vulgaire*").[97]

In certain passages in Castel's writings, color music is defined as the simultaneous union of painting and music into a more perfect multimedia whole: "It is true that the ocular harpsichord will speak indivisibly to the eye and to the ear by the most intimate marriage of sounds and colors, and that Music and Painting will thus in the end continue to come much

[96] Castel, "Nouvelles Expériences," *Mémoires de Trévoux*," December 1735, 2705: "de soi les couleurs et toutes les couleurs sont belles pour la vue, et riantes pour l'espirit. Elles tiennent à la nature et à la belle nature dont toutes les idées sont riantes. Le bleu célest, l'azur, le vert, le couleur de feu, le couleur d'or, le jonquille, l'orangé, l'aurore, le souci, le violet, l'amarante, le poupre, le couleur de rose, le couleur de chair, l'agathe, le colombin, etc. Ces nom seuls sont riches et précieux, se sont des noms de fleurs, de riches métaux, de pierreries, de tout ce qu'il y a de plus aimable… Les noms des sons sont vague, abstraits, secs, grecs et ne réveillent de soi aucune idée, je ne dis pas de la nature en general, mais de la nature même des choses qu'il désignent."

[97] Castel, "Nouvelles Expériences," *Mémoires de Trévoux*," 2740.

closer."[98]As described above, this desire for this union presented Castel with what he considered the greatest technical challenge in building his instrument: constructing mechanisms that would permit the simultaneous performance of sounds and colors. If this had not been his ideal, it is unlikely he would have labored over it. He expressed the opinion that doubling would improve the experience of musical concerts by adding "spectacle," something to look at, where before there had been none.[99] This expansion of the musical experience, he thought, was to the benefit of the "common music": he "rob[bed] no one of his ears," he proclaimed, and did "not annihilate our music, the common, the auricular music. I double music in rendering it at once auricular and ocular."[100]

Such placatory statements of peaceful co-existence come into conflict with Castel's previously cited claims of color music's superiority over its sonic counterpart. His descriptions of competition and rivalry became particularly sharp in his unpublished *Journal*. In this text he railed against the "despotic reign of auricular music."[101] He went so far as to suggest the new music could usurp the place of the old: the *clavecin* "as if by flying, finely, without a fracas, without noise, without warning, promptly, lively, intuitively will give ocular harmony a liveliness, a brilliance, a force, a glow, a shock," and "is capable, I say it boldly, of effacing the auricular music, itself lazy, coarse, more corporeal than sensual or sensitive, yelling, noisy, and

[98] Castel, "Résultats du clavecin oculaire." *Mercure de France*, December 1751, 21: "ll est vrai que le *Clavecin* oculaire parlera indivisiblement àl'œil & àl'oreille par le mariage plus intime des sons &des couleurs, & que par là la Musique & la Peinture ne laisseront pas enfin de se raprocher beaucoup."

[99] Castel, "Nouvelles Expériences," *Mémoires de Trévoux*," December 1735, 2738–2740.

[100] Quoted in *Explanation of the Ocular Harpsichord Upon Shew to the Public*, 15–16.

[101] Castel, "Journal historiques," 37r.

above all old, toothless and outdated."[102] Even in his earlier published work, he described, "a silent Music, all the more effective to reach the heart," words that foreshadow John Keats' lines that "Heard melodies are sweet, but those unheard/ Are sweeter."[103]

Such passages cast doubt on Castel's commitment to color music as a form of musical multimedia instead of a silent art of pure color. While his first article had proposed turning Rameau's keyboard works into color, in his *Journal* he raised the possibility of original compositions specifically for color music, composed by musicians with "eyes as sensitive as ears."[104] Some composers could write pure color music, others sound music, and others both, he hypothesized. We might describe this as a progression from "color music" as a hybrid concept implying the coming together of the music and color (or painting) towards "color music" meaning a music of colors, in which color is the sole medium.

Such musings raise the question of why Castel wanted to perform with music at all. According to his own theories, the *clavecin* would produce all the pleasures of music and more besides. One (speculative) answer could come from his comparison of color music to an unfamiliar music from a foreign country, one that requires familiarization to enjoy. Elsewhere he wrote that "New tastes, of whatever kind, are acquired gradually, little by little, by analogy,

[102] Castel, "Journal historique," 32v: "comme en volant, finement, sans fracas, sans bruit, sans en avertire, promtement,vivement, intuitivement donnera a l'harmonie oculaire un piquant, un brillant, une force, un eclat, un saississement, capable, je tranche le mot, d'éffacer la Musique auriculaire, de soi parasseuse, grossiere, plus corporelle que sensuelle ou sensible, braillarde, fracassiere, et sur le out vieille, edentée et surannée."

[103] Castel, "Nouvelles Expériences," *Mémoires de Trévoux*, November 1735, 2576. John Keats, "Ode to a Grecian Urn," accessed April 5, 2019, https://www.poetryfoundation.org/poems/44477/ode-on-a-grecian-urn.

[104] Castel, "Journal historique," 39r.

passing steadily from the known to unknown."[105] In neither of these places did he explicitly discuss the relationship between color music and ordinary music, but his words suggest that the association with aural music can aid comprehension of the new art (what we might consider "remediation"). The progression in these passages implies, however, that the known could be abandoned as the new was accepted.

While Castel was in the course of developing his instrument and struggling to make the instrument both musical and colorful, the instrument was—at least for a stage—silent.[106] Perhaps the inventor returned to this idea, wondering if this could be a realization rather than an imperfect and incomplete manifestation of his concept.

Conclusion

In 1930, the lighting designer and author Adrian Klein referred to Castel as the "Giotto or Guy d'Arezzo of Colour-Music."[107] Since he coined the expression "color music," first proposed it as an art form, and first proposed an instrument to realize it, his position in the visual music canon would seem justified. But, coming from a Pythagorean tradition of thought, Castel had a very different idea of what music was, and how music created its emotional effects, from later color

[105] Castel, "Nouvelles Expériences," *Mémoires de Trévoux*, December 1735, 2678: "Les nouveaux goûts , de quelque espece qu'ils soient,ne s'acquierent que peu à peu, de proche en proche, par analogie, en passant régulierement du connu à l'inconnu."

[106] Diderot, "Letter on the Deaf and Dumb," *Diderot's Early Philosophical Works*, trans. & ed. Margaret Jourdain (Chicago: The Open Court Publishing Company, 1916), 171. Maarten Franssen also cites a passage from one of Diderot's novels in which the silent *clavecin* is contrasted with its noisy sonic counterpart as a metaphor for repression and passion. See Maarten Franssen, "The ocular harpsichord of Louis-Bertrand Castel: The science and aesthetics of an eighteenth-century cause célèbre," *Tractrix: Yearbook for the History of Science, Medicine, Technology and Mathematics*, 3 (1991): 52.

[107] Adrian Bernard Leopold Klein, *Color Music: The Art of Light* (London: C. Lookwood & Son, 1930), 188.

instrument inventors. Naturally this also affected his attempt to make a color music, which he conceived in music's image, on the presumption that music was itself the image of divine harmony. Castel's disregard for materiality was sometimes shared by later color organists and light artists who did not want to define their art mechanistically, but they would rarely be so promiscuous in their approach to media, nor so oblivious when it came to form.

As I have demonstrated, Castel's vision of color music is not without tension or contradiction. From the very beginning then of the color music tradition, a tension arose between the two words in its name, color and music. Could color music be the union of the two or should it be an art independent from music, even superior to music? If color music became the perfect analogy of music, did sound remain necessary? The figures in the later chapters return repeatedly to these questions, without realizing that Castel had raised them.

Epilogue 1: Other *Clavecins*, Other Color Musics

In the immediate aftermath of Castel's instrument, he served as an inspiration for further experimentation with the art of color. In some cases, these experimentations amounted to simple "improvements" on Castel's design but in other cases, these newly designed instruments constituted critiques of his ideas and new conceptualizations of what color music could be.

An example of a simple elaboration on Castel's ideas would be the instrument described by the anonymous English author of the pamphlet *The Explanation of the Ocular Harpsichord Upon Shew to the Public*. He reported that he had built an instrument that fulfilled Castel's ambitions that was apparently shown to the public in the Great Concert Room in Soho Square, London, in 1757, although the only account of this instrument outside this pamphlet states that

the instrument was displayed but not performed on, raising the question of whether it actually functioned.[108] The account has more design details than Castel provided, calling for an addition of a box "in the form of a beaufet [buffet, i.e. a counter or cupboard], of the height of five feet eight inches, breadth three feet four inches, and in depth two feet, placed perpendicularly upon the fore part of a common Harpsichord."[109] The color-producing element of the instrument was therefore positioned vertically as opposed to the horizontally positioned sounding mechanisms of an ordinary harpsichord. The colors themselves were produced as the pressing of a key opened a window under which a colored glass was lit internally by a candle.[110] Perhaps from patriotism more than anything else, the author attempted to operate using Newton's color scale rather than Castel's, although it is clear he does not fully understand this, since he says D is represented by violet (which actually represents the interval between C and D is Newton's mapping).[111]

The German naturalist, doctor, and member of the Royal Prussian Academy of Sciences Johann Gottlob Krüger's critique of Castel's ideas took the form of an alternative proposal, a *Farbenklavier*, which he apparently never built. Krüger repeated a number of criticisms of Castel's instrument that he attributed to fellow German scientist Georg Wolfgang Krafft: that Castel's color scale was arbitrary; that since Castel's colors did not mix together, true color harmony was lacking; that white light, being stronger than darkness, should have been associated

[108] Franssen, 37. The copy of this document in the British Library has a handwritten note on its front that states: "The Idea of this Instrument is something very extraordinary, not to say Extravagant; I was admitted among a select Party to a sight of it at the Great Concert Room in Soho Square; but to a sight only of the instrument, for nothing was then performed nor afterwards, as ever I heard, neither did I ever know why."

[109] *Explanation of the Ocular Harpsichord on Shew to the Public*, 17.

[110] Ibid, 18.

[111] Ibid, 18-20.

with the bass range; and that the pleasure of painting was not found in its colors anyway (but rather, presumably, it forms or design).[112] It was the second of these critiques that formed the basis for Krüger's improved instrument: that a color instrument needed a way to represent harmony. Krüger understood "harmony" more simply than Castel—as chords—while his idea of how to visualize it returned to the conceptualization in Cureau, de Piles, and Félibien of color mixture as color harmony. Using Newton's scale, Krüger also did something that Castel never did: he investigated the color harmonies that result from combining specific pitches on his color scale. Krüger noted that creating dissonant musical intervals such as second and sevenths on his color scale produced perfectly pleasant color consonances.[113]

This disanalogy and his criticisms of Castel did not dissuade Krüger from his belief that color music and a color instrument could be successful. The instrument he proposed, like the color organs of the later nineteenth and early twentieth centuries, employed colored light. He proposed to produce this light with candles behind colored glass and suggested that the colors be projected against a white wall using concave mirrors.[114] The glasses were to be revealed by the pressing of a key and be round in shape. He proposed using different sizes of circular opening depending on pitch with larger openings for lower pitches and higher pitches for higher ones; this, like Castel, he attempted a visual representation of absolute pitch as well as pitch class. According to this design, when a chord was played, the root would be larger and therefore enclose the lower pitches within. Krüger took the C major triad as his example, explaining that a

[112] Krüger, "von einer neunen Art des Farbenklaviers," 409.

[113] Ibid, 412.

[114] Ibid, 413.

large red circle would enclose a smaller yellow and yet smaller blue. These could mix together so that a red rim would blend into an orange and in the middle into a mixed shade.

Krüger's conception follows Castel's in seeming to imagine the possibility of color music that is separate or separable from music. He wrote that the instrument may be performed alongside a sounding harpsichord to produce simultaneous lights and music, but he did not consider this essential; additionally, the non-correspondence of musical and color harmonies/mixtures failed to disturb him or his ambitions. He described his goal as to create all the effects of music in colors regardless of co-presentation: "color runs, color trills, color arpeggios, color dissonance, und many kinds of color changes."[115]

Another proposal for an improved version of Castel's instrument was published in 1788 among the writings of the German mystic Karl von Eckartshausen, an author whose work was enthusiastically received among later nineteenth-century occult circles including the infamous Englishman Aleister Crowley, and later quoted frequently in the writings of the filmmaker Sergei Eisenstein. Like Castel, Eckartshausen's belief in color music stemmed from a belief in a common basis to sensory perception. He expressed his goal thus: "I have occupied myself for a long time with determining the harmony of all sensory impressions, to make them concrete and palpable. To this end I improved the ocular music, which Father Castel already invented."[116] Although Eckartshausen described his instrument as rendering "color chords," his changes from

[115] Krüger, "Anmerkungen aus der Naturlehre über einige zur Musik gehörige Sachen," *Hamburgisches Magazin* 1 no. 4, 1748, 375.

[116] Karl von Eckartshausen, *Aufschlüsse zur Magie aus geprüften Erfahrungen über verborgene philosophische Wissenschaften und verdeckte Geheimnisse der Natur* (Munich, 1788), 336: "Ich beschäftigte mich lange Zeit, die Harmonie aller sinnlichen Eindrücke zu bestimmen, sie anschaulich und fühlbar zu machen. Zu diesem Ende verbesserte ich die bereits von dem Pater Castell [sic] erfundene Augenmusik."

Castel's model amount to a change in the source of color: he used cylindrical glasses full of colored liquids that were revealed when a flap, connected to the keyboard with a wire, opened when the appropriate key was pressed.[117] As Jewanski notes, Eckartshausen reductively suggested the only problem that Castel's instrument raised was a mechanical one: making colors "disappear" as quickly as musical notes do.[118] Eckartshausen claimed his design solved this problem.

Eckartshausen's *Augenmusik* differs more from Castel's *musique de couleurs* than his *Farbenklavier* differs from the *clavecin oculaire*. The German mystic proposed an extremely different form of multimedia from his French predecessor. Firstly, he advocated adding *Augenmusik* to the combination of spoken word and instrumental music that constituted the genre of melodrama. More radical than this proposition was his idea of how the media would relate; he stated that "[a]s the musical tones must harmonize with the expression of the poet in a melodrama, so too must the colors match the expression."[119] To explain his meaning, he provided an example of a melodrama text with recommendations for accompanying music and colors. For example, he wrote that the first line ("She wandered sadly, the most beautiful of maidens") should be accompanied by "gently sighing flute notes" and an olive color with some pink and white. "Rising, joyous tones" and a green alternating with violet blue and "may flower yellow" should join the second line ("in flowery fields") before more rising, quicker notes and

[117] Ibid, 337. He wrote that, "The beauty of the colors, which far exceeds the most magnificient gem stones, is indescribable." ["Die Schönheit der Farben lässt sich nicht beschreiben, die weit die herrlichsten Edelgesteine übertreffen."]

[118] Ibid, 337. Jewanski, *Ist C=rot?*, 542.

[119] Eckartshausen, 338: "Wie die Töne der Musik mit dem Ausdrucke des Dichters in einem Melodram harmoniren müßen, so müßen die Farben ebenfalls mit dem Ausdrucke übereinstimmen."

dark blue colors changing with bright red and yellow-green would accompany the third ("Joyfully, she sings a song, like the lark").[120] A further line on "the divinity" ought to provoke "a mixture of the most magnificent colors" and "majestic" music, while strong yellow was suggested for one that mentions the sun. At no point did he suggest pitch mapping, instead presenting the colors as fully equivalent to the vague musical expressions he suggests appropriate for the text. At certain points these colors clearly "paint" the text: green colors correspond to mentions of the field or earth and yellow to the sun. Otherwise they generally are associated with the text on the level of affect, for example, in the "magnificent" colors that accompany the reference to divinity. These examples prove that he believed the practice of color music should be based on some of form of expressive correspondence rather than a translation of pitches into colors. The proto-Romantic Eckartshausen explicitly describes color as a means of expression rather than following Castel, who speaks rather of harmony and the pleasure that results from harmony.[121]

Eckartshausen and Krüger came up with different answers on the debate of whether color music should be a form of multimedia or a medium-specific art of its own. Contradictorily, in supporting the latter view, Krüger criticized Castel for not approaching music closely enough by not providing a visual analogy of the musical chord.

Two further inventors from the later eighteenth and early nineteenth centuries drew inspiration from Castel in proposing color music instruments, but unlike the three previous

[120] Ibid, 338-339. The poem, in full, reads: "Traurig wandelt sie, das schönste der Mädchen/ im blumichten Fluren/ Freudig, wie die Lerche, singt sie ein Lied/ und die Gottheit höret sie im Tempel der Schöpfung/ Die Sonne glänzt schon über die Berge/ und beschient das Veilchen im Thal."

[121] Ibid, 339: "Es ist genug anzuzeigen, daß auch Farben das Seelengefühl auszudrücken find" ("It is enough to indicate that colors are capable of expressing the feelings of the soul.").

example they abandoned the keyboard interface. In a book on "recreations" that included several magic tricks, the inventor Edmé-Gilles Guyot proposed a handheld *clavecin oculaire*.[122] Guyot adopted Castel's color scale, with *ut* corresponding to blue, but his device only provided colors to represent eight diatonic pitches, stretching from *ut* to *ut*. Guyot described a box to be candle-lit from the inside with eight holes covered with colored paper on its front running from blue to blue; inside the box a cylinder was to be placed that could be turned by a crank mechanism. In a design that strikingly resembles later player piano rolls, cylinders for specific pieces of music with holes corresponding to the melody would be required so that the correct colors would be exposed. Despite its continued use of the "*clavecin*" title, the instrument in no way resembled a keyboard instrument, and Maarten Franssen is justified in referring to it as a "toy."[123] In fact, Guyot described his instrument's main purpose was to demonstrate the futility of Castel's invention by emphasizing the distance between the perception of sound and color. Nevertheless, perhaps it showed, albeit in a primitive form, that color music based on a direct translation of pitch to color might be accomplished mechanically or automatically.

More well-known than of these other color instruments, the kaleidoscope is usually recognized as an invention of the Scottish scientist and inventor, David Brewster, who wrote that the device "realizes, in the fullest manner, the formerly chimerical idea of an ocular harpsichord."[124] The instrument bore no resemblance to Castel's physically, but Brewster quoted from Castel's *Optiques* at length in his own history of his invention. He considered the missing

[122] Guillaume-Germain Guyot, *Nouvelles récréations physiques et mathematiques…*, Vol. 3 (Paris: Chez Gueffier, 1770), 234–240.

[123] Franssen, 36.

[124] David Brewster, *The Kaleidoscope: Its history, theory, and construction* (London: John Camden Hotten, 1870), 159.

ingredient from his French predecessor's instrument to be form, which his invention provided. The name "Kaleidoscope," after all, is a portmanteau in which the Greek for "form" (*eidos*) is sandwiched between *kalos* ("beautiful") and *scope* ("scope"). Brewster wrote that:

> It must be obvious, indeed, to any person who considers the subject, that colour, independent of form, is incapable of yielding a continued pleasure. Masses of rich and harmonious tints, following one another in succession, or combined according to certain laws, would no doubt give satisfaction to a person who had not been familiar with the contemplation of colours; but this satisfaction would not be permanent, and he would cease to admire them as soon as they ceased to be new.[125]

The kaleidoscope then, with its forms and symmetries, seems closer to traditional painting, and particularly design—and the instrument was marketed to designers to produce patterns—than Castel's conception of color music. However, not only did Brewster compare colored abstraction to music generally, but he proposed that the kaleidoscope's imagery could be projected to accompany performances of music in a passage that foreshadows liquid light shows or disco lighting:

> Combinations of colours and form may be adapted to a piece of music, and their succession exhibited on a screen by means of the electric, or lime-ball, or other lights…forms in different colours, and in tints of varying intensity, losing and resuming their peculiar character with different velocities, and in different times, might exhibit a distinct relation between the optical and the acoustic phenomena simultaneously present to the senses. Flashes of light, coloured and colourless, and cloud of different depth of shadow, advancing into, or emerging from the centre of symmetry, or passing across the radial lines of the figure at different obliquities, would assist in marking more emphatically the gay or gloomy sounds with which they are accompanied.[126]

No evidence exists to suggest that Brewster's concept was ever carried out. Indeed, the association with music was perhaps merely part of his attempt to "uplift" his technology, suggesting it could be used alongside elite art forms rather than being merely a cheaply available

[125] Ibid, 158.

[126] Ibid, 160.

form of entertainment. Nevertheless, he played with the same dualism as Castel: colors as music, and colors with music.

Epilogue 2: The Aesthetics of Music and Color After Castel

In the later eighteenth and nineteenth centuries, writers on aesthetics repeatedly turned to theme of color and music, most often to describe their dissimilarity. Many who touched on this theme turned to Castel or to the concept of the *clavecin* or of color music as an extreme example of equating music with color. Most frequently, Castel's instrument became an emblem of wrong-headed hybridity. While some merely pointed to scientific differences between the mediums or, like the Gascon philosopher, sensory difference, other Romantic or proto-Romantic aestheticians invoked Castel's idea to make a case for musical exceptionalism. Jean-Jacques Rousseau granted a chapter to the theme of the "false analogy between colors and sounds" in his *Essay on the Origin of Language* while the German philosopher Karl Heinrich Heydenreich spent an entire chapter of his *System of Aesthetics* specifically on Castel. Further references can be found in the writings of the French music critic Michel Paul Guy de Chabanon and in more than one piece of writing by the Germans Moses Mendelssohn and Johann Gottfried Herder. Even in 1800, a writer called August Apel would still be dealing with Castel's provocation in an article for the *Allgemeine Musikalische Zeitung*. Support for the analogy in the field of aesthetics was instead found in the writings of the aesthetic formalists, Kant and Hanslick, who both referenced the concept of a color art or color instrument without specifically naming Castel.

The contrast between music's temporality and color's spatiality became a recurring theme in this discourse. Critics took issue with the mixing of these two in the concept of color

music. These criticisms shared a categorizing and essentializing impulse with a key text in the history of medium specificity, namely Gotthold Lessing's 1766 *Laocoön: An Essay on the Limits of Painting and Poetry,* in which the writer, comparing sculptural and poetic treatments of the grizzly death of the Greek mythical character Laocoön, arrives at the conclusion that "the essential difference" between poetry (and by extension music) and sculpture (also painting) is a difference between the successive (*Nacheinander*) and the spatial (*Nebeneinander*).[127]

Rousseau considered this to be a matter of essential difference in the materials of music and color: "the effect of colors is in their permanence, the that of sounds is in their succession."[128] Citing the example of Castel ("this famous harpsichord, on which one pretends to make music with color"), Rousseau argued that treating color temporally (or sounds spatially) did not alter the fundamental difference of their sensory impact nor that colors necessarily existed in space and sounds in time: "to multiply the sounds heard at once or to develop colors one after another is to change their economies, to put the eye in the place of the ear and the ear in the place of the eye."[129] Expanding his argument beyond Castel's concept of color music to painting, Rousseau described the latter medium as not only stationary, but dead. Writing later, Apel largely agreed with Rousseau, maintaining that that it was impossible to think of colors as a "music" because of the difference between their spatial and temporal mediums. Apel considered treatment of one being totally unsuitable for the treatment of the other:

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[127] Gotthold E. Lessing. *Laocoon: An Essay on the Limits of Painting and Poetry*, trans. Ellen Frothingham (New York: Noonday Press, 1957), 90.

[128] Jean-Jacques Rousseau, "Essai sur l'origine des langues," in *Collection complète des oeuvres, Genève, 1780-1789*, vol. 8, no, 4, https://www.rousseauonline.ch/pdf/rousseauonline-0060.pdf.

[129] Ibid.

> [Close examination of the relationship reveals that] tone and color absolutely do not stand next to each other as parallels, but rather stand across from one another as opposites and because of this contrast, what suits one does not suit the other; and it is impossible to establish a self-sufficient art of color on this opposition[130]

Furthermore, he added that a new art of color would require a consideration of "the division of space" as it was a spatial medium, whereas Castel and others who had hopes for "color music" had concentrated solely on succession.[131] Heydenreich in his 1790 *System of Aesthetics* agreed that mobility was something foreign, rather than innate, to color's essence, writing that "Color, as color, does not move."[132] He perceptively extended this argument by asserting the materials on which colors are present may be mobile, as they were in Castel's *clavecin*, but the colors themselves were not. Heydenreich and Mendelssohn returned to Voltaire's argument, stating that if moving colors were to be pleasing, they would necessarily need to change at a slower speed than pitches in music, weakening the analogy between the two.[133]

As well as supporting an essentialist division between the spatial and the temporal, critics of the color-music analogy turned to the image of the *clavecin* to support the case that music was by nature a passionate medium, while color was not. These writers scorned the analogy because the sensory effect of music was more powerful than the sensation of color. Mendelssohn expressed this stance clearly: "The passions are naturally expressed through certain tones, and can therefore be recalled to our memory through their imitation in tones. But which passion has

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[130] August Apel, "Ton und Farbe," *Allgemeine Musikalische Zeitung* 2 (30 July & 6 August), col. 755: "Ton und Farbe durchaus nicht neben einander als Paralleln, sondern als entgegengesetze einander gegenüber stehen, dass wegen dieses Gegensatzes dem Einen nur zukommt, was dem Andern nicht zukommt und dass auf diesen Gegensatz die Unmöglichkeit einer Farbenkunst."

[131] Ibid.

[132] Karl Heinrich Heydenreich, *System der Aesthetik*, Volume 1 (Leipzig: Georg Joachim Göschen, 1790), 233.

[133] Ibid, 234; Moses Mendelssohn, *Gesammelte Schriften* (Leipzig: F. A. Brockhaus, 1843), 150.

the least kinship with a color?"[134]In opposition to the "deadness" of painting, Rousseau described music as the quintessential "human art" because of its greater ability to excite the emotions.[135] Herder disregarded any physical similarity of the color and music, believing that the different sensations they produce are sufficient evidence of their incompatibility.[136] In his *Kalligone*, the author embraced a version of the Boethian *musica humana* in explaining music's unique emotional hold, comparing the soul to a musical instrument. In the following passage (in the form of dialogue with "B" representing Herder's own views), the philosopher references Castel's instrument to exemplify what the soul is not:

> B. Music plays a clavichord in us, which is our own innermost nature.
>
> A. But is it not something like Father Castel's color keyboard or a keyboard of images, which is moved in us?
>
> B. No images! What do images have to do with the movement of the spirit, or the vibrations and passions of our inner elasticity. That would mean tone painting.[137]

In this passage Castel's instrument is invoked as an illustration of something antithetical to the truly musical (comparable to "tone painting") and the truly human ("our innermost nature"). In his critique of Castel, Heydenreich shared Herder's view that music had privileged access to the inner realm of human feeling, describing it as "my heart's own language."[138] Believing that notes

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[134] Ibid: "Die Leidenschaften werden natürlicherweise durch gewisse Töne ausgedrückt, daher können sie durch die Nachahmung der Töne in unser Gedächtniss zurückgebracht werden. Welche Leidenschaft aber hat die mindeste Verwandtschaft mit einer Farbe?"

[135] Rousseau.

[136] See also Dolan, *The Orchestral Revolution*, 71–87.

[137] Johann Gottfried Herder, *Kalligone* (Weimar: H. Böhlaus, 1955 [1800]), 40: "B. Die Musik spielt in us ein Clavichord, das unsre eigne innigste Natur ist./ A. Es ist doch nicht etwa P. Castels Farben- oder ein Bilderclavier, was in uns gerührt wird?/ B. Keine Bilder! Was hätten Bewegungen des Gemüths, Schwingungen und Leidenschaften unsrer inner elastischen Kraft mit Bildern? Das hieße, Töne mahlen."

[138] Heydenreich, 236.

could depict emotion in and of themselves, he argued that music functioned as a mirror to the human soul, and therefore effected identification. The human soul could not recognize itself in color, according to Heydenreich, because of the essentially static, unchanging nature of color.

For thinkers of this kind, Castel's idea represented victory of reason over sensation. Chabanon insisted that Castel was too devoted to mathematics and too insensitive to the sensation of music:

> It is therefore quite evident that Father Castel judged music only through reason, more or less as a person deaf from birth, to whom one was trying to give some idea of this art, would judge it. It is also evident that with less mathematic and reason in one's head that the *clavecin*'s creator had, and with more correct and musical sensations than his, one would not be duped as he was by a ridiculous invention and absurd chimera.[139]

Rousseau too dismissed any appeals to the shared vibratory nature of music and color as a cold academic approach, insensitive to the different nature of the sensations they produced.

Sometimes, ironically, these writers' views reiterated those of Castel. Castel too believed that the human passions existed only in time; thus, it was necessary for an art to be temporal for it to hold real power over the soul. Rousseau's word for painting, "dead" (*morte*), is exactly the word Castel had used to describe that art. Castel, however, believed the *clavecin* was the solution to this problem, an instrument that could mobilize colors. For the cited authors, such a solution was perverse as it ignored the essence of color: moving color was still spatial according to them, it was just less pleasing than when stationary. Heydenreich, in particular, saw this movement as imposed by the *clavecin*: he argued, it was the paper strips or other materials that moved rather

[139] Michel Paul Guy de Chabanon, *Observations sur la musique, et principalement sur la métaphysique de l'art* (Paris: Pissot, 1779), 7–8: "II est donc comme évident que le Père Castel jugeoit de la Musique par le seul raisonnement, à-peu-près comme en jugeroit un sourd de naissance , à qui l'on tâcheroit de donner quelque idée de cet Art. II est encore évident qu'avec moins de mathématiques & de raisonnement dans la tête , que n'en avoit l'Auteur du *Clavecin* coloré , mais avec des sensations plus justes & plus musicales que les siennes , on n'eût pas été comme lui dupe d'une invention ridicule, & d'une absurde chimère."

than colors. Additionally, in stark opposition to Castel's stated belief that tones only became powerful in combination as harmony or melody, philosophers of this era increasingly wrote of tones as being expressive in themselves, as Emily Dolan has illustrated.[140] Castel had worked from the assumption of the superiority of color over sound as a medium even as he held music to be more powerful than painting, since he believed colors to be pleasurable in isolation. From this point of view, Castel's claims of the superiority of color music melt away. A further difference in the assumptions of the above from Castel was the role of mathematics. For Castel, music embodied mathematics and its effects were essentially reducible to mathematics (and hence, in translating the mathematics to a new medium the effects could be imitated or doubled). But for these figures, mathematics had no explicatory power in relation to music, which they considered to enable the greatest aesthetic experiences.

Despite significant differences in the value they ascribe to music, Immanuel Kant and Eduard Hanslick differed from the above figures in lending credence to a music-color analogy. Both these figures seem to reference Castel more obliquely, or at least his concepts of the *clavecin* and/or color music. In his *Critique of Judgment,* Kant first contemplated color with regard to painting, where he took the view that colors are secondary to design: the latter is essential, while the former merely adds to charm.[141] Later, Kant spoke of a "*Farbenkunst*" (art of colors) alongside a "*Tonkunst*" (art of tones, i.e. music). Kant placed these two artforms together on the lowest rung of his hierarchy of the fine (*schöne*) arts below rhetoric and poetry (on top) and painting and sculpture (in the middle). In his description, both the art of tones and the art of

[140] Dolan, *The Orchestral Revolution*, 47.

[141] Immanuel Kant, *Critique of Judgment*, trans. Werner Pluhart (Indianapolis: Hacket, 1987), 226.

colors constituted together "the artistic play of the sensations of hearing and of sight" that he belittled as more connected to agreeableness than to beauty because they provide sensations rather than concepts.[142] He did not explicitly cite Castel, and *Farbenkunst* is admittedly vaguer than *Farbenmusik*; nevertheless it is explicitly distinct from painting and since it lacks design and he associates it with music, an interpretation of *Farbenkunst* as color music becomes inevitable. As Franssen notes, Kant's reference is the more remarkable for the fact that he appears to accept an art of color without justifying or critiquing the idea.[143]

Eduard Hanslick may have taken a much higher view of music than Kant, but shared his belief in the analogy. In a single sentence in his text *On the Musically Beautiful*, Hanslick at once embraced the comparability of color and music and dismissed the "ocular organ" ("*Augenorgel*") and color keyboard ("*Farbenklavier*"): "If one wants to raise color to music's level in reality and not merely in thought and to incorporate the medium of one art into the effect of another, one ends up with the tasteless gadgetry of the 'color keyboard' or 'ocular organ,' the invention of which proves, however, how the formal side of both phenomena rests on the same basis."[144] Hanslick rejected musical aesthetics that concentrated on emotions ("the content of music is not the representation of emotions"); he therefore embraced an analogy with color because it seemed to be a form without content.[145] Even in 1854 then, the year of Hanslick's text, Castel's concept

[142] Ibid, 324–325.

[143] Franssen, 56.

[144] Eduard Hanslick, *Vom Musikalisch-Schönen* (Leipzig: Breitkopf & Härtel, 1922 [1854]), 60–61: "Will man nicht bloß in Gedanken, sondern in Wirklichkeit die Erhebung der Farbe zur Musik vollziehen, und die Mittel der einen Kunst in die Wirkungen der andern einbetten, so gerät man auf die abgeschmackte Spielerei des »Farbenklaviers« oder der »Augenorgel«" deren Erfindung jedoch beweist, wie die formelle Seite beider Erscheinungen auf gleicher Basis ruht."

[145] Ibid, 20.

could serve as a test case for the limits of a color-music analogy and more generally of the limits and virtues of medium specificity. It is somewhat ironic that Hanslick, having dismissed the color organ, then turns to compare instrumental music to another color music instrument, the kaleidoscope:

> Each of us delighted as a child in the changing play of colors and form of a kaleidoscope. Music is such a kaleidoscope, although on an immeasurably higher, more ideal level. In ever-developing variety music conveys beautiful forms and colors, gently merging, sharply contrasting, always coherent and yet always new, self-contained and self-fulfilled. The main difference is, that the tone kaleidoscope presented to our ear appears as the unmediated emanation of an artistically creating mind, while the visible kaleidoscope appears as an ingenious toy.[146]

[146] Ibid, 60: "Jeder von uns hat als Kind sich wohl an dem wechselnden Farben- und Formenspiel eines Kaleidoskops ergötzt. Ein solches Kaleidoskop, jedoch auf unmeßbar höherer idealer Erscheinungsstufe, ist Musik. Sie bringt in stets sich entwickelnder Abwechselung schöne Formen und Farben, sanft übergehend, scharf kontrastierend, immer zusammenhängend und doch immer neu, in sich abgeschlossen und von sich selbst erfüllt. Der Hauptunterschied ist, daß solch unserm Ohr vorgeführtes Tonkaleidoskop sich als unmittelbare Emanation eines künstlerisch schaffenden Geistes gibt, jenes sichtbare aber als ein sinnreich-mechanisches Spielzeug."

Chapter 2: Alexander Wallace Rimington's Color Music and the Separation of the Senses

On June 6, 1895, in London's premier concert hall of the time, St. James's Hall, a concert was given. The concert program, featuring highly popular classical repertoire, would have raised few eyebrows: Chopin's Preludes in C minor and A major, Dvorak's Waltz in A major (op. 54, no. 1), Gounod's *Ave Maria*, and the prelude from Wagner's *Rienzi*. A pianist, an organist, a choir, and an orchestra were all present, but the star of the show was no person. The hall had been reconfigured for the occasion: a large instrument was in the middle of the hall in an aisle with a huge white curtain in front of it. A closer look at the instrument would have revealed a power cable to deliver its necessary 150 amps (a massive amount at the time), a musical keyboard at its front, and fourteen openings, each containing an arc lamp, above the keyboard.

The inventor of the instrument was Alexander Wallace Rimington (1853–1918), who was present to introduce the packed-out audience to what they were about to see, although the instrument would be played by someone else. He spoke to the audience about this instrument, referring to it as a "color organ," which he said would bring about a new art a form, a "color music." Then, as the music played, the color organ produced effects note for note, each musical pitch represented by its own shade rendered by the color organist, Mr. Ernest Pitts, at his keyboard. No obvious forms were produced, but a variety of shades now appeared across the huge white curtain as the lights and colors combined, quickly shifting in time with the rhythm of the music. Later in the concert, a "pure color composition"—not based on a musical work—followed.

Neither a recording nor the instrument survives, but perhaps some idea of the effects that evening can be gained from Rimington's evocative and breathless prose. He wrote of "the

faintest possible flush of rose colour, which very gradually fades away while we are enjoying its purity and subtlety of tint" followed by a "rapid series of touches of pale lavender notes" and a "delicate primrose" that goes through "passages of indescribable cinnamon color to deep topaz." Before finishing, the screen "begins to glow with note after note of red and scarlet," before a "rapid crescendo which finally leads up to a series of staccato and forte chords of pure crimson which almost startle us with the force of their colour."[1]

Rimington's background was as a painter of water colors, and he much admired the paintings of Joseph Turner. He finished building the color organ two years before its London premiere and installed it at a studio fashioned from a disused public swimming pool in Norwood in London. Among those who visited him there were the English composer Arthur Sullivan, who played the color organ during his visit, and Queen Victoria's second oldest son, Alfred, the Duke of Saxe-Coburg and Gotha. Following his concerts in London in 1895, he toured with his instrument to Manchester and Bradford. The press reaction to the concerts, both in London and in the north of England, was tepid, and Rimington apparently gave no further public performances after 1895. Nevertheless, he continued to make alterations to the organ and committed his vision of the instrument and color music generally to historical memory through a book he wrote between 1895 and 1911, entitled *Colour Music: The Art of Mobile Colour*. In 1914 the conductor Henry Wood contacted Rimington about the possibility of using the

[1] Alexander Wallace Rimington, *Colour music: the art of mobile colour* (London: Hutchinson, 1912), 57–59.

instrument for a concert of Scriabin's *Prometheus* but the first world war put the plans on permanent hold.[2] No record exists of the organ's final resting place.[3]

Although Rimington frequently features in the canon of visual music, he has not been the subject of much academic inquiry with the recent exception of Nicholas Gaskill's article.[4] In this chapter, I situate Rimington's work within late nineteenth-century debates about color and music, and about color more generally. I trace three key ideas in Rimington's work—color organ, color music, and color sense. The first part of the chapter considers the particularities of Rimington's instrument and queries the appeal of the organ as a prototype for light instruments. Next, I interrogate what it meant for Rimington to make "color music" during a period where conflicting opinions on the music-color analogy abounded, and argue that, counterintuitively, Rimington's conceptualization of his work supported both analogical and autonomous conceptualizations of color. The last section of the chapter contextualizes Rimington's practice and discourse in contemporaneous debates on sensory perception and sensory cultivation. Throughout the chapter, I problematize any assumptions that connect color music with synesthesia by demonstrating Rimington's own interest in medial and sensory separation.[5]

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[2] Rimington, "Color Music," *Scientific American*, July 24, 1915, 79.

[3] This biographical information comes from: Adrian Bernard Leopold Klein, *Colour Music: The Art of Light* (London: C. Lookwood & Son, 1930), 6–9.

[4] Nicholas Gaskill, "The Articulate Eye: Color-Music, the Color Sense, and the Language of Abstraction," *Configurations* 25, no. 4 (2017): 475-505.

[5] Simon Shaw-Millar, "Synaesthesia," in *The Routledge Companion to Music and Visual Culture*, ed. Tim Shephard and Anne Leonard (New York: Routledge, 2014), 19; Joshua Yumibe, *Moving color: early film, mass culture, modernism* (New Brunswick, N.J. : Rutgers University Press, 2012), 35; Polina Dimova, "Synesthesia," *Routledge Encyclopedia of Modernism*, ed. Stephen Ross (Abingdon-on-Thames: Taylor and Francis, 2016), accessed 6 April 2019, https://www.rem.routledge.com/articles/synaesthesia. doi:10.4324/9781135000356-REM1011-1.

Color Organ

As Castel had learned in the previous century, making analogies (vague or more concrete) between color and musical pitch or harmony was a rather different matter from making instruments or proposing new art forms. Although Gaskill's article speaks liberally of "color musicians" as practically anyone who supported the music-tone analogy, Rimington's theories were tied to and embodied in a concrete artefact, the color organ. In this regard, Rimington found particular encouragement in the treatment of the topic in Rev. Hugh Reginal Haweis's popular 1871 book, *Music and Morals*, which called for the foundation of an art form of pure color, describing it as the "only possible rival to Sound as a vehicle for pure emotion."[6] In both public talks and in his book Rimington quoted Haweis, whom he met and who encouraged him. Rimington believed he had created the foundations for a new art form that Haweis had hypothesized in his book:

> Had we but a system of colour-notation which would as intensely and instantaneously connect itself with every possible tint, and possess the power of combining colours before the mind's eye, as a page of music combines sounds through the eye to the mind's ear—had we but instruments, or some appropriate art-mechanism for rendering such colour-notation into real waves of colour before the bodily eye, we should then have actually realized a new art, the extent and grandeur of whose developments is simply impossible to estimate.[7]

Rimington employed the term "color organ" to describe his instrument for fulfilling Haweis's dream, but this was not an original coinage. In 1735 Castel had described the

[6] H. R. Haweis, *Music and Morals* (London: Longmans, Green, and Co., 1903 [1871]), 30. This book went through a total of sixteen editions.

[7] Ibid, 39.

possibility of such an instrument ("*orgue de couleurs*"),[8] but the first person to apply the label to a realized instrument was the American inventor, Bainbridge Bishop. Bishop filed a patent in 1874 for what he described as an "attachment for key-board musical instruments" or "instrument for displaying color," but which he described to a newspaper reporter in 1881 as a "color organ."[9] In his case, the reason for the description is obvious: what he developed was an attachment for a normal reed organ that did not interfere with its sound-making possibilities. Each pedal or key of the organ would open a window containing a colored light that would diffuse this "attachment"—a glass screen atop the instrument. The device contained color "stops" allowing the color function to be turned on and off, so that the instrument might be used simply as a "sound organ." A special apparatus of Bishop's instrument was a pedal that provided a background tint behind all the other colors, which Bishop prescribed for providing the "tonic" color of whatever piece was being played. Bishop described selling one instrument to P.T. Barnum for his country house in Bridgeport (apparently his famed "Iranistan" mansion). But this, along with the two other organs he completed, was, as he described in his 1893 booklet "Souvenirs of the Color Organ," destroyed by fire.[10] His instrument clearly embodied a desire to

[8] Louis Bertrand Castel, "Nouvelles expériences d'optique et d'acoustique," *Mémoires de Trévoux*, December 1735, 2719.

[9] Bainbridge Bishop, "U.S. Patent no. 186, 298: Improvement in Attachments for Key-board Instruments," filed June 7, 1876, issued January 16, 1867. "Color Music: A Reporter Studies Bainbridge Bishop's Color Organ," *Boston Daily Globe*, February 27, 1881, 6.

[10] Bishop, *A Souvenir of the Color Organ with Some Suggestions in regard to the Soul of the Rainbow and the Harmony of Light* (New York: De Vinne Press, 1893). Bishop does not state what caused the fire, but presuming these instruments all used natural light, the color organ was presumably not at fault.

create something in addition to or heightening musical experience, embracing hybridity rather than aesthetic autonomy for color.[11]

The advent of electricity gave new impetus to the development of light instruments in the later nineteenth century. Bishop's instrument as patented was to be placed in front of natural light, with blinds that opened to let the light through the appropriate colored glass when the key was struck.[12] An earlier proposal from 1844 by an Englishman, D. D. Jameson, considered using colored liquids (one for each pitch class) contained in the walls of a darkened chamber, which would be revealed in time with music by a piano keyboard, but there is no evidence he ever built this imagined construction.[13] In contrast, all instruments proposed from the 1880s on used electricity as their light source. An 1885 article in *The Gentleman's Magazine* looked back at Castel mockingly but stated that things had changed, because electric lighting allowed for "expressing variety, velocity, intensity, form, elation, and depression" in a musical manner.[14] By 1893, after his color organs had been consumed by conflagrations, Bishop also spoke of electricity as the light source for any future devices. Almost concurrently with Rimington, another Englishman, William Schooling, also proposed an instrument that he referred to as an "electrical color-organ" that would use vacuum tubes for its colored lights.[15]

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[11] Bishop declared that: "I am not seeking a substitute for music but a union of color with it." See "Color Music: A Reporter Studies Bainbridge Bishop's Color Organ."

[12] Bishop, "U.S. Patent no. 186, 298."

[13] D. D. Jameson, *Colour-Music* (London: Smith, Elder, and Co., 1844), 11. This proposal is very similar to that of Karl von Eckartshausen, described in Chapter 1.

[14] J. Crofts, "Colour-Music," *The Gentleman's Magazine*, September 1885, 271.

[15] William Schooling, "Color-Music: A Suggestion of a New Art," *Littell's Living Age*, August 10, 1895, 349–356. Schooling never patented his instrument and probably never built it. In his original article, published in 1895 but with an editor's note dating it from 1893, Schooling claimed to have made the instrument he described, but in a

Rimington did not claim the broad idea of music-color parallels was original, but, beyond scant reference to Castel, he does not refer to any other proposal, including Bishop's, even though his instrument and Bishop's shared a name. Nevertheless, Bishop's work did receive some British press coverage and Rimington had read Lady Archibald Campbell's book *Rainbow Music*, in which the author wrote of an "American instrument…said to have been invented a few years ago called a colour-organ."[16] Rimington might therefore have adopted the term "color organ" indirectly under the influence of Bishop, although he probably had no understanding of the working of the latter's instrument. Equally plausibly, the expression might have been adopted

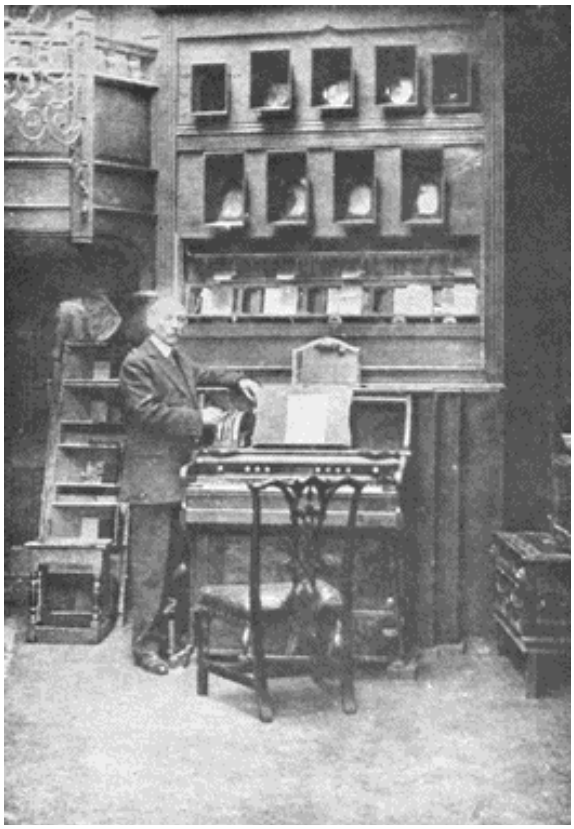

Figure 2.1: Rimington and his color organ (from Klein, 190)

review of Rimington's book in *The Daily Telegraph* (Schooling, "Colour Music," Daily Telegraph, 6 April, 1912, 14), the same author wrote that "Mr. Rimington is the only man who has yet made such an instrument."

[16] Lady Archibald Campbell, *Rainbow-Music; Or, the Philosophy of Harmony in Colour-Grouping* (London: Bernard-Quaritch, 1886), 23.

because of mechanical as well as superficial similarities between his instrument and the conventional musical organ. Most obvious among these similarities was the musical keyboard of five octaves that fronted his instrument. Moreover, the color organ drew its mechanisms of pulling and rotating rods from the manufacture of the musical organ, and Rimington used organ terms to describe them (trackers and rollers respectively). Additionally, Rimington employed stops to produce special effects. Thus, the organ model evidently appealed to Rimington because its multiplicity of controls could be repurposed to control different parameters of the light.

In Rimington's organ (figure 2.1), each pitch class corresponded to a different colored light (in total twelve colored lights) and there were two extra lamps for white lights. All the keys of the same pitch class were connected via the trackers and rollers to one of the twelve colored lights (figure 2.2). Although a 1914 article from *The Scientific American* suggested that prisms were used for the purpose of producing colors, Klein, who inspected the instrument, mentioned

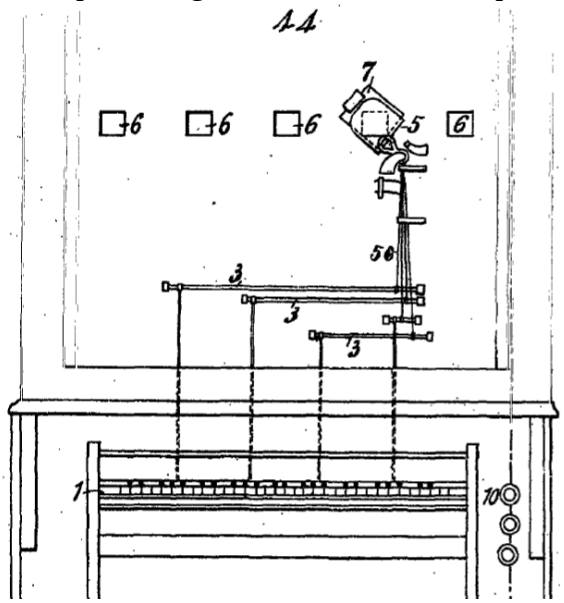

Figure 2.2: Diagram of the lower section of the color organ, showing how each key of the same pitch class is connected to a single colored light via trackers and rollers, labelled 3 and 56 (from Rimington, "[British] Patent no. 24,814: Method and Means or Apparatus for Producing Color Effect," filed 23 December, 1893, issued March 23, 1895).

only color filters, although he also expressed frustration at being unable to examine the inner workings of the instrument.[17] The filters' dye was more concentrated at one side and more diluted at the other to allow the variation of chroma within a single color dependent on its octave (more pure for higher octaves, more diluted for lower octaves). Additional stops mentioned in the 1912 book could create "softening" or flashing "staccato" effects. A pedal controlled diaphragms of heat-resistant mica in front of the lights, which enabled differences of brightness. Unlike Bishop's instrument, Rimington's was silent, even though his patent allowed a space that could be filled by a small organ or a harmonium so that the same keyboard and the same organist might simultaneously perform music and colored lights.

Although the front of the instrument was covered with fourteen light apertures that might have given the flashing effect of disco lights, the intention, as expressed in his patent was clearly for the lights to be projected and for them to be combined on a screen: "It is to be understood that the various adjusting devices hereinbefore mentioned are provided in order that the cones or beams of light…may be projected wholly or partially onto one and the same portion of a screen or other body, in order that the resultant color effect…shall be that due to the combination of all the beams or cones of light."[18] The two white lights were used to create two bars of white on the edges of the screen so that the colors would stand out in higher relief. The screen joined the organ then as part of a larger, indivisible *dispositif*. Despite his preference for lights without intervening forms, Rimington performed in 1895 with drapery as a screen, an arrangement also

[17] Klein, 190–191. John W. N. Sullivan, "An Organ on which Color Compositions Are Played," *The Scientific American* 110, No. 8 (February 21, 1914), 163 & 170.

[18] Rimington, "[British] Patent no. 24,814: Method and Means or Apparatus for Producing Color Effect," filed 23 December, 1893, issued March 23, 1895.

found in his studio, the effect of which must have added some shadow and texture to his displays.[19]

Why did Rimington, with his predecessors, turn to the musical keyboard as an interface? The musical keyboard held the practical advantage of being commonly available and understood; in addition, keyboard instruments of the day were sufficiently large that they could cope with the additional apparatus for color and light production. But basing a new artform not only on music but on specifically keyboard instruments evinces a certain understanding of both music and color. Although Rimington's pedals also allowed for light swells to analogize musical crescendos, he understood music primarily as a series of discrete pitches classifiable under twelve chromatic pitch names. Like many of his predecessors, instrument inventors or theorists, he based his color-pitch combinations, described below, on the centrality of C as a pitch and C major as a scale. This also demonstrates a certain "keyboard thinking" not shared by, for example, string players or harpists, for whom C major is not the simplest, most "natural" key. He also built, like others, a multiple octave instrument, which suggests a belief that the color sequence of the spectrum repeats itself, even if such repetitions are not humanly perceptible. More particular to Rimington was the advantage he saw to the keyboard interface in its relationship with musical notation. He made clear his goal of creating a color notation system via his instrument, and unlike other musical instrument interfaces, the keyboard clearly represents notatable pitch in its layout, as individuated keys represent individuated pitches that span over a

[19] Bishop also proposed the use of such screens. Bishop, *Souvenirs of the Color Organ*, 15: "Beautiful effects could be produced by a combination of statuary and gauze curtains, which, as the music pealed forth, would flash and fade with the soft, melting hues of colored lights in symphony with the chant of adoration."

single continuous span.[20] Notation in turn promised the ability to bring precision and systematism to color.

One further arrangement that Rimington proposed and which a later version of his color organ allowed for was the distribution of the color spectrum across the entire keyboard, such that the lowest octaves would make red and the highest keys would produce violet shades.[21] Pulling a certain stop allowed for this setup in place of the usual repeating octaves of color. Naturally this arrangement would have allowed for much smaller steps in the color spectrum, rather the twelvefold division Rimington otherwise favored. Wedded to an analogy between pitch class and color, Rimington described this arrangement as impractical for rendering pieces of music, but useful for improvising (sans music). Rimington also experimented with a three-lever interface. The abilities and results of this option are confusing, because Rimington opted for the subtractive primaries of red, yellow, and blue. This curiously means that his three levers could be unable to produce green, and that if combined equally would create a black, or at least dark grey.[22] Klein describes these levers as being attached to the organ, but it is unclear how they would have interacted with the organ generally or its function. Through these alternative arrangements Rimington entertained the idea of a more light-specific interface but they could not be used for translating music and lost the advantage he saw in the use of musical notation.

[20] Rimington, "[British] Patent no. 24,814."

[21] Rimington, *Colour Music*, 51.

[22] Klein "corrected" Rimington; without comment, he assumed the levers to represent red, green, and violet. Klein, 191.

Color Music: The Debate

Rimington used the term "colour music" to describe his activities, which in his view, amounted to a new art form in the making. The press took up the term in their coverage of his work. As with "color organ," it was not an original coinage: Castel used the French equivalent in 1735 and its first appearance in English seems to have been in Jameson's book, in which he described both a potential instrument for realizing color music and a method for notating music using colors. Defining his work as a form of music required a great deal of justification, as a great quantity of his book and his previous public pronouncements were dedicated to the long-debated and elaborated-on topic of the analogy between music and color. Rimington's contradictory impulses towards this relationship found their origin in the opposing tendencies of turn-of-the-century color discourse: towards autonomy on the one hand, and towards expanding justifications for music-color analogies on the other.

Art and film theorist Rudolf Arnheim groups color-sound analogies into three categories: physical, synesthetic, and expressive.[23] Because of his scale usage, Clark Farmer suggests Rimington might belong in Arnheim's "physical" group, while Kenneth Peacock too writes of "physical connections" with regard to Rimington's organ.[24] The physical analogy between light and sound did continue throughout the nineteenth century, and was expanded by a new scientific understanding of the nature of light. The wave theory of light, established in the early nineteenth

[23] Rudolf Arnheim, "Colors: Irrational and Rational," *The Journal of Aesthetics and Art Criticism* 33, No. 2 (Winter, 1974): 149–154.

[24] Clark Farmer, "'Every Beautiful Sound Also Creates an Equally Beautiful Picture': Color Music and Walt Disney's Fantasia," in *Lowering the Boom: Critical Studies in Film Sound*, ed. Jay Beck and Tony Grajeda (Champaign, IL: University of Illinois Press, 2008), 186; Kenneth Peacock, "Instruments to Perform Color-Music: Two Centuries of Technological Exploration," *Leonardo* 21, no. 4 (1988): 403.

century by Thomas Young and Augustin-Jean Fresnel, gave new justifications to pitch-tone analogies. Although the concept that light might be made up of vibrations was not new, this new understanding eclipsed the popular Newtonian view of light as corpuscular and established that light could be measured, like sound, in frequency and wavelength. Two texts referenced by Rimington, Denis Macdonald's *The Analogy of Sound and Color* and W. F. Barrett's article on light and sound in *The Quarterly Journal of Science*, demonstrate this influence; both scientists matched pitch classes to color based by relating their measured frequency or wavelength.[25]

Using the evidence of wavelength and frequency, color-tone analogists continued to build color scales and harmonies. Newton's seven-part division of the color spectrum enjoyed wide distribution, and Macdonald, for example, used it as the basis of his analogy. Others, however began dismissing it out of hand, for various reasons, including that the number of colors was essentially arbitrary.[26] For those who also employed color scales, such vocabulary extended into notions of consonance or dissonance for matching or clashing colors as it did for Rimington. For example, MacDonald and Barrett noted that just as adjacent notes in the diatonic scale clash and create dissonance so too do adjacent colors on the color scale (for example, red and orange, or indigo and violet).[27] This idea continued after Rimington: in the 1920s Henry Fitch Taylor

[25] Rimington, *Colour Music*, 6; J.D. Macdonald, *The Analogy of Sound and Color* (London: Longmans, Green, Reader, and Dyer; 1869); Klein, 80. The Macdonald system produced red and green as a "consonant" pairing, which Klein derided. Klein is actually wrong to suggest that Macdonald believed in the "ether"; unusually, for this period, some time before the Michelson-Morley experiment disproved or at least cast doubt on the existence of the ether as light's medium, Macdonald states that it is "probable" that no such medium exists. W. F. Barrett, "Light and Sound: An Examination of Their Reputed Analogy," *The Quarterly Journal of Science* 7 (January 1870): 1–16. Barrett's article gives reasons for likening color and sound that range from haute science (waves forms and the structure of the eye and ear) to simplistic matters of taste (the notes in a scale and the colors in the spectrum are in the most "pleasing" order).

[26] Barrett, 14. Hermann von Helmholtz, widely cited on this topic during this era, also dismissed Newton's scale as based on musical logic rather than the nature of light: H. Helmholtz, "Ueber die Theorie der zusammengesetzten Farben" *Annalen der Physik* 163, no. 9 (1852): 47.

[27] Macdonald, 29; Barrett, 16.

created a commercially successful color harmony system that produced sets of three complimentary colors based on the musical triad.[28] The existence of these analogies challenges Emily Dolan's work, which suggests a trajectory in which musical timbre replaced musical pitch as the principal music parameter discussed in relation to color during the late eighteenth and early nineteenth centuries.[29] While this might be true of the language of musicians and music writers, a number of analogists, with wave theory in mind, ignored this development.

The terms of the debate were not merely based on the physics of pitch and color, however, in spite of Arnheim's typology. As noted in the previous chapter, Castel had already suggested that the eye and ear (and all senses) transmitted vibration, but nineteenth-century analogists could marshal greater and more detailed explanations of the connection between eye and ear, owing to the expansion of physiological investigation.[30] The Young-Helmholtz theory of color vision loomed particularly large. It described how specific cone cells in the eye were responsible for color vision, with specific cells responsible for each of the three primary colors of red, green, and blue; it therefore introduced a dichotomy between the properties of light and the physiology of vision. These scientific discoveries found sympathy in color theory too, where Goethe and Schopenhauer characterized color as a creation of human vision rather than an aspect of light. In this context, Macdonald's book and Barrett's article both lent credence to the idea that there existed structural and functional similarities between the ear and the eye. Macdonald

[28] "The Taylor System of Colour Harmony," *Colour Trade Journal* 12, no. 2 (February 1923), 55–58

[29] Emily Dolan, *The Orchestral Revolution: Haydn and the Technologies of Timbre* (New York: Cambridge University Press, 2014), 23–52.

[30] Similar new modes of inquiry in music studies are discussed in: Burdette Green and David Butler, "From acoustics to Tonpsychologie," in *The Cambridge history of Western music theory*, ed. Thomas Christensen (Cambridge: Cambridge University Press, 2001), 246–271.

listed almost part by part equivalents in each organ, as well as reiterating Castel's point that the retina was subject to sympathetic vibration.[31] Barrett connected even more to modern science; citing Helmholtz, he posited that the reason that rods and cone cells of the eye responded to specific colors was because of sympathetic vibration, and equated this characteristic with the Corti's organ in the ear (itself a nineteenth-century discovery) whose hair cells vibrate in sympathy with sound.[32]

Rimington cited these ideas, but he even more strongly identified with investigations in psychology: he wrote of "auditory sensation" and "visual sensation" instead of sound and light, and claimed that the connection between color and music ought to be "a question for the psychologist," not for the physicist. A psychologist from King's College London (Dr W. Brown) prefaced the book, and Rimington suggested the color organ itself could be used in psychological studies into color vision.[33] However, despite this avid interest, Rimington displayed little interest in synesthesia. Following a trickle of investigations into isolated cases of cross-modal perception in the early and mid-nineteenth century, the period in which Rimington's concerts took place and in which he published his book was an era that experienced an explosion of scientific interest in synesthesia. Large scale studies on the topic were carried out for the first time during the 1880s and 1890s, most notably by famed English psychologist and eugenicist Francis Galton. Although the broader term of "synesthesia" only first appeared in 1892 and was popularized some time later, psychologists did identify several broad types of the phenomenon,

[31] Macdonald, 32–37.

[32] Barrett, 8.

[33] In order: Rimington, *Colour Music*, 173; ibid, 33; ibid, 33; ibid, xv–xvi; ibid, 163.

one of the most investigated being music-color association (at the time often called colored audition, now known as "chromesthesia").[34] Despite all of this, Rimington made only one passing reference to it (as "color hearing") in his 1912 book, only to confirm that he found it to be an insufficient basis upon which to base an art form, because of the arbitrary and idiosyncratic connections synesthesia research had produced.[35]

As these ways of thinking through the analogy between sound and color emerged, a large number of systematic color theorists in the later nineteenth century and early twentieth century dismissed the color-sound analogy, often repeating the criticisms of Castel's idea, which I cited in Chapter 1. These dismissals are testament to the pervasiveness of the analogy, but nineteenth-century color theorists most often favored color-specific systems over musical borrowings. Ogden Rood's *Modern Chromatics,* widely circulated and celebrated by important impressionist painters like Georges Seurat and Camille Pissarro, described sight and hearing as fundamentally unalike for numerous reasons: that sound is perceived temporally but color spatially; that the audible sound spectrum encompassed several octaves but the viewable color spectrum a single "octave"; and that painters had to phase color in "invisible steps," whereas in music, made of semitones, a similar effect would be "ludicrous." Furthermore, Rood wrote, "when two masses of coloured light are mingled, a new colour is produced, in which the original constituents cannot be recognized even by the eye of a painter. Thus, red and green light when mixed furnish yellow light; and this yellow is in no way to be distinguished from the yellow light of the spectrum, except that it is somewhat paler." Rood concluded that the connection is more "fancy" than

[34] Jörg Jewanski, "Synesthesia in the Nineteenth Century: Scientific origins," in *Oxford Handbook of Synesthesia*, eds. Julia Simner and Edward Hubbard (New York: Oxford University Press, 2013), 369–398.

[35] Rimington, *Colour Music*, 149–150.

"fact."[36] Rood's criticisms of the idea were rearticulated in the reception of both Rimington's concerts and book.

Widely distributed textbooks on color by the British chemist Arthur Hubert Church, the American board game pioneer Milton Bradley, and Bradley's compatriot Albert Munsell, also discount the musical analogy as a way of describing colors.[37] In Munsell's *Color Notation*, a work that appeared between Rimington's concerts and the publication of his book, the author wrote: "Let us leave these musical analogies, retaining only the clue that *a measured and orderly relation underlies the idea of harmony* [italics in original]."[38] Therefore, the reader learns that terms such as "pitch," "tone," and "key" ought to be abandoned in descriptions of color because, as musical properties, their use vis-à-vis color is "mixed and indefinite" and that music is "not so handicapped" by terminology borrowed from other art forms.[39] Furthermore, according to Munsell music was (and color ought to have been) "equipped with a system by which it defines each sound in terms of its pitch, intensify, and duration, without dragging in loose allusions to the endlessly varying sounds of nature."[40] Munsell therefore wrestled with the seeming contradiction that for color to become musical (i.e. an independent entity), it had to abandon the language of music. Rimington never cited these authors for obvious reasons, but, despite dissimilarities, Munsell-esque claims of autonomy also inflected his work.

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[36] Ogden Rood, *Modern Chromatics with applications to art and industry* (New York: D. Appleton and Company, 1879), 304.

[37] A. H. Church, *Colour, an elementary manual for students* (London: Cassell and Company, 1897 [1872]), 27.

[38] Albert Munsell, *A Color Notation* (Boston, G. H. Ellis Co., 1905), 86.

[39] Ibid, 11.

[40] Ibid, 10.

Color Music: Rimington's Approach

The above sources demonstrate divergent tendencies around Rimington: towards autonomy on the one hand, and towards expanding justifications for music-color analogies on the other. As I will demonstrate, Rimington's practice and discourse attempt to exploit color's twin status as an independent medium and as always already musical. As well as influencing Castel's discourse and artistic practice, the debates over this correspondence colored the reception of Rimington's work too. While some of the responses to Rimington's work criticized or praised its visual aesthetic, many concentrated on perceived weaknesses in the analogy between color and music, either generally, or specifically in Rimington's transduction.[41]

As with nearly all theories that supported the analogy, Rimington's color music and color organ relied on a constructed homology between pitch and hue based on a shared notion of scale. This took precedence over other sonic parameters: organ did not register timbral differences, despite the use of an orchestra in certain concerts for the works by Gounod and Wagner, which

N

TO SHOW DIVISION OF COLOUR SCALE UPON KEYBOARD COLOUR-ORGAN WITH MIDDLE C CORRESPONDING TO LOWEST RED OF SPECTRUM

Approximate ether vibrations Mil. mil. per sec.	395·0	433·0	466·0	500·0	533·0	566·0	600·0	633·0	666·0	700·0	733·0	757 ·0	Invisible
Approximate colour	Deep red	Crimson	Orange-crimson	Orange	Yellow	Yellow-green	Green	Bluish green	Blue-green	Indigo	Deep blue	Violet	
Musical note	(Middle) C	C♯	D	D♯	E	F	F♯	G	G♯	A	A♯	B	C_1

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APPENDIX

Figure 2.3: Rimington's color scale represented in frequencies and adjectives (Rimington, Color Music*, 177).*

[41] E.g. William Platt, "Colour Music? A Protest and a Challenge," *Musical News,* August 10, 1895, 116.

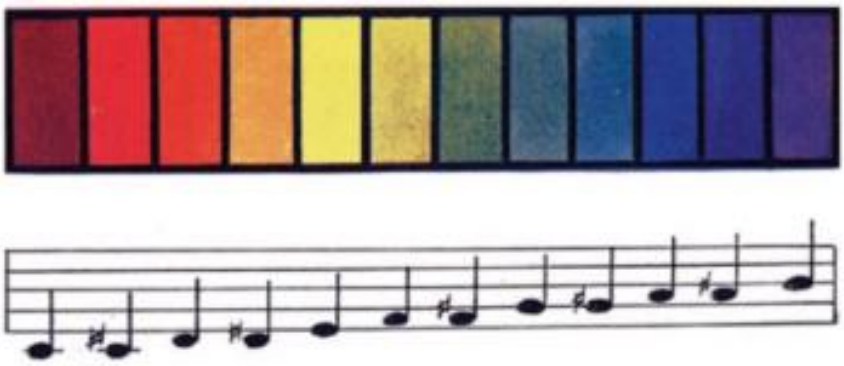

Figure 2.4: Rimington color scale represented in pigments (Rimington, Colour Music*, 18–19).*

multiple responses to the London concerts lamented.[42] Rimington reached his own color scale (Figures 2.3 and 2.4), based on the chromatic scale and therefore a twelve-part division of the color spectrum. This might help suggest the reasons Rimington employed Chopin's prelude in C minor as a concert opener, apart from its popularity and familiarity. A series of secondary dominants and tonicizations means that all pitch classes have been included by the end of the fourth measure of the piece, which means that all twelves hues would have been employed in its color-organ realization (Figure 2.6). The lament bass of the second and third phrases of the work would also exploit the gamut of colors.

Rimginton's scale stands out in comparison to its predecessors because he attributed a larger range to the red of the spectrum, distinguishing five colors between "deep red" and green in comparison to three between green and "deep blue"; further, only violet stands between deep

[42] "A Difficulty about Colour Music," *The National Observer*, July 13, 1895, 259; "Comments on Events," *Musical news*, June 15, 1895, 553. A review of Rimington's book in 1912 erroneously gave the impression that Rimington's work in fact match colors to individual instrumental timbres: "Editorials," *The Musical Herald,* April 1, 1912, 112.

blue and deep red when the sequence is repeated.[43] The primary colors of red, green, and blue, are therefore unevenly spaced at intervals of an augmented fourth and major third, and (presuming a spectrum repeat) a major second. This stands at variance from proponents of a musical color harmony (including Castel and Macdonald) who proposed the primaries colors as constituting a triad. A C-major chord in Rimington's system equals deep red, yellow, and greenish blue, conforming to neither the additive red-green-blue nor the subtractive red-yellow-blue primaries. As with the theories he cited, he rationalized his division of the spectrum by emphasizing frequency. Working on an erroneous presumption that the notes of a chromatic scale are equally spaced in their frequency range, Rimington equally spaced his colors by frequency too.[44] Rimington provided three sources for understanding his twelve-part color scale: verbal descriptions, colored boxes, and frequencies. He explained the origins of his divisions thus:

> The complete spectrum-band, greatly lengthened by sufficient distance, was thrown upon the screen by two bisulphide of carbon prisms—the source of white light being an enclosed arc-lamp. An opaque diaphragm was then interposed close to the screen with an extremely narrow slit in it, and the fine slice of rays passing through it was made to correspond in position on the spectrum-band and approximately as to its rate of vibration to the notes of the musical scale in their relative intervals.[45]

[43] It is possible that "deep red" is meant to include some blue and that "crimson" is pure red. It is possible that "deep blue" contains some red and that "indigo" is pure blue. Analysis of Rimington's printed examples suggests this to be the case.

[44] The intonation of notes in the chromatic scale is in fact calculated by a ratio, meaning semitones are spaced unequally with regard to Hertz. Rimington, writing some time after the Michelson-Morley experiments, still describes light in relation to "ether" vibrations.

[45] Rimington, *Colour Music*, 48.

As Klein notes, this experimental approach was probably not particularly accurate with regard to obtaining the exact ratios and frequencies he sought, and it may explain the discrepancy between the colors as painted and the descriptions and the frequencies he gives.[46]

Rimington's instrument followed its predecessors in creating correspondences based on octave equivalence, so that each C was a red etc. Rimington noted Rood's criticism that the perception of color was limited to a "single octave," but he retained a color-wheel-like notion of the return of the red after the blue, and therefore the possibility of further octaves.[47] Rimington always underlined the hypothetical and arbitrary designation of C as red and the beginning of his color spectrum, suggesting that any note could be a possible starting point as the ratio is the essential feature. Nevertheless, his repetition of the C-red correlation makes it the most likely arrangement for his 1895 concerts.[48]

Another common feature Rimington found between color and sound was "harmony and discord," which he understood to be associated with combinations, the former with pleasure, the latter with pain.[49] One of the chief innovations of his instrument over Castel's and Bishop's and over the proposed instruments of Schooling and Jameson was its ability to render harmony. From his descriptions and from contemporary accounts and criticisms, it is clear that he depicted musical harmony through mixing together two or more colored lights to correspond to the

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[46] Klein, 190.

[47] Rimington, *Colour Music*, 20-21.

[48] One piece of evidence that confusingly seems to contradict this is a newspaper report that relates that as "the keynote of the famous Bach-Gounod "Meditation" was struck on the piano, a flood of violet light illuminated the scene." Famously, however, this piece is in C major (not "violet" B major). Rimington's deep red of C might have featured a little blue in its composition though, which might explain this remark. "Colour and Music," *The New Age*, June 13, 1895, 171.

[49] Rimington, *Colour Music*¸ 24.

musical chord at hand. In this regard, he realized the ambitions of Johann Gottlob Krüger, discussed in the previous chapter. Contrast in the color organ's performances would have been largely temporal rather than spatial and thus, according to him, more musical, because colors were combined together and quickly alternated.

As we have seen, speaking about an individual color or a color mixture as "color harmony" has long precedence, stretching from Aristotle to seventeenth-century art criticism. However, this is a curious department in the context of the nineteenth century or earlier twentieth centuries. All other descriptions of color harmony I have encountered in nineteenth-century color theory, for example in the work of Michel Chevreul or Macdonald or Campbell, understand it to mean simultaneous, spatial harmony. The idea of a single color, albeit one produced by multiple colored lights, embodying a harmony, Rimington justified with reference to the color magenta, i.e. a color made by combining red and violet. This "disagreeable" shade, Rimington reasoned, was similar to the unpleasantness of a major seventh interval in music; in Rimington's pitch-color scheme, red was C and violet B.[50]

Some of the more detailed responses to Rimington's work concentrated on this conception of harmony. More than one response suggested that the perception of simultaneous pitches and of color mixture was fundamentally different in that the individual pitches were still perceptible as discrete entities, while the effect of combined colors was singular; this criticism repeats the previously cited theories of Ogden Rood. Hence, a review of Rimington's monograph wrote, "taking a F major triad as an example: we get the effect of C+F+A, not a conglomerate of

[50] Ibid, 29. Magenta is an "extra-spectral" color, i.e. not seen in the visible spectrum.

all three and of none in particular, as we do in well-blended colours."[51] Rimington countered an earlier version of this criticism following his initial concerts by asserting that artists, i.e. people with a refined "color sense," did in fact look on colors this way, as an amalgam of components.[52]

One writer to the *Musical News* proclaimed the effects totally unlike music, suggesting that "excruciatingly horrible" musical discords would make beautiful color chords and that harmonic "shocks," like playing a D-flat major chord in a C major context, would not result in any color shock.[53] Another deficiency of Rimington's color mixing, when judged by its approximation of music, was that his approach did not distinguish between a chord and its inversions: a C major triad would always yield a deep red, yellow, and bluish green regardless of which note was in the bass.[54] One critic, suspecting this, suggested that Rimington ought to render the bass note of each chord, although this would be completely counter to Rimington's aim of producing mixed, even unique, hues.[55] Octave doubling, common in the piano music of Chopin and the orchestral writing of Wagner, presumably also did not change the color of a chord; for example, a C major chord played with four roots but only one third and one fifth would not contain more red than a C major chord with a single root played because of Rimington's repetition of his color scheme in each octave. Given that each octave of the five

[51] Douglas Donaldson, "Colour-Music," *Musical Standard*, July 6, 1912, 9.

[52] Rimington, "Colour Music," *Musical News*, August 24, 1895, 157.

[53] In fact, this Neapolitan relationship does occur, albeit in the parallel minor, throughout Chopin's C minor prelude. Platt, "Colour Music?"

[54] One report also cited malexecution during the performance, as the same chord did not always produce the same color. "Colour Music: A New Art," *The Pall Mall Gazette*, Friday, June 28, 1895.

[55] W. Macdonald Smith, "Colour Music" *Musical News*, July 6, 1895, 10.

octaves on his keyboard was brighter than the previous one, presumably the brightest shade of any "doubled" color would show when octave doubling took place.

Another difference between accumulating pitch classes and multiplying the colors projected at once was clear in Rimington's concerts. Adding more pitches or pitches to a chord might be said to enrich or intensify a sonority or, more vaguely, to add greater color. Regardless of whether subtractive or additive color mixture is employed, the effect of adding more colors to a mixture is to dilute the intensity of color; additional additive color mixing leads towards a whitening effect on the resultant color, while additional subtractive mixing induces greying. The color organ's lights would have been subject to additive mixture. This means, as was pointed out in the press, that pressing all twelve keys on the color organ in a given octave produced pure white light whereas pressing all the keys on a musical keyboard would create a dense, extreme dissonance. The writers who mentioned it considered it an extreme example of analogical breakdown. Rimington, however, defended the foolproofness of the analogy, since he considered an all-pitch-class chord as "noise" and white light the luminous equivalent of "noise."[56]

Even simple chords, however, would inevitably have been whiter than their component colors. Any complete triad in thirds built would feature elements of the red, green, and blue primaries. For example, a D major triad would translate into orange-crimson (red with a little green), green (pure green), and indigo (pure blue or with a little green). Even though Rimington shunned the commonplace equation of the primary colors with a C major triad, either an F-sharp major or F-sharp minor triad—both almost equal in their distribution of red, blue, and green—would have come close to yielding pure white light, depending on the exact shades used. As one

[56] "The Music of Colour and Motion," *The Pall Mall Gazette*, Tuesday, July 23, 1895.

critical account put it, "instead of gaining richness, like the chord of music, the colours are swamped and dulled."[57] Others mention "a blur of grey," "washed-out and meaningless" tints, "a muddy white," and, more positively, "delicate" colors.[58] The white lights Rimington employed at the edges of the screen were present so that the tint resulting from an uneven mixture of red, green, and blue would have been more obvious on the screen.

My own attempt to mimic the colors produced in Rimington's rendering of Chopin's prelude (Figures 2.5 and 2.6), despite its inexactness, suggests the veracity of the reports on the results of color harmonies. The work's chordal texture would have exploited the color organ's ability to blend colors in a "harmonic" manner. Its chords generally feature three pitch classes, although chords of four simultaneous pitch classes also result from augmented sixth chords, seventh chords, and non-chord tones (passing tones, suspensions, and appoggiaturas). The first chord of C minor would have featured a combination of deep red, orange, and bluish green, corresponding, respectively, to C, E-flat, and G. This combination of lights would feature the three primaries of red, green, and blue, with only a small proportion of the last but a larger quantity of red than green, yielding a pinkish orange color. The second combination corresponding to the subdominant seventh on the second beat would also feature a higher green admixture owing to the presence of yellow-green (F), and thus result in something more yellow. The results from the first ten chords of Chopin's prelude in C minor suggest the mixed colors mostly compromised pinks, oranges, and beiges. The colors generally support one critic who

[57] Ibid.

[58] Ibid; "Colour and Music," *The New Age*, June 13, 1895, 171; "Comments on events"; "Color Music," *The Morning Post* (London, England), Friday, June 28, 1895, 6.

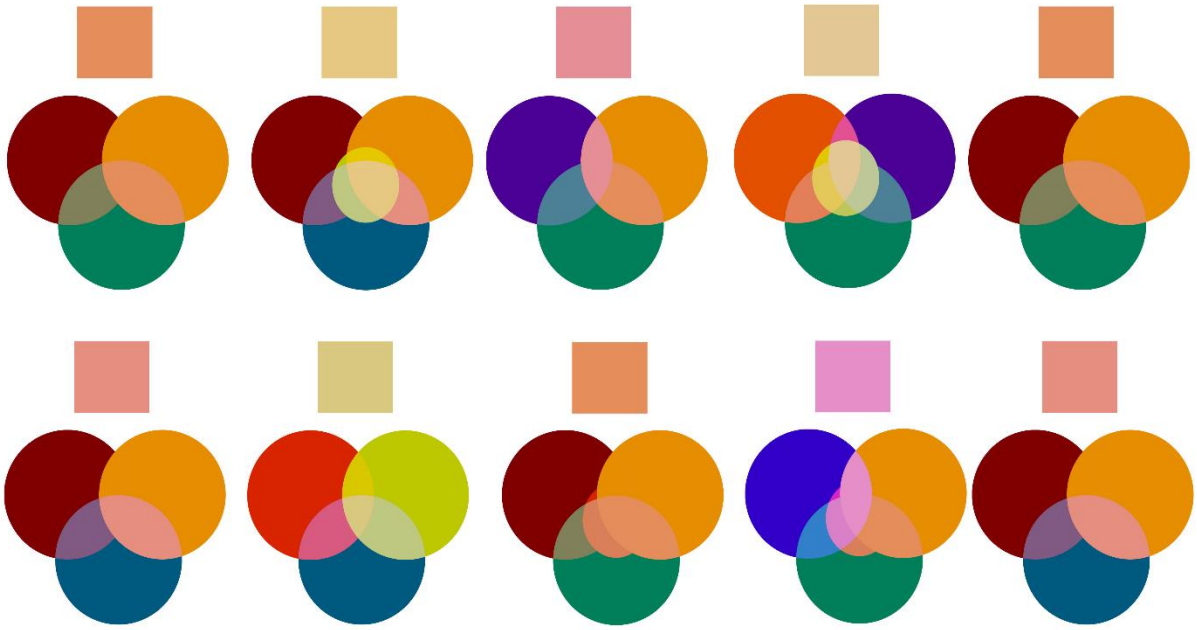

Figure 2.5: My rendering of Rimington's colors for Chopin's prelude in C minor. Each circle corresponds to an individual pitch class in the chord, while the squares above show the combined shade of those colors. The colors are based on the pigments and descriptions given above and combined according to additive mixture on Adobe Photoshop. The ten groups of colors and ten squares therefore correspond to the first ten chords of the piece, shown in Figure 2.6.

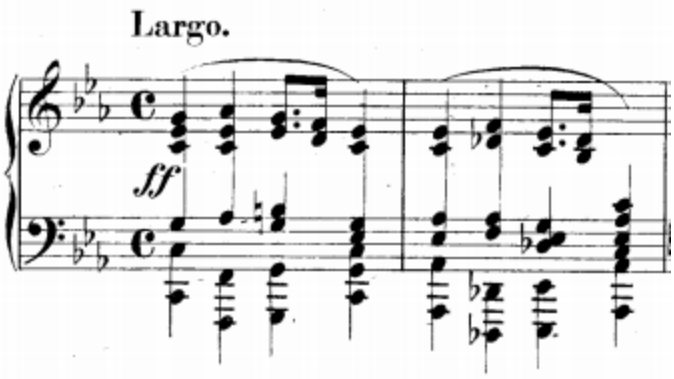

Figure 2.6: The first ten chords (or two measures) of Chopin's Prelude in C minor.

wrote, using a term from contemporary fashion with a little contempt, that Rimington's organ generally produced "'crushed strawberry' and colors of that style."[59]

My realization of the first two measures of Dvorak's Waltz in A major (Figures 2.7 and 2.8), also featured in the original program, shows more striking contrast by virtue of the greater contrasts in texture with a single pitch, dyad, triad and five-pitch-class chord all occurring in the opening. Nevertheless, it is salient to observe that the fourth color produced, which results from a complex dominant ninth chord with an augmented fifth, differs little from the color of the tonic triad that precedes it despite the considerable aural difference between them. Both appear as pale yellows or beiges. These results demonstrate that the input of a very different collection of pitches/hues can result in a similar appearance if their combination features similar quantities of red, green, and blue. One of Rimington's early critics pointed out this disanalogy: that no primaries exists in music, a C and G not combining to produce, for example, D. [60] The more conspicuous opposition, between magenta and pure yellow, occurs in the first bar, which musically amounts to an unfolding or breaking of the tonic chord between the A—C-sharp dyad and the fifth of E, i.e. a point of no harmonic contrast.

As essential to Rimington's art as this concept of harmony, and also bemoaned in several reviews, was his approach to time and rhythm. Naturally, having a color light up for every single note regardless of the latter's rhythmic value led to quick procession of colors; some reviewers

[59] "Colour Music," *The Times*, June 28, 1895. Reproduced in Klein, 261–262.

[60] Joseph Goddard, "Colour compared with Music and Painting," *Musical Opinion and Music Trade Review* 18, no. 216 (September 1895): 777.

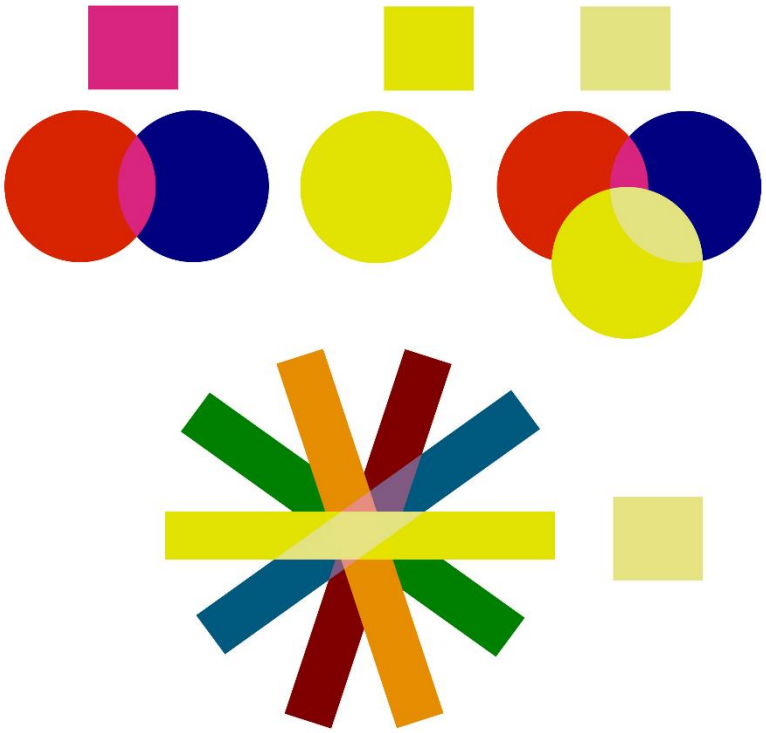

Figure 2. 7 My rendering of Rimington's color for Dvorak's Waltz in A major (op. 54, no. 1). As with figure 2.5, the individual colors are shown as circles or rectangles while the combined result appears in squares. The four color "chords" correspond to the first two measures depicted in Example 3b, with the five-note chord of measure two appearing below the harmonies of measure one.

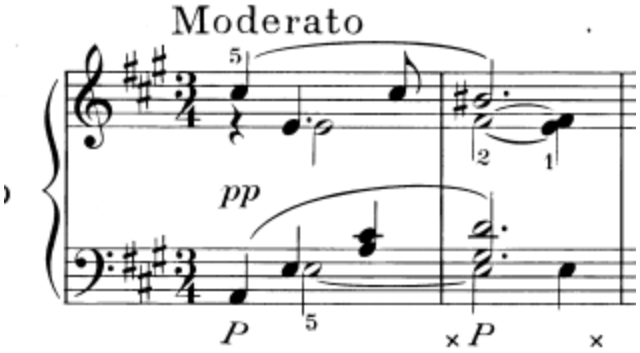

Figure 2.8: The first two measures of Dvorak's Waltz in A major (op. 54, no. 1).

found this blinding or dazzling.[61] While the critic from *The New Age* found the flashing effect "very pleasing to the eye," and someone from *The Morning Post* wrote that "The most entertaining effects were produced by rapid music which caused the colours to merge quickly and almost imperceptibly into each other," the general consensus was in favor of slower shifts.[62] Rimington had embraced sequential over simultaneous contrast. This bemused a *Musical News* reviewer, who wrote, that "when the chief pleasure we derive from them (colors) is their simultaneous and not their successive contrasts, and to make them succeed each other rapidly, as the notes in music, when the eye is not adapted to rapid changes of impressions, seems most unreasonable."[63] In his book *Color Music*, however, Rimington, citing a German scientific study, averred that movement of colored effects led to a heightened experience that audiences could become accustomed to.[64] One commentator worried that colorizing slow music by a second-rate composer would trump fast music by a great one: "One could hardly believe that there would be any close connection between the sense which admired Beethoven and the sense which preferred, say, Albert Chevalier."[65]

The relationship between rhythm in the two mediums at least seems to have been easily perceptible. On the issue of affect, critics and audiences were left more perplexed.[66] A

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[61] *Manchester City News*, December 7, 1895, reproduced in Klein, 262; "The Music of Colour and Motion," *The Pall Mall Gazette*, Tuesday, July 23, 1895.

[62] "Colour and Music," *The New Age*; "Colour Music," *The Morning Post*.

[63] Smith, "Colour Music."

[64] Rimington, *Colour Music*, 166. The study cited is Bernard Berliner, *Der Ansteig der reinen Farbenerregung im Sehorgan* (Leipzig: Wilhelm Engelmann, 1907).

[65] "Colour Music," *The National Observer*, June 15, 1895, 343. Chevalier was an English musical hall singer and actor.

[66] "Colour Music," *Freeman's Journal and Daily Commercial Advertiser* (Dublin, Ireland), Saturday, June 8, 1895.

particularly harsh critic from *The Musical Times and Singing Class Circular* suggested not only the problems outlined above in realizing harmonies but that the emotional connotations of the colors were often at odds with those of the music: "many of the richest chords are represented by the coldest shades, the method thus failing psychologically. A greater failure has, indeed, seldom been seen."[67] Klein, summarizing the response to the color organ performances notes that "[t]hose who witnessed his performances do not seem to have remarked upon the fact that the coloured light conveyed just the same artistic ideas as the musical composition, a result hardly to be wondered at in view of the lack of any psychological relationship between certain colours and certain pitches."[68] The well-known music critic Ernest Newman argued, after reading Rimington's book, that that the affective capacities of music and color were essentially dissimilar: that music represents "definite emotions" but "colours (or, say, a sunset) can only represent indefinite emotions."[69]

Rimington had emphasized his hope that colors could become a medium for emotional expression; it was an essential component of his argument that color music constituted a novel art form. As he analogized music and color's expressive potential in general, it is perhaps to be understood that his lighting and the pieces of music it translated would also be emotionally analogous. The one description in his book of lighting for an unnamed piece of orchestral music suggests as much; the lights "sympathize" with the piece's "pathetic" character before

[67] "Occasional Notes," *The Musical Times and Singing Class Circular* 36, No. 629 (July 1, 1895): 450.

[68] Klein, 170.

[69] Ernest Newman, "A Note on Colour-Music," *The Observer*, September 21, 1919. Reproduced in Klein, 236–239.

developing a "more joyous character" "in consonance with the sound-music."[70] This may be an unspoken assumption of Rimington's work: borrowing musical structures, in his idiosyncratic translations, would necessarily result in the same sort of affective experience gained in listening to music. Nevertheless, it seems unlikely that the colors for Chopin's Prelude in C minor, for example, were significantly more dark or pathetic than those accompanying Gounod's *Ave Maria*. Audiences of Rimington's works might have experienced disjuncture between what they saw and heard even if this was not what the artist had intended: a montage aesthetic of parallel or competing rather than complimentary streams. This disjuncture was interpreted by Rimington's critics as failure.

Despite the amount of time he spent researching and justifying the musical analogy, despite his employment of musical concepts and terminology, and despite his concert practices, Rimington still claimed color music was not limited to musical translation, nor was musical translation its *raison d'être*. He proclaimed that "musical methods should be regarded as merely the scaffolding upon which the first arch is thrown across the chasm of the untried."[71] He used the analogy primarily as, he wrote, "a convenient working hypothesis," one he recognized as debatable and open to further scientific investigation.[72] This allowed him to brush off opposition from those who denigrated his work merely because they thought the analogy between music and color close not enough. Rimington's ultimate goal was the creation of pure color compositions to be made as color compositions, not musical translations. One reviewer spoke of the idea in terms

[70] Rimington, *Color Music*, 59–60. The piece mentioned could be the overture to Wagner's *Rienzi* since it begins with a "Wagnerian trumpet blast," although the opening trumpet note is a sounding A, which does not correspond to "orange" in Rimington's scheme.

[71] Ibid, 45.

[72] Rimington, "The Music of Colour and Motion," *The Pall Mall Gazette*, Tuesday, July 23, 1895.

that evoked Mendelssohn: before, there had been songs without words, and now there could be "songs without sounds."[73] In these works, music might still be provided, but the priority would be reversed; he imagined the color composition being treated like a libretto in opera production. In the concerts, one item evoking a sunset was produced either for color alone or at least as an original color composition with free musical accompaniment. One critic praised the work for lacking the quick flashing of the musical translations of the rest of the program.[74]

This begs the question of why Rimington needed music at all, and not only provided music in his concerts, but had those pitches translated on a note-for-note (or chord-for-chord) basis.[75] Rimington justified his work with logic that presages the concept of remediation in media studies: new art forms, he reasoned, necessarily form themselves in the image of older ones.[76] Furthermore, the method seemed to aid understanding; Rimington found, on testing people, that they simply preferred works based on music rather than original color compositions. He even claimed that the best composers' music produced the best colors.[77]

Rimington's choice of metaphor ("musical scaffolding") suggests music's importance too: music provided structure. Returning to Arnheim's three categories of analogy, in practice he largely made analogies at the physical level (rhythm and frequency) even though he draws on psychology and physiological justifications too in his discourse. These physical analogies might

[73] "Colour Music," *Freeman's Journal and Daily Commercial Advertiser*.

[74] "Colour Music," *The National Observer*, June 15, 1895, 343.

[75] Rimington once in his book mentions the possibility of color accompanying music without translating it directly, but only briefly and obliquely; it is unclear if this ever happened in his concerts. Ibid, 60.

[76] Ibid, 46.

[77] Rimington, "Colour Music," *Musical News*.

be said, in the manner of Nicholas Cook's criticism of the lights in Scriabin's *Prometheus*, to merely "duplicate" information already present in the music.[78] However, these analogies often put the disanalogies in higher relief, such as the difference between Rimington's color mixtures and musical harmony, the difference between perception of duration in sound and light, and the difference between emotional qualities of each medium.

The critics suggested that Rimington's colors did not merge with the music, but Rimington himself seemed strongly to desire autonomy for color. In practice his art might have appeared hybridic: a combined sensory experience. However, his conception was more purified: "color music" meant music of colors, not a color-music union. If not hybridic, such a conception may perhaps be called parasitic. As I argue in the next section, works that associate Rimington with synesthesia mischaracterize his aims. There appeared no invitation that the audience should hear the piece in a new, colored way. The streams were ultimately separate and even separable for Rimington.

The color organ also played a role in Rimington's notion of autonomy by analogy. Responding to a critic, he wrote that the "influence of time, rhythm, instantaneously variable combination, and changeful intensity (under the control of the executant), all of which the new instrument has brought to bear on colour, and *made* [my italics] common to both arts."[79] Therefore, for all his elaboration of physical similarities and his various appeals to authorities on the subject, Rimington suggested that such pre-existing similarities are inessential, because his instrument has made music and color similar.

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[78] Nicholas Cook, *Analysing Musical Multimedia* (Oxford: Oxford University Press, 1997), 38.

[79] Rimington, "The Music of Colour and Motion," *The Pall Mall Gazette*.

The Color Sense: Debates and Contexts

In his address to the audience at his first concert in 1895, Rimington replied to imagined critics, who might question the usefulness of his instrument: "What are the uses of any art?"[80] He then elaborated, "Are they not to ennoble, to refine, to increase the pleasures and interests of life, to educate the special sense or senses to which they minister?" Exposure to color music, Rimington declared, led to an education of the eye.[81] On his subsequent tour to Manchester and Bradford, Rimington's audiences were provided with a pamphlet describing what they were going to experience in the color organ concerts. In this justification, Rimington wrote of color music's beauty, expression, and its pleasurable and charming properties, but again returned to the idea that his art had an educational capacity. Introducing the term "color sense" for the first time, Rimington wrote of the art "as a means of educating the eye to appreciate the exquisite changes and combination as well as the strong and splendid contrasts of which colour is capable."[82] Other supporters of an art of color music from this period sometimes made similar arguments in their suggestion of color music's ability to expand or improve audience's senses. Schooling, for example, did not employ the concept of the "color sense," but spoke instead of "appreciating meaning in color," that is, understanding color devoid of form as a form of emotional expression.[83] Journalist Edward Rice Doyle, writing in *The Bookman*, argued that it was only the lack of a color sense that stopped color music from flourishing.[84]

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[80] Klein, 259.

[81] Klein, 260.

[82] Klein, 265.

[83] Schooling, "Color-Music: A Suggestion of a New Art," 351.

[84] Edward Rice Doyle, "Will Colour Music Become an Art?" *The Bookman* 41, no. 4 (June 1915): 400.

By the time of his 1912 book-form manifesto, Rimington would dedicate multiple chapters on his conception of this use for his instrument. Any art, he argued, "tends to develop the faculties upon which it depends for its existence," meaning an art of pure color would transform the human body's perception for color.[85] This was a particular concern for him, as he believed that "in modern times, the colour sense has in a very large proportion of people been allowed to lie dormant, and their appreciation of colour in nature and art is extremely limited" and, he argued, this situation was getting worse.[86]

As Gaskill notes, Rimington's use of the term "color sense" implicates his description of the uses of his instrument and art form in late nineteenth-century debates over the development of this sense that involved philologists, psychologists, and anthropologists. The *Oxford English Dictionary* first attests the term "color sense" from 1867 in an article from *The Quarterly Journal of Microscopical Science,* which is a translation of a piece of writing on the retina by the German anatomist Max Schultze.[87] The English "color sense" here translated the German compound "*Farbensinn*" and debates about the capacity to perceive color circulated between England and Germany in this period.

The notion of a distinct "color sense" in biological discourse reflects the influence of the Young-Helmholtz Theory of how specific cells in the eye dictated color vision. The sensation of color therefore became one of two separable eye functions. Benjamin Joy Jeffries of the

[85] Rimington, *Colour Music*, 8.

[86] Ibid, 7.

[87] "Colour sense," *OED Online*, March 2019, Oxford University Press, accessed April 6, 2019, http://www.oed.com/view/Entry/36596?redirectedFrom=color+sense. Max Schultze, "On the Structure and Physiology of the Retina," *Quarterly Journal of Microscopical Science* 7 (1867): 32.

American Ophthalmological Society and Harvard University opined in 1882 that "it is not always remembered that the eye has, so to speak, two senses: viz., form and color."[88] Ten years later, in Britain, the Royal Society Report's on color vision likewise distinguished between the eye's capacity to perceive form and color and proposed different forms of testing for each faculty.[89]

Although accounts of the "color sense" debates of the late nineteenth century generally begin with the theories of William Gladstone, his observations were marginally pre-empted in the third volume of the prolific English art critic John Ruskin's *Modern Painters*, in which the critic declared that "the Greek sense of colour seems to have been so comparatively dim and uncertain that it is almost impossible to ascertain what the real idea was which they attached to any word alluding to hue; and above all, colour, though pleasant to their eyes, as to those of all human beings, seems never to have been impressive of their feelings."[90] Looking at further examples from Greek literature, Ruskin wrote that Sophocles "really did not know green from yellow or brown."

Two years later, Gladstone—a four-time British Prime Minster and also a classicist—published a tome entitled *Studies on Homer and the Homeric Age*. In the third volume of this work, Gladstone observed the paucity and inconsistency in Homer's application of color

[88] B. Joy Jeffries, *Color-names, Color-blindness, and the Education of the Color-sense in Our Schools* (Boston: L. Prang and Company, 1882), 1.

[89] "Report of the Committee on Colour-Vision," *Proceedings of the Royal Society of London* 51 (1892), 281.

[90] John Ruskin, *Modern Painters* (New York: E.P. Dutton, 1856), Vol. 3, 225. A modern account of the debates described here can be found in: Guy Deutscher, *Through the Language Glass: Why the World Looks Different in Other Languages* (New York: Picador, 2011]; and a contemporaneous summary can be found in Rudolf Hochegger, *Die geschichtliche Entwickelung des Farbensinnes; eine psychologische Studie zur Entwicklungsgeschichte des Menschen* (Innsbruck: Verlag der Wagner'schen Universitätsbuchhandlung, 1884). Future contributors to the debate like Magnus and Rivers (discussed below) referenced Gladstone on this issue rather than Ruskin.

terminology in *The Iliad* and *Odyssey*. Homer, Gladstone believed, relied on brightness, with color terms merely connoting degrees of light or dark rather than hue. For one thing, colors were often absent where they might have been expected, for example in describing the blue of the sky or the green of foliage; for another, the color terms used were often puzzling, most famously in the description of the sea as "wine-red" or "wine-colored," a term also used in the poem for oxen. Gladstone concluded that these curious attributes did not originate in any poverty of language but rather in a poverty of perception; Homer's "perceptions of prismatic colour…were, as a general rule, vague and indeterminate."[91] Unfamiliar with "an ordered system of colours," the Greeks of antiquity possessed "organ[s] of colour" that were "but partially developed."[92] Gladstone therefore argued that contemporaneous color perception was the "result of a slow traditionary growth in knowledge and in the training of the human organ," although he conceded that "heroic Greece may probably have been far behind some countries in the east in the use and in the idea of colour, which has always had a privileged home there."[93]

While Gladstone's assessment of the Greek's sensory limitations may appear substantially similar to Ruskin's, the more explosive suggestions in the former—that the Greeks were, in a manner, colorblind, and that a linear history of color perception existed—made it a touchstone for later writers exploring the "color sense." German philosopher and linguist Lazarus Geiger took up and expanded Gladstone's argument along philological lines by demonstrating the existence of some of the same deficiencies in color vocabulary that Gladstone

[91] William Gladstone, *Studies on Homer and the Homeric Age* (Oxford: Oxford University Press, 1858), Vol. 3, 483.

[92] Ibid, 488.

[93] Ibid, 496.

had observed in other ancient world literatures. Geiger found no descriptions of blue in the Indian Vedas, the Bible, nor in the (considerably more recent) Quran or Icelandic sagas, although he skirted over the probable exception of the Ancient Egyptians. According to the etymologies provided in his *History of the Development of the Human Race* (*Zur Entwicklungsgeschichte der Menschheit*), the words meaning "blue" in modern European languages originally signified either green or (more frequently) black.[94] Furthermore, he suggested that the word "green" and its equivalents in other European languages were also relatively recent coinages and that green and yellow were indistinguishable for Homer and his contemporaries. According to Geiger, of all colors, it was first red that was perceivable to mankind, and therefore the first to be given a name and used in literature.[95]

Geiger's countryman, the ophthalmologist, Hugo Magnus, supported the philologically grounded conclusions of Geiger's work, adding physical justifications as to why certain colors might be easier to perceive. Magnus considered that red was the first color identified historically because of its light-rich nature; accordingly, he ordered the perceivability of colors in the spectrum from strongest to weakest (red, then yellow/orange, then green, then blue and violet).[96] He supposed that, "[t]he retina…was gradually heightened in its performance and essentially refined in its responsiveness by the constant and unceasing light beams that penetrated it."[97] For

[94] Lazarus Geiger, *Zur Entwicklungsgeschichte der Menschheit, Vorträge* (Stuttgart: Verlag der J. G. Cotta'schen Buchhandlung, 1871), 46–50.

[95] Ibid, 58.

[96] Hugo Magnus, *Die geschichtliche Entwickelung des Farbensinnes* (Leipzig: Verlag von Veit & Comp., 1877), 9. As Deutscher notes (Deutscher, 76), Magnus's theory was in fact wrong: red has the lowest energy and blue and violet the highest.

[97] Ibid, 47: "Die Netzhaut…wurde durch die unausgesetzt und unaufhörlich auf sie eindringenden Lichtstrahlen allmählich in ihrer Leistungsfähigkeit erhöht und in ihrer Reactionsfähigkeit wesentlich verfeinert."

Magnus, the possibility for yet further "refinement" (perhaps the perception of ultraviolet rays) existed.[98]

These ideas spilled over into anthropology and zoology. The ethnographer Adolf Bastian responded to Geiger's work by asserting the elision of green and blue among the Burmese; he further stated that Ilicos and Tagalogs had adopted words for green and blue from Spanish.[99] W.H.R. Rivers, best remembered now as the psychiatrist who treated the shell-shocked English poet Siegfried Sassoon at Edinburgh's Craiglockart Hospital during the first world war, carried out investigations on the color sense among Marshall Islanders living in the Torres Straits. Testing the inhabitants of the Marshall Islands, Rivers failed to find a single instance of red-green color blindness among the Islanders. Although the expedition's findings were generally considered to weaken claims of racial difference in sensory perception, particularly the theories of Herbert Spencer that the "primitive" "races" were endowed with greater sensory acuity at the expense of "higher" mental functions, Rivers, influenced by earlier debate, nevertheless persevered with his conclusion that the Islanders experienced some difficulty in perceiving the color blue.[100] He noted that, although a word for 'blue' was to be found in his subjects' language, it was a clear borrowing from contemporary English.

These views were already being questioned during the late nineteenth century. In Berlin the anthropologist (and noted anti-Darwinian) Rudolf Virchow tested a group of "Nubians"

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[98] Ibid, 53.

[99] Adolf Bastian, "Miscelle," *Zeitschrift für Ethnologie* 1 (1869): 89–90.

[100] Graham Richards, "Loss of innocence in the Torres Straits," *The Psychologist* 23, no. 12 (December 2010): 982–983. The British psychologist Edward Titchener argued that different lighting conditions existed between Rivers' tests in the Marshall Islands and those for his English control group: E.B. Titchener, "On Ethnological Tests of Sensation and Perception with Special Reference to Tests of Color Vision and Tactile Discrimination Described in the Reports of the Cambridge…," *Proceedings of the American Philosophical Society* 55, No. 3 (1916): 219.

(from Sudan) who were being exhibited in the Berlin Zoo, and found that they were entirely capable of matching color, regardless of "missing" colors in their lexicon.[101] The science writer Grant Allen criticized Geiger and Gladstone for employing purely philological evidence for their grand theses, while also disparaging Magnus's more biological account. For Allen, Magnus's apparently evolutionary model failed because 3000 years was simply too short; furthermore, he wrote at length on what he considered the well-developed color sense of many non-human animals, concluding that, if even the "lower animals" could distinguish between a range of colors, surely this ability was universal among humankind.[102] He further criticized Gladstone, Geiger, and Allen for failing to take anthropological evidence into account.

Allen sent surveys to Englishmen living throughout the world to have their feedback on the ability of native populations to distinguish between colors. He wrote that all groups appeared to have no problems matching and distinguishing colors regardless of the extensiveness of their color vocabularies. He further described that many artworks and cultural objects from throughout the world suggested that humans everywhere possessed an advanced "color sense," writing that "even the Andaman Islanders, probably the lowest known species of the human race, daub their faces with red and white."[103] Although he cited and lent credence to the views mentioned above,

[101] Rudolf Virchow, "Die zur Zeit in Berlin anwesenden Nubier*," Verhandlungen der Berliner Gesellschaft für Anthropologie, Ethnologie, und Urgeschichte* (1878): 333–55: "Dabei ergab sich, dass die Leute durchaus keinen Mangel an Farbensinn hatten. Sie fanden die übereinstimmenden Blätter leicht zusammen. Was ihnen abgeht, ist also nur die sprachliche Unterscheidung der Farben." On displays of this nature, see Coco Fusco, "The Other History of Intercultural Performance," TDR 38, no. 1 (Spring, 1994): 143–167. As Fusco writes (Fusco, 146): "Performance Art in the West did not begin with Dadaist 'events.' Since the early days of the Conquest, "aboriginal samples" of people from Africa, Asia, and the Americas were brought to Europe for aesthetic contemplation, scientific analysis, and entertainment."

[102] Grant Allen, *The Colour Sense: Its Origin and Development* (London: Trubner, 1878), 148.

[103] Ibid, 212.

Rivers also wrote in 1901 that "in general, however, the views of Gladstone and Geiger have been wholly rejected and it has been supposed that there is no necessary connection between colour language and colour sense."[104]

That variegated languages clearly indexed color perception was an underlying assumption in those thinkers who credited the theory of a historical or evolutionary advancement in the color sense. For example, River wrote: "Existing primitive races agree in showing the same defect of color language as is found in ancient writings, and, in at least one such race, there has been found to be a corresponding defect in color sense, consisting in a certain degree of insensitiveness to those colors for which the nomenclature is defective."[105] As Guy Deutscher has observed, another premise of this debate was a Lamarckian belief in the inheritability of acquired characteristics, i.e. that individuals could improve their vision and pass that on to their ancestors.[106]

Academic postulations on the color perception of historically or geographically distant people might not have featured high on the political agenda, but the "color sense" was in fact a political issue in as far as it relates to color blindness during a time when color blindness was seen as an increasing threat and, as such, became regulated and subject to standardized testing. In particular, concern on both sides of the Atlantic arose over the dangers of color blindness among railway and maritime workers, particularly after a fatal train crash in Sweden in 1875 that was

[104] W. H. R. Rivers, "Vision," in *Reports of the Cambridge Anthropological Expedition to the Torres Straits*, ed. A. C. Haddon. Vol. 2: "Physiology and Psychology" (Cambridge: Cambridge University Press, 1901), 49.

[105] Rivers, "Primitive Color Vision," *Popular Science Monthly* 59 (May 1901), 57.

[106] Deutscher, 54. Jean-Baptiste Lamarck was a French naturalist who wrote influentially on evolution in the early nineteenth century, some time before Darwin's theories.

blamed on the condition.[107] The standard testing for color blindness, the general adoption of which was recommended in Britain by the Royal Society's report on color vision, was the Holmgren test, developed by the Swede Frithiof Holmgren. The test involved matching skeins of wool based on hue; the purported advantage of this test over previous attempts was that the examinees or test subjects did not have to make recourse to language. As a result, it distinguished between two categories of color insensitivity distinguished in the Royal Society report: color blindness (the inability to perceive color) and color ignorance (the inability to describe color).[108] Its use not being confined to the removal of colorblind individuals from certain forms of employment, the Holmgren test was also employed by Rivers when he carried out his investigation of the Marshall Islanders' vision.

Rimington shared a term with these discourses (and a belief therefore that the "color sense" existed as a distinct sense) but in his thought, "color sense" no longer seems to straightforwardly signify the perception of color, i.e. he did not suggest people with a deficient "color sense" view the world monochromatically or with medically recognized color blindness.[109] Gaskill describes this shift as a move from the "physiological" to the "psychological"; indeed, Rimington wrote of the "mental sense of color" (meaning "the mind

[107] Ibid, 47.

[108] "Report of the Committee on Colour-Vision," 296. For more on color blindness testing in Britain during his period, see: Elizabeth Green Musselman, "Local Colour: John Dalton and the Politics of Colour Blindness," *History of Science* 38, no. 4 (2000): 401–424; and Jordanna Bailkin, "Color Problems: Work, Pathology, and Perception in Modern Britain," *International Labor and Working-Class History*, No. 68, "Labor in Postwar Central and Eastern Europe" (Fall 2005): 93–111.

[109] Although Rimington's book does not cite any of the of the evolutionary theories of color vision, Edward Rice Doyle, writing in *The Bookman* (Doyle, 400), in response to the New York premiere of Scriabin's *Prometheus* echoed many of Rimington's opinions and directly referenced the theories of Magnus et al, saying that "in very primitive countries, the only color distinctions known are frequently but black, white, and red."

and emotions") that his color organ appealed to.[110] His frequent gestures to psychology in his book underline his commitment to an understanding of the "color sense" as a mental faculty. In the history of the aesthetics of painting, it was sometimes suggested that color held less importance than design because of color was purely sensuous, pleasurable but unable to provoke thought.[111] Influenced by the conception of the "color sense," however, Rimington believed in color as something fundamentally mental.

This shift in the meaning of "color sense" might also be considered a move from the biological to the aesthetic, in which the term "color sense" comes to mean something closer to "color sensibility," or, simply, "taste." A piece of writing by Oscar Wilde from the 1890s employed "color sense" with a similar meaning: "To discern the beauty of a thing is the finest point to which we can arrive. Even a colour-sense is more important, in the development of the individual, than a sense of right and wrong."[112] As the Austrian academic Rudolf Hochegger wrote, summarizing and hoping to explain the causes of the previous debates that "the word 'color sense' (*Farbensinn*) is applied with a very wide scope… the use of the term 'color sense' subsumes concepts that can be strongly separated: the ability to sense color, color sensibility (*Farbengefühl*), and the ability to distinguish colors."[113] Rimington's definition might encompass the latter two of these without the first.

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[110] Gaskill, "The Articulate Eye," 487; Rimington, *Color Music*, 161.

[111] See the discussion of Kant in Chapter 1.

[112] Oscar Wilde, "The Critic as Artist: With Some Remarks Upon the Importance of Doing Nothing," accessed April 6, 2019, http://www.online-literature.com/wilde/1305/.

[113] Hochegger, 18. Unabbreviated original: "Das Wort Farbensinn wird in einem sehr weiten Umfange gebraucht. Farbensinn kann bedeuten sowohl schlechthin die Fähigkeit Farben zu empfinden, als auch die Neigung, die Lust und Unlust der angeborenen oder erworbenen Gefühlslage einer Farbenempfindung gegenüber; endlich kann Farbensinn von der intellectuellen Gewandtheit, die durch unmittelbare Wahrnehmung oder frühere Erfahrung gegebenen Farbenempfindungen ihrem Inhalte nach zu beurtheilen, zu vergleichen und zu classificiren, gebraucht

Understanding the color sense as a form of psychological discernment rather than a physical faculty did not of course preclude a belief that it was unequally distributed among populations. Pursuing Ruskin's pronouncement that "color power is a great sign of mental health in nations; when they are in a state of intellectual decline, their colouring always gets dull," Rimington himself lamented at length that the lower classes in his homeland had lost touch with color.[114] According to Rimington, a poor "color sense" was particularly common among the urban working classes, among whom, he found, enjoyment "appears to have perished."[115] Rimington suggested that being detached from the beauties of natural color and moving to the drab surroundings of the city has blunted these people's color abilities.[116] For this group, color was a more urgent matter than music, he contested, because color permeated their everyday lives regardless of their inattention towards it.[117] Despite its neglect, he found that it had many uses that extended from the artistic to the quotidian via the commercial with a heightened sense of color applicable to discriminating between chemicals in a laboratory and describing the world in poetry.[118]

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werden. Der Sprachgebrauch subsumirt somit unter „Farbensinn" die scharf von einander zu trennenden Begriffe Farbenempfindungsvermögen, Farbengefühl und Farbenunterscheidungsvermögen."

[114] Ruskin, *The Elements of Drawing: Three Letters to the Beginner* (London: Smith, Elder, & Co, 1857), 162. The nineteenth-century English Egyptologist John Gardner Wilkinson too shared Rimington's concern about the insufficiencies of the English color sense; like him, he compared it unfavorably with past and foreign examples, and, like him, he took a patrician tone that asserted that the lower classes needed to be educated in color so that both the "maker and purchaser" of goods might enjoy them fully. See J. Gardner Wilkinson, *On Colour and On the Necessity of a General Diffusion of Taste Among All Classes* (London: John Murray, 1858), 172.

[115] Rimington, *Colour Music*, 10.

[116] Ibid, 77.

[117] The issue of color blindness was of particular concern with regard to the eyes of the working class, because the jobs for which color blindness created safety fears were working class jobs. See: Bailkin.

[118] Rimington, *Colour Music*, 81–82.

Magnus had in fact shared Rimington's perception on the lack on taste among the lower classes with regard to color and likened this difference between intracultural groups to the intercultural difference between people on the "higher and lower steps" of culture; according to the German scientist, the lower classes, like the lower cultures, preferred "garish, lively colors" while the upper classes, like higher cultures, preferred "delicate" colors and less luminous shades.[119] Whereas Rivers and Magnus inter alia saw modern European eyesight as the pinnacle of evolutionary achievement, Rimington instead averred that the majority of people in England, if not Europe, suffered from a deteriorating color sense. He wrote of downward trajectory from the Middle Ages, an age in which, as he described it, one could "find good color everywhere."[120] As well as comparing his contemporaries unfavorably to the people of an idealized past, he also juxtaposed their impoverished sensibilities with "the East" (including Persia, Japan, China, and India).[121]

The Color Sense: Color Music as Color Education

As previously mentioned, Rimington not only diagnosed a culture-wide color malaise, but also proposed his color organ as a remedy. As Joshua Yumibe notes, citing Miriam Hansen's work on classical Hollywood's "production of the senses," Rimington sought to "engage and educate

[119] Magnus, 8: "Im Allgemeinen lässt sich sagen, dass der Farbensinn der höheren Bevölkerungsschichten ein feinerer, gebildeterer ist, wie der der unteren Klassen; denn während diese im Durchschnitt mehr die grellen und lebhaften Farben bevorzugen, lieben jene mehr die zarten, lichtärmeren Töne, ein Verhältniss, das in ähnlicher Weise wohl auch zwischen den auf höheren und tieferen Culturstufen stehenden Völkerschaften zu herrschen scheint."

[120] Rimington, *Colour* Music, 75.

[121] Ibid, 76.

mass audiences."[122] His proof that the color organ affected the "color sense" was that the more viewers were exposed to it, the more acclimatized they became to its rapidly changing colored lights.[123] He also noted that the color organ more greatly pleased people with greater exposure to and prior education about color, namely visual artists.[124] Additionally, the color organ could develop color memory. Rimington imagined a scene in which an observer could (in the manner of playing by ear) watch a display on the color organ and afterwards try to recreate by guessing which keys had been used to produce it.[125] Preempting a possible criticism of his effects, he criticized any desire that color music contain form in addition to color as uneducated and insensitive: "It is simply the insufficient training of the colour sense in many people that makes them demand form in addition to colour, or prevents them from enjoying colour for its own sake."[126] Color music could be at once the catalyst for a rejuvenation of the color sense among people who found no pleasure in color and the beneficiary of this bettered appreciation.

Some other writers on color music from Rimington's lifetime shared his belief that color music might transform society's relationship with color generally. Schooling also justified the rapid changes that resulted from the direct translation of pitch into distinct colors as progressive, insisting that it was necessary to "develop what little [color appreciation] at present exists so far as to respond as readily to change of hue as now can to changes of sound."[127] He also accorded

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[122] Yumibe, 36; Miriam Hansen, "The Mass Production of the Senses: Classical Cinema as Vernacular Modernism," *Modernism/modernity* 6, no. 2 (1999): 59–77.

[123] Rimington, *Colour Music*, 68.

[124] Ibid, 103.

[125] Ibid, 101.

[126] Ibid, 72.

[127] Schooling, "Color-Music: A Suggestion of a New Art," 351.

with Rimington's optimism for the future of color music, proposing a similar feedback loop in which color music changes an audience's perceptions, and in which an these altered perceptions lead to an aesthetic appreciation of that same color music: he wrote of the possibility of "educat[ing] our perceptions so that we may appreciate the melody and harmony of color as we now appreciate the melody and harmony of sound."[128] In an earlier article on the possibility of color music from a British magazine (from 1885), the author noted that that color perception was not unique to humanity but argued that a true understanding of beauty in color, one that takes place in the mind, is unique to the "cultivated man."[129] Presaging Rimington, the author wrote that color music had the potential to cultivate this ability to perceive color meaning. Journalist Doyle, in his response to Scriabin's *Prometheus*, reiterated two arguments from Rimington: that the appreciation of formless, mobile colors required a higher degree of cultivation than appreciating static color; and that a color sense refined through color music would transform the colors of the urbanized world. He elaborated that "it will educate the world to a sense of color harmony it has never known before, and will revolutionize exterior decoration and ornament. Our black sooty factories will be done away with. Laws will be passed to prevent individuals from violating the sense of color decency."[130]

While Rimington's concept of a trainable color sense may appear incompatible with the previously cited evolutionary debates, Lamarckian beliefs from a period prior to any understanding of genetics meant that an ability could be both at once inherited and acquired.

[128] Ibid, 349.

[129] Crofts, 252.

[130] Doyle, 401.

Magnus, who had lent biological weight to a hypothesis previously based on linguistic grounds, published his own method for a color education, in which he stated "it is a fact that the operations of our sensory organs in general, and the color sense in particular, is capable of refinement and enhancement through regular exercise."[131] Once again suggesting the influence of Lamarckian beliefs, several authors explained the much lower preponderance of color blindness among women uncovered by late nineteenth-century scientific studies by suggesting that color played a much larger part in their everyday lives, suggesting that if men paid greater attention to color in their lives, this sensitivity would be inherited and reduce the rates of color blindness.[132]

Rimington's didactic commitment also suggests connections with color educationalists of his period who shared his faith in a cultivatable color capacity. Not all art critics and color theorists shared this faith. To take one earlier, but prominent, example, the critic Ruskin, wrote that an "eye for color" or color "gift" was required of an artist. He advised that "if you cannot choose and harmonise them by instinct, you will never do it at all," and accused color insensitive people of "tormenting the eyes and senses of people who feel color." For Ruskin, bristling against theorization, treatises on the subject of coloring were full of the "utterly horrible and harsh."[133] But even an author of one of those very theorizations, the aforementioned Ogden Rood, wrote that education could not "supply or conceal the absence of this [color] capacity."[134]

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[131] Magnus, 6: "Dass die Thätigkeit unserer Sinnesorgane im Allgemeinen und die des Farbensinnes im Besondern durch wiederholte Uebung einer Verfeinerung und Erhöhung fähig sei, ist eine Thatsache."

[132] E.g. Jeffries, 5.

[133] Ruskin, *The Elements of Drawing*, 155.

[134] Rood, 308.

Rimington stood on the opposing side with two contemporaneous American color educationalists whose methods were widely disseminated, Albert Munsell and Milton Bradley. Regina Lee Blaszczyk has noted this similarity, describing how Rimington's objectives "presaged those of Albert Munsell."[135] Indeed, Rimington noted and praised the work being done in American schools in his book.[136]

Bradley, now best remembered as a game manufacturer, concentrated his efforts on elementary school and kindergarten education, writing books aimed at teachers of young children to encourage them to include color as a central part of the education. While he noted that children generally encountered color during the art classes, he criticized this limited approach, calling for teachers to pass on knowledge from color science and not to limit children's encounters with color to paint pigments. His system was based largely on encouraging color differentiation and "harmonization"; he wrote that a child "should be taught to recognize from fifty to one hundred colors and know their combinations before creating/combining pigments."[137] In place of pigments, Bradley encouraged the adoption of Maxwell color discs (named after James Clerk Maxwell) which allowed for the three primary colors (red, green, and blue – *not* yellow) to be mixed to various degrees when spun. As Gaskill notes, Bradley's project was grounded in a desire for a standardized color vocabulary that he believed would allow students of his system to perceive color in a heightened way; without this cultivation, perception

[135] Regina Lee Blaszczyk, *The Color Revolution* (Cambridge, Mass.: MIT Press, 2012), 193. Rimington's full exploration of this theme does not predate Munsell's *Color Notation* (1905), however.

[136] Rimington, *Colour Music*, 83.

[137] Milton Bradley, *Color in the School-Room: A Manual for Teachers* (Springfield, Mass.: M. Bradley Co., 1890), 16.

was "blunted."[138] Like Rimington, Bradley believed that an education that produced a color-aware population had both commercial and aesthetic advantages.

Munsell conceived a particularly successful color system that was widely adopted in industry, but his initial interests also lay in color education.[139] Like Rimington, Munsell's background was as a painter, and, as Blaszczyk notes, his notion of color education shared a taste-forming mission with that of Rimington. He particularly discouraged the "gaudy" in favor of more subtle color, believing that a corrective education, based on his principles, could lead students from the former to the latter. Rather than a color organ or Maxwell discs, he created two unique means to objectify his system: one a sphere, the other a "tree." Both allowed for the spatialization of the three central aspects of his classification system: hue (color), value (light versus dark), and chroma (strength). Munsell shared with Bradley a belief that color was best considered as an abstract quality distinct from its worldly manifestations. He used the term "color sense," equating it with a sort of color memory, which students of his method could use to recall and imagine specific colors.[140] As a leaflet for his company declared, the human race is "born with eyes, which, when normal, see all the color of the universe, hence any training in color one receives must necessarily be mental."[141]

Although Rimington is not specific about which methods he is describing when he addresses the superior quality of color education in American schools, as Michael Rossi reports,

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[138] Gaskill, *Chromographia: American Literature and the Modernization of Color* (Minneapolis: University of Minnesota Press, 2018), 130–131. Bradley, 14.

[139] Michael Paul Rossi, "The Rules of Perception: American Color Science" (PhD Diss., MIT, 2011), 277.

[140] Cochrane, 32.

[141] Cited in Rossi, 286.

the Munsell system enjoyed wide adoption across schools in Massachusetts and Rhode Island along with large-scale industrial adoption, making it the likelier candidate.[142] However, Rimington shared the belief of both that a color education could be used to enhance taste and perception. His most obvious point of departure from these figures is the color organ itself as an instrument with the purpose of educating the "color sense"; Munsell and Bradley would have seen this instrument, in comparison to their discs or globes, as a throwback to discredited analogies between color and music that they dismissed. Rimington's belief in his instrument's ability to develop the color sense was also associated with his belief in the importance of motion to his conception; he believed that strong and sudden shifts in colors developed the mind, a belief apparently not shared by Munsell and Bradley, who believed in classifying and dividing color into individual entities perceived in isolation. Additionally, the color organ's primary function was clearly the creation of art, whereas Munsell and Bradley prescribed instruments with the purpose was developing an understanding of color, which could, among other uses, be then employed to make art. However, Rimington believed that aesthetic experience was in itself a form of education, which was not unique to his new art form, but rather shared by other art forms.

In common with these educationalists' methods, and also with the Holmgren test used in color blindness testing in industrial and anthropological settings, Rimington treated color as an abstract entity. In line with American color educationalists, he spurned pigments for light, despite suggesting the usefulness of his invention for painters. Unlike Bradley's methods and more like the Holmgren test, Rimington's organ was meant as a method for teaching color, of

[142] Ibid, 341.

remedying "color ignorance" that did not rely on resorting to language. Indeed, Rimington stated that the color organ enabled the production of myriad, unknown colors "to which no name can be given, many of which one has never seen before."[143] According to Rimington's ideals, his organ would allow subtle color differentiation without having to learn long lists of color names. This allowed a form of immediacy: remediating color through the terms of music obviated the requirement of remediation through language.

Rimington argued that the color organ and the color music it produced were perfect vehicles for educating the color sense because of the attributes that critics found most strange or unsatisfactory about them. The washed-out colors created by combining all the primaries to correspond to musical triads were, Rimington thought, more subtle than base primaries.[144] The more tints, the more beautiful and complex the result, he found; like Munsell, Rimington found that strong color suggested merely poor taste. Their very mixed-ness, only perceptible to what Gaskill calls the "articulate eye," was also a test of the color sense, since Rimington argued that color-sensitive individuals would be able to break them down into their component parts.[145] His appropriation of the term "color sense" became inseparable from the color organ and the color music it produced.

In practice, Rimington's argument that the color-sensitive eye could break down chords like a musically-trained ear appears fragile; even if the eye of someone with a particularly acute

[143] Rimington, *Colour Music*, 100.

[144] Ironically, a German scientific study on beauty and ugliness cited by Rimington held that colors are considered more beautiful the closer they come to the primaries. Rimington might have considered this an example of the poor taste that abounded on such matters. Franz Exner, *Zur Charakteristik der schönen und hässlichen Farben* (Vienna: Kaiserlich-Königlichen Hof- und Staatsdruckerei, 1902), 905.

[145] Gaskill, 493. Gaskill's sense of "articulation" comes from Bruno Latour: Bruno Latour, "How to Talk About the Body? The Normative Dimension of Science Studies," Body & Society 10, no. 2–3 (2004): 205–229.

color sense is capable of breaking down a mixed color into its component parts, the human eye is only capable of perceiving three distinct hues, not the twelve of the color organ. As I have demonstrated above, very different chords can create very similar results if the proportion of red, green, and blue is similar in the mix. There would be no way to distinguish these—to say that one set of "notes" had produced it over another. His previously mentioned experiments with a three-lever interface represent a possible acknowledgment of the fact that his color organ weakly resembled the human color organ, i.e. the eye or retina.

Conclusion

Rimington hoped for autonomy for color music: color free from painting, and eventually free from music. With regard to the first, he used colors liberated from pigments just as his American educationalist counterparts did. Although Rimington rhapsodized less about light as a medium than some of his successors, he still suggested the superiority of the colors that result from its use. Another distinction from painting was his detachment of color from form. The distinction between color and form or design has a long history in the aesthetics of painting. However, I would argue that Rimington's invocation of the term "color sense" implies that his understanding of this distinction was shaped by a scientific view of color as a unique attribute with its own sense, rather than a decorative element for form. As painting catered to the "form sense," a new art form could cater to and cultivate the color sense. Schooling, whose argument broadly approximates Rimington's, takes this point to an extreme, suggesting that in the face of color music, painting will cease to make any claim on color and become monochromatic.[146] The lesson

[146] Schooling, "Color-Music: A Suggestion of a New Art," 352.

of color education via the color organ was not only that color is important, that color should be carefully handled, that color is part of our everyday lives, that colors are to be carefully distinguished, but also that color is a separate and separable quality. By avoiding form, Rimington believed color could approach Helmholtz's characterization of music as "pure sensation."[147]

Given Rimington's attempts to treat color as a separate entity, I believe Joshua Yumibe mischaracterizes Rimington's argument crucially when he writes of "Rimington's educational impulse towards synaesthesia."[148] Not only did he display little interest in synesthesia, but in appealing to the "color sense," Rimington drew on a worldview in which senses are divided, separating not only vision from hearing, but color vision from the perception of form. In contrast to Scriabin, he does not suggest that the fusion of music and light creates any sort of *Gesamtkunstwerk.* Instead, he suggested musical performances as one step on the road towards greater autonomy for color. Ironically then, Rimington can be placed alongside Rood and Munsell and the theorists who sought autonomy for color; at the very least, it demonstrates that competing understandings of color fed into color music in its discourse and practice.

Jörg Jewanski more shrewdly summarizes Rimington's contribution to the field of color and light by saying that "orientation by the musical model as previously accepted could now be abandoned."[149] Surpassing the musical model was a goal that would become important for later light artists, like Thomas Wilfred and Mary Hallock Greenewalt: the production of independent

[147] Cited in Rimington, *Colour Music*, 123–124.

[148] Yumibe, 35.

[149] Jörg Jewanski, "Colour and music," *Grove Music Online*, 6 April, 2019, http://www.oxfordmusiconline.com.ezproxy.cul.columbia.edu/grovemusic/view/10.1093/gmo/9781561592630.001.0001/omo-9781561592630-e-0000006156.

light art. Yet Wilfred and Greenewalt, artists who pursued this abandonment, did not understand Rimington's contribution as Jewanski does; rather they saw him as the epitome of a wrong-headed approach that fully relied on music, and was therefore subservient to it, and furthermore aesthetically unsatisfactory as visual art. Nevertheless, the terms that Rimington employed and helped spread would shape the reception of future artists working with light in the early twentieth century. The publicity around Rimington and then around the New York premiere of Scriabin's *Prometheus* in 1914 meant that the terms "color organ" and "color music" were adopted and persevered despite great technological and aesthetic variance, as will be detailed in the third and fourth chapters. If these terms were as much Rimington's legacy as the abandonment of the "musical model," part of his inheritance was also to keep light and color as artist mediums bound to music. Nevertheless, artists and inventors responded to these hybrid terms with yet greater claims of autonomy and medium specificity.

Chapter 3: Bejeweling Beethoven with Mary Hallock Greenewalt

When Carnegie Hall experienced the world's first complete performance of Alexander Scriabin's tone poem, *Prometheus*, in March 1915, complete with the "tasteria per luce" part for a "light instrument" or "color organ," the New York press gave the event substantial attention. In Philadelphia, however, one local newspaper greeted news of the Carnegie performance with derision, suggesting that what was novel for New York wasn't novel for the city to its south. *The Evening Star* reported that "[i]n Philadelphia music circles, the news from New York that an instrument to produce 'musical color' instead of sound, or, 'clavier a lumieres,' has been given a trial, hailed as a startling innovation, is received with amusement."[1] The reason: coordinated music and light had already been prominently exhibited in Philadelphia by the outspoken inventor and musician Mary Hallock Greenewalt (1871–1950).

Greenewalt was born in Beirut (then located in Syria) in 1871, the daughter of Samuel Hallock, an American consul and widower, and his then sixteen-year-old Syrian bride, Sara Tabet. While still young, Greenewalt moved to Philadelphia, where she would be based for the rest of her life. Greenewalt's mother suffered from paranoid delusions and died in a New England sanatorium for the mentally ill at the age of 28, by which time she already given birth to five children. Nonetheless, Greenewalt maintained a high social status, attested to by a 1903 portrait of her by American realist painter Thomas Eakins, and solidified via her connections to

[1] "Mary Hallock Led in Giving Color Music," *The Evening Star* (Philadelphia), March 19, 1915, press clipping, Box 12, Folder 9, Mary Elizabeth Hallock Greenewalt Papers, The Historical Society of Pennsylvania, Philadelphia, Collection 867. See also "Diffuse Color Lighting to Vary Musical Moods," *Public Ledger* (Philadelphia), March 17, 1915, press clipping, Box 12, Folder 9, Greenewalt Papers.

one of America's wealthiest families, the Du Ponts, into which both her sister Ethel and her son Crawford, married.

Greenewalt grew up playing the piano, studying both at the Philadelphia Musical Academy and with composer and pianist Theodor Leschetizky in Vienna, who also taught Ignacy Jan Paderewski, Artur Schnabel, Ossip Gabrilowitsch, and many others over his long career. She was a soloist with both the Philadelphia Orchestra and Pittsburgh Symphony Orchestra and recorded Chopin for Columbia Records in 1920. Seeking to differentiate herself from other pianists, she sometimes performed in middle eastern garb, wearing turbans and long gowns during concerts.

In her own accountings of her life and career, Greenewalt gave both the years 1905 and 1906 as years in which she first began to experiment with artistic lighting, at first as a way to enhance the ambiance during her piano recitals.[2] In her earliest attempts she used colored film to provide a variety of illuminate hues. In 1911, Wanamaker's in Philadelphia, one of America's most famous department stores, often used for concerts (and to this day, home to the largest pipe organ in the world), hosted Greenewalt's first public performance with colored lights, including her lighting designs in a program in its Egyptian Hall that featured Debussy's *La lune descend sur la temple qui fut*.

Greenewalt continued to experiment with different mechanisms and materials. During this time, her performances including lights were infrequent, but others after the Wanamaker concert took place, in Perkiomen Seminary (Pennsburg, Pennsylvania) in 1912, and in Dayton,

[2] For example, 1905 in: Untitled note ("The Work as a whole that creates the subject matter…"), undated, Box 6, File 6, Greenewalt Papers; 1906 in: Greenewalt, *Light: Fine Art the Sixth* (Philadelphia, 1918), 13.

Ohio, in 1914.[3] She sometimes considered 1916 a major turning point in the progression of her artistic activities, as that year she gave a public demonstration before the Society of Illuminating Engineers of Philadelphia that included a performance of Beethoven's "Moonlight Sonata." Two years later, she gave a lecture to the same group entitled "Light Art: Fine Art the Sixth." Later she would refer to her light art as *nourathar* from the Arabic for essence (*-athar*) of light (*nour*).

By 1918, Greenewalt had designed a preliminary version of a special instrument to control lighting intensity and color. She christened it the *sarabet* after her mother Sara Tabet. Although her background was in music and not in electrical engineering, Greenewalt designed the elements of her *sarabet* herself. As she continued to develop her *sarabet*, Greenewalt applied for a number of patents; although the Patent Office was reluctant to allow a number of these, by 1930, she had obtained eleven in total. The patents that Greenewalt obtained cover various components of her instruments, including their color filters, switches, and rheostats, as well as the instruments as a whole and a system for notating light. Although she had made some versions of these devices by hand, she employed various companies to construct parts according to her designs as she sought to improve her *Sarabet*: General Electric manufactured the rheostat, the Westinghouse Company made the lamphead with remote controlled color filters, and the Eastman Kodak Company made the color filters themselves. The Commercial Engineering Company constructed the entire instrument that was finished in 1924 under the supervision of the engineer C. T. Alcutt.

[3] The most thorough summary of these can be found in "Brief for Defendant Appellee," and "Brief for Plaintiff Appellant," both Box 16, Folder 9, Greenewalt Papers.

Meanwhile, in 1922 she gave demonstrations in New York's Wanamaker store, and also continued to experiment in the basement of that city's Strand movie theater, owned by the famed movie theater impresario Samuel Rothafel. Pierre du Pont, Greenewalt's relative through marriage, commissioned an instrument for the conservatory on his Longwood Estate, allowing Greenewalt to employ it in the Calvary Church in Pittsburgh before it was delivered. Here she accompanied a performance of Brahms' Requiem, but also used the *Sarabet* during church services, including portions (such as Lord's Prayer) that were not strictly musical. She eventually performed with the *Sarabet* at the Longwood Estate, although the instrument did not find a permanent home there; instead it was returned to her and then displayed in 1934 in Chicago's Museum of Science and Industry.[4]

Despite these successes, Greenewalt's career was distinguished by the inventor's litigiousness. Feeling that her concept of colored light performance was being exploited by others, Greenewalt turned to the law in order to gain acknowledgment and remuneration for her efforts. Throughout the 1920s and 1930s she suggested that a number of individuals and corporations were infringing on her intellectual property rights, as stated in her patents. Greenewalts believed that most of the major electronics companies had stolen her concepts, including those companies she had worked with in constructing her instrument, such as Westinghouse and General Electronic, as well as movie theaters (including Rothafel's) and contemporaneous light artists (including Thomas Wilfred). She initiated legal proceedings against two groups, the Stanley Corporation and the Musical Arts Association. The first of these owned a movie theater in Philadelphia, while the second owned Severance Hall in Cleveland,

[4] Some more information on this performance is available on the Longwood Gardens website: Colvin Randall, "Light, Magic, Music!" accessed April 5, 2019, https://longwoodgardens.org/blog/2012/09/20/lights-music-magic.

Ohio, the home of the Cleveland Symphony Orchestra. Both the Stanley Corporation and the Musical Arts Association used lighting effects alongside music in ways that Greenewalt considered to be covered by the broad claims in her patents, but the courts disagreed—Greenewalt lost both legal battles. Less archival information survives to document her activities following these unsuccessful court cases, though Greenewalt appears to have continued giving talks on her work and performing occasionally. In 1939, a version of her *Sarabet* was installed in a chapel of the Delaware State Hospital. Her book, *Nourathar*, which at 412 pages provides a thorough introduction to her aesthetics and technologies, was published in 1946, four years prior to her death.

Although Greenewalt has been frequently cited in lists of color organ inventors, she has not been the subject of much scholarly attention in herself, despite being perhaps the only female inventor of a color organ. Additionally, some of the information that has circulated about her, particularly in the work of media scholar Michael Betancourt, is contradicted by material that survives in her archive. In casting Greenewalt as simply another figure in the color music lineage, little attention has been paid to the idiosyncrasies of her approach both to working with light and working with music. Greenewalt was deeply concerned with differentiating her practice and technologies from earlier ones, imagining in the process a bright future for light art—an autonomous, abstract art with its own specific medium.

In this chapter, I present Greenewalt's aesthetic goals, analyze how these were afforded and materialized by her instruments, and use two extant notated works to suggest how her lights were coordinated with music in performance. I then demonstrate, through an analysis of

Greenewalt's legal undertakings, how aesthetic and commercial interests collided, and how her work operated within a broader context of lighting as theatrical spectacle. Throughout the chapter, I scrutinize Greenewalt's claims to novelty and autonomy and suggest the centrality of music to her light aesthetics. Greenewalt's aesthetic trajectory and ideals, as well as her struggles to find a workable institutional context for her performances, present a foil to those of Thomas Wilfred, a more well-known light art or color music practitioner, whose work is analyzed in the dissertation's final chapter.

From Color Music to *Nourathar*

Greenewalt distanced herself from her color music predecessors on both scientific and aesthetic grounds, in so doing articulating a desire for new forms and a new relationship between music and lighting. Seeking a marked break from the past and encapsulating the novelty of her conception, she turned to neologisms: *Sarabet* and *nourathar* could take the place of "color organ" and "color music." Although she sometimes employed the term "color organ" interchangeably with *Sarabet* in the 1920s, at other times "color organ" and "color music" were terms that Greenewalt reserved to indicate things done by other people—namely Rimington and the other color-tone analogists.[5]

From her earliest forays into light and color, Greenewalt rejected any claim of establishing a real, physical relationship between specific pitches and specific colors. In *Nourathar,* she stated, "[n]ot for one instant did I think of the art I had in mind as analogous to

[5] Compare: Rose Rosner, "New Color Organ to Interpret Music," *New York Times*, November 12, 1922, 98; and "Brief for Plaintiff Appellant."

the physical nature of musical notes and their combinations. Indeed, I had not thought it possible that such wrong vagary could exist."[6] To the magazine *Musical America*, she proclaimed: "The note C is the note C; and no amount of multiplication of its wave frequency will change it into the color red. Stand on your head, progress into space…It's no use. C is C and red is red."[7] In her criticisms of previous color music, Greenewalt repeatedly returned to the issue of the octave, i.e., spectral colors do not repeat as pitch classes do.[8] In 1946, she also called on up-to-date scientific knowledge to bolster her objections, writing that "Light is different in kind from sound. It is not a vibration. It is a quanta or wave or indeed both."[9] As well as rejecting parallels between light and sound, Greenewalt also cast doubt on the similarity of hearing and seeing: "It needs no saying that all art catering to the eye belongs to an aesthetic world entirely different from those catering to the ear. Their respective instruments are entirely and utterly dissimilar. They cannot in any way be made into Siamese twins. Each is free to turn as it wills."[10] In the aftermath of the work of Scriabin, Rimington and others, Greenewalt's views on this were nonetheless sometimes misrepresented; for example, an article in *Popular Science Monthly* suggested that she was a believer in color-pitch analogies. She wrote a furious letter in response and received an apology for the "misinterpretation" of her views.[11]

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[6] Greenewalt, *Nourathar: The Art of Light-Color Playing* (Philadelphia: Westbrook Publishing Company, 1946), 402.

[7] "Applying Spectral Colors to Music," *Musical America,* April 2, 1921, 48.

[8] E.g. *Nourathar*, 107.

[9] Ibid.

[10] Ibid, 232.

[11] "Playing Music with Light Doubles Your Enjoyment," *Popular Science Monthly*, September 1922, 31, press clipping; Letter from Kenneth W. Payne to Greenewalt, September 8, 1921; both Box 7, Folder 12, Greenewalt Papers.

Believing no pre-determined relationships to exist between light and/or color and music, Greenewalt thought that artists choosing lighting for a piece of music should base their choices on taste, writing, "I would rather trust the feeling in its sensings, as to color values, than the mathematics of ray or quanta numberings."[12] Greenewalt claimed that all art was essentially subjective, and choices of color and light ought to be too.[13] She delineated the process a light artist should take to a *New York Times* reporter, repeatedly equating artistry with interpretive decision-making:

> Let us take the first phrases of Beethoven's 'Moonlight Sonata.' Shall the color artist give to this melody a pink? The notes are pungent, clear, sharp, not high but in the middle register. Would a clear blue have sufficiently these qualities? How high a pink should it be and what value, what average of color shall the artist strike that he may take its paler shades for still higher melodies later? Where shall the color begin and the color cease? How frequently can the changes of intensity and tint be changed and not tire the muscles of iris and the nerves of the retina?
>
> Here the real labor of the color artist begins—to exercise choice—while all the threads are firmly held. This exercise of choice, backed by what is learnable, is the true master in art, light and color not excepted. That is the creative end—my end.[14]

In contrast to the scientific-aesthetic hybridization of her forebear Castel, Greenewalt thought that systematized color-tone parallels constrained creative freedom and were antithetical to art.[15] Instead, Greenewalt preferred to think of music-light relationships in metaphorical terms: she explained that for a musical phrase to suggest a color was as natural as to refer to a shirt as

[12] Greenewalt, *Nourathar*, 218.

[13] Greenewalt, *Light: Fine Art the Sixth*, 16.

[14] Rosner, "New 'Color Organ' to Interpret Music."

[15] Greenewalt, *Light: Fine Art the Sixth*, 16. The judge in her initial patent infringement case against the Stanley Corporation of America described her as a "true artist" because she had abandoned music-tone parallels in favor of "feeling." Greenewalt v. Stanley Co. of America, 39 F.2d 102, 5 U.S.P.Q. 318 (D. Del. 1930).

"loud" or a morning as "good." "The whole brain," she stated, "is one associated or linked sensation."[16] In this regard Greenewalt's method parallels the multimedia theory of Nicholas Cook, who theorizes a tripartite metaphor model in which two media are connected by some "enabling similarity."[17]

For Greenewalt the main "enabling similarity" between music and light was emotion. The relationship between media in her art corresponds generally to what Cook refers to as "triadic conformance," i.e. the two media forms are consistent in as far as they both correspond to the work's "emotion."[18] In this regard, Greenewalt's aesthetics seem to have been based on an almost naïve-seeming parallelism: darkness for somber music and brightness for jubilant sounds, for example.[19] That Greenewalt's lighting works accompanied warhorses of piano literature from Mozart to Debussy may not merely have been a matter of choosing those works most familiar to her, but might have represented a choice of works that for her, as a socially elite woman of her time with a thorough background in classical music, best represented and afforded emotional expression. She showed no interest, for example, in providing lights for contemporary popular music.

As well as casting doubt on her predecessors' tone-pitch analogies and their ability to express emotion, Greenewalt's also distinguished her work's forms from those by earlier color musicians. She reiterated critiques of Castel's *clavecin* and Rimington's organ: "[c]ontinually

[16] Rosner, "New 'Color Organ' to Interpret Music."

[17] Nicholas Cook, *Analysing Musical Multimedia* (Oxford: Oxford University Press), 70.

[18] Ibid, 101.

[19] Greenewalt, *Light: Fine Art the Sixth*, 5.

flashing on and off lights cannot produce a pleasing emotional effect, and cannot really represent any one or definite emotion. The effect can only be confusing and inharmonious and emotionally corresponding to a confusion of unrelated sounds."[20] She found a quick succession of colors, unlike a quick succession of changing pitches, incomprehensible.

Since Greenewalt associated colors with moods or melodies instead of individual pitches or chords, their movement was relatively slow in comparison to her predecessors. Light intensity—rather than color—became crucial to her practice. Unlike Castel or Rimington, she defined light rather than color as the medium of her work. Indeed, she claimed that *nourathar* could function perfectly well with pure white light, so long as its intensity could be controlled; in her 1918 address to the Society of Illuminating Engineers, she stated that "if it were a question of one or the other only: a mechanism controlling color, or one controlling intensities, the palm must surely be given to the latter as the indispensable factor."[21] Time was more marked by the shifting of light intensity than by the alteration of colors; this intensity she associated with emotional expression, too.

Alongside this different concept of temporal form, Greenewalt cultivated a new concept of spatial form that she contrasted with that of her predecessors. She idealized a flooding effect across an entire performance space, writing that "[l]ight, in its very nature, is an atmosphere, a suffusion, an enveloping medium. To give it the sharpness of short succession, as with the notes

[20] I attribute these words to Greenewalt and believe the sentiment and possibly the wording to be hers, but they appear in a letter from her lawyers Prindle, Wright, Neal and Bean in which her lawyers make the case of the difference between her invention and previous manifestations, including Rimington's: Letter from Prindle, Wright, Neal and Bean to Commissioner of Patents, June 28, 1926, in "Transcript of Record in the United States Circuit Court of Appeals for the Third Circuit, No. 4469, Volume II, Exhibit Book," page180, Box 18, Folder 2, Greenewalt Papers.

[21] Greenewalt, *Light: Fine Art the Sixth*, 3.

of an instrument, is inconceivable."[22] She described her ideal venue as egg-shaped, with reflective surfaces and no sharp corners; lighting this venue would immerse the audience in a "living jewel" that would fill their fields of vision.[23] Recalling that Greenewalt named the *Sarabet* after her prematurely deceased mother, Anne Ciecko has suggested that the effect evokes Julia Kristeva's conception of Plato's *chora*: a pre-subjective all-encompassing maternal space, sometimes considered synonymous with the womb.[24] Greenewalt herself sometimes employed similar imagery by comparing *nourathar* with a bath.[25] Unlike Rimington, she did not want to limit her art to a screen.

From Hybridity to Purity

Greenewalt's coinage of terms like "*nourathar*" and "*Sarabet*" was not only meant to distinguish her activities from the color music tradition, but also served as a means of claiming medium autonomy for her works. Greenewalt insisted on the autonomy of *nourathar* by virtue of its distinct medium: light. Eschewing "color music" and "color organ" meant establishing independence from music. She described *nourathar* as "fine art the sixth" (after music, painting, sculpture, architecture, and poetry—she declined to include either drama or dance),[26] belonging

[22] Greenewalt, Ibid, 16.

[23] Greenewalt, *Nourathar*, 26.

[24] Anne Ciecko, "Mary Hallock-Greenewalt's Spectral Middle East," *Feminist Media Histories* 3, No. 1 (2017): 29.

[25] Greenewalt, *Nourathar*, 103.

[26] Greenewalt, *Light, Fine Art the Sixth*.

essentially to the temporal or "successive" arts.[27] All this suggests Greenewalt's own investment in medium specificity rather than hybridization or intermediality, despite her work's hybrid origins.

In *Nourathar*, Greenewalt also stresses the "fineness" of light as a medium. She wrote: "[t]he instrument of play captures the intent and makes the ether speak…The spectral ray itself, of itself alone, is of a supreme exquisiteness, a momentous, a conspicuous beauty… Strained, cleared, purified by the ability of man, it subtends and surpasses the natural."[28] Although the postulated universal medium of "ether" had long fallen out of scientific favor by the book's 1946 publication date, Greenewalt meant to prove that light, and concomitantly her art, was transcendent—literally ethereal.[29] She therefore believed purity to be not merely the result of her art's distinction from other arts, but a quality immanent to the medium itself.[30] "It is the rarest of the mediums so far used in fine art expression," she claimed.[31] She wrote that light was finer than sound and implied that it had even greater expressive potential because, she speculated, it penetrated further into the human body.[32] Her praise of light's purity contrasts with her

[27] Greenewalt, Letter, *Musical America*, February 2, 1922, cited in Andrew Robert Johnston, "Pulses of Abstraction: Episodes from a History of Animation" (PhD Diss., University of Chicago, 2011), 46.

[28] Greenewalt, *Nourathar*, 210.

[29] Ibid, 379 & 386. On ether see: Steven Connor, *The Matter of Air: Science and Art of the Ethereal* (London: Reaktion Books, 2010), 149–172. The Michelson-Morley experiments of 1887 disproved the existence of ether as universal medium (Albert Michelson went to be a supporter of Wilfred's lumia) but, as Connor describes, both scientists and occultists continued to latch on to the idea. The theremin was also originally known as "the etherphone."

[30] On the association of "purity" with medium specificity in musical aesthetics, see: Mark Evan Bonds, *Absolute Music: The History of an Idea* (New York: Oxford University Press, 2014), 107–108.

[31] *Nourathar*, 210.

[32] Ibid, 45.

previously cited description of the "Siamese twins" of color music, a term that suggests in her usage not only hybridity, but monstrosity. Light expressively wrought was even better than everyday experiences of light: she distinguished between natural light in the world, which she called "light for seeing" and set akin to noise, and *nourathar*'s artificial and expressive light, which she referred to as "light for feeling," more comparable to music.[33]

Greenewalt maintained a strict division between the spatial and temporal arts (Lessing's *Nebeneinander* and *Nacheinander*) in her writings, with *nourathar* firmly in the latter category, an "art of succession." She considered light to possess a vague sense of a rhythmic beat in common with music. As she wrote in *Nourathar*, "it is to be remembered that all the arts created in their forms by time and its beat hark back to the same blood-propelling pulse of all humanity."[34] Her emphasis on the temporal dimension of her work may explain her antipathy towards representing any distinct spatial forms in her work. Her "flood of light" was also intended to be "substantially shapeless."[35] Yet by placing *nourathar* into a neatly bifurcated model of all the arts, she minimized some of the more important and innovative aspects of her own work. As Michael Betancourt notes, Greenewalt's art may be thought of as a form of "architectural lighting".[36] Matthew Guerrieri similarly writes that, "demonstrations of *Nourathar*

[33] Ibid, 18.

[34] Ibid, 231; and Greenewalt, "Light, Fine Art the Sixth," 3. See also Greenewalt, "Time Eternal," *Metaphysical Magazine* 19, no 8 (October 1906), 21–29.

[35] Greenewalt "United States Patent Reissue 16,825: Method of and Means for Associating Light and Music," filed August 30, 1918, issued January 15 1924, reissued December 20, 1927, disclaimer filed December 23, 1933.

[36] Michael Betancourt, *The History of Motion Graphics: From Avant-Garde to Industry in the United State*s (Rockville, MD: Wildside Press, 2013), 24

were more like site-specific installations than concert performances."[37] Since the performance space was the canvas on which she worked, and since she never succeeded in build her egg-shaped auditorium, space must have been essential to the audience's experience of her work, as well as to the practicalities of planning each performance. However, she appealed to a conservatively divided aesthetic model to explain *nourathar*'s place among the arts.

Justifying her conception of an autonomous light art not only required establishing that it had a unique medium and that it fit into the mold of a temporal art, but also necessitated the renunciation of music as a necessary multimedia component. Such an endeavor was not inconsequential; Greenewalt's conception had clear origins as a part of her musical performance routine. In a 1916 article in the *Philadelphia Ledger*, she represented her work as a response to the poor state of lighting in concerts.[38] In the 1922 *New York Times* interview, she continued to describe the conception as arising from a desire for greater control over the concert ambience in her time as a performer:

> Should I take on freakish personal attributes in order to draw to myself the attention of the managers and the public? No, I decided, I could never do that. The idea came to me that I must find something new – even something startling – not for myself, but for my art. Then came the flash – sunlight makes the world sing; why shouldn't light help the song sing?[39]

[37] Matthew Guerrieri, "Mary Hallock Greenewalt's Illuminated Music," accessed April 5, 2019, http://daily.redbullmusicacademy.com/2017/09/mary-hallock-greenewalt-feature.

[38] "Lights Measured to Flowing Music," *Philadelphia Ledger* (September 22, 1916), press clipping, Box 7, Folder 7, Greenewalt Papers.

[39] Rosner, "New 'Color Organ' to Interpret Music."

Indeed, this framing indicates that Greenewalt initially understood colored lighting as a gimmick that she thought she could employ to differentiate herself in a crowded market of concert pianists. Additionally, nearly all her light projections took place alongside music and in concert-hall-like spaces. However, Greenewalt's definitions of the light art of *nourathar* from the late 1910s—but especially those from the 1920s—suggest music was no longer a necessary constituent of her art form. *Nourathar* now meant light in isolation as well as a component in multimedia. She also suggested that *nourathar* could appear with any "any art of succession"—including dance and theater, not just music. By 1946, when Greenewalt published her monograph, she predicted that one day, independent light works without musical or any other accompaniment could be composed, but she did not think the world yet ready for that.[40]

Her patents and descriptions of her technologies also bear witness to her shift in conceiving of *nourathar*'s status as medium. Her eclectic early patents describe her technologies as a "means for associating light and music," but her later patents for the *Sarabet* (filed in 1924 and 1927) describe the instrument instead as an "instrument for light and color play."[41] She claimed already in 1923 that her earlier patents were "kept hitched to music" because her lawyers "thought the patent office would not allow claims based on timing light and color successions according to the timing of pulse and respiration nor on the 'rhythm' of the arts of succession."[42] The 1924 patent describes her objective as providing "such means as will allow playing with light and color for substantially similar purposes as one plays with music

[40] Greenewalt, *Nourathar*, 396.

[41] Compare: Greenewalt, "United States Patent Reissue 16,825"; and Greenewalt, "United States Patent Number 1,731,772: Instrument for Light and Color Play," filed January 3, 1924, issued October 15, 1929.

[42] Letter from Greenewalt to Mr. Biebel, June 4, 1923, Box 1, Folder 7, Greenewalt Papers.

sounds…for the exercise of emotional and abstract expression."[43] By this point music functioned as analogy rather than necessary accompaniment. As described in this patent, illustrating music is no longer the *Sarabet*'s *raison d'être*: the end is expression. *Nourathar* may thus adhere to André Gaudreault and Philippe Marion's model for the genealogy for media: that emerging media have two births, first the "integrating birth" (subordination towards other media and their attendant institutions) and then the "distinguishing birth" ("a movement towards detachment" from other media and existing institutions).[44] Greenewalt suggested this progression, when, looking back in 1946, she wrote: "It is a fine art in itself alone, in spite of its start."[45]

The fact she continued to perform almost exclusively with music did necessarily not undermine Greenewalt's beliefs. Music could make the new art of light more accessible, she argued. She wrote of having "nailed down the meaning held in the light play by music played in parallel with it."[46] Whereas aestheticians and music theorists have usually considered music the indefinite component in musical multimedia, in which the words of song or visuals of film may tether music to specificity, Greenewalt seemingly considered musical meaning accessible and specific enough to tether light.

Despite Greenewalt's attempts to make *nourathar* independent of music, I would argue that *nourathar* was an innately musical art. In particular, Greenewalt's understanding of light as an expressive medium was based on light's potential similarities with instrumental music.

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[43] Greenewalt, "United States Patent Number 1,731,772."

[44] André Gaudreault and Philippe Marion, "The Cinema as a Model for the Genealogy of Media," *Convergence* 8, no. 4 (2002), 12.

[45] Greenewalt, *Nourathar*, 154.

[46] Ibid, 63.

Philosopher Derek Matravers summarizes two of the differences between the expression of emotion in music and painting to suggest why the former has been prone to attract the rhetoric of emotions rather than the latter: firstly, music is temporal (music takes place in time as does that act of expressing emotions); secondly, since music is performed, emotional expression may be attributed to either performer or composer.[47] I would add that instrumental music's lack of semantic specificity, its vagueness or abstraction, invites interpretation in the terms of (to quote Berlioz quoting Chateaubriand) the vagueness of emotions. *Nourathar* shared music's vagueness, abstraction, temporality and performativity. Greenewalt's light work might still be understood as remediating music, but in comparison with her predecessors, she had a different understanding of what music was. Music, for Greenewalt, was not primarily a changing series of pitches or chords nor a sounding out of universal harmony; instead it was "feeling in essence," as she wrote in *Nourathar*.[48] Thus, rather than abandon the analogy between light and music altogether, she changed its terms. Music, therefore, was not only part of *nourathar*'s origin story, but a fundamental component of its continued and evolving realization as an art form. The aspects that Greenewalt most prized about *nourathar*—its pure medium, its temporal nature, its expressiveness—were the same elements she associated with music.

[47] Derek Matravers, "Expression in the Arts," in *The Oxford Handbook of Philosophy of Emotion*, ed. Peter Goldie (Oxford: Oxford University Press), 627. Matravers includes a third difference too: that the "musical expression of emotion" is distinct from the "natural expression" of emotion, whereas painting can be understood as the "natural expression" of emotion.

[48] Greenewalt, *Nourathar*, 290.

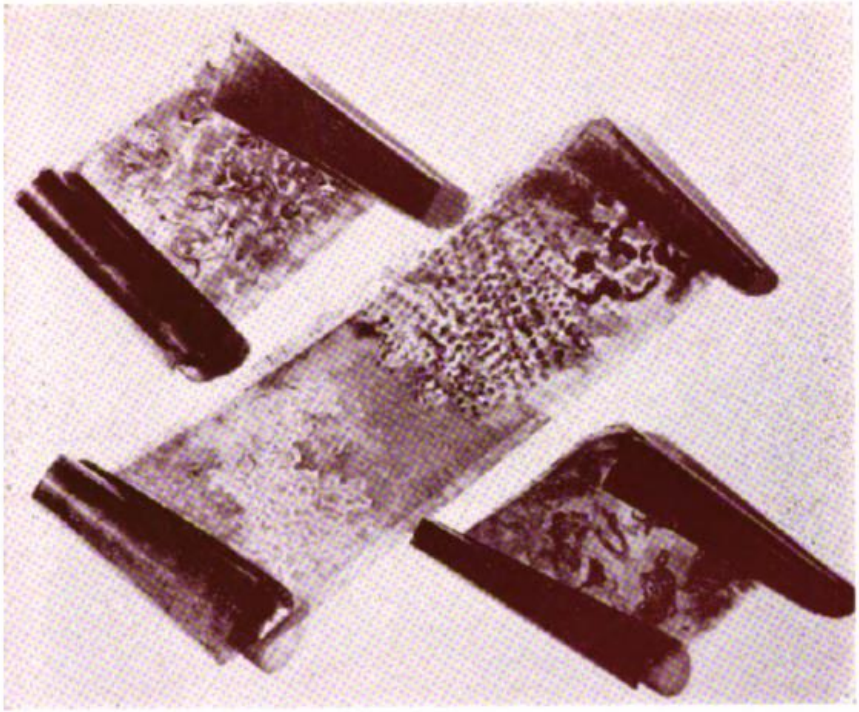

Figure 3.1: Greenewalt's photograph of her film rolls for three pieces of music (from Greenewalt, Nourathar*, 270).*

From Color Organ to *Sarabet* (via Film)

Greenewalt's attempts to distance herself from the color music past and establish a new art form that was true to light as a medium were also embodied in her newly-invented technologies. Greenewalt's *Sarabet* appeared after a period in which she experimented with other mediums in pursuit of the control of luminosity and color. Despite their varied nature, these technologies all comprised a break with the established concept of the color organ. They provide further clues as to the development of her aesthetic, as they materialize it. However, Greenewalt's own position on the relationship between these technologies and her vision of *nourathar* as a "fine art" could be ambivalent.

Between 1909 and 1916, Greenewalt experimented with dyed translucent materials—gels, developed photographic film, and cellulose acetate. These translucent materials could be

drawn in front of a source of light, such as a stereopticon, to reproduce a preconceived color series. Although these "gel films" do not survive—possibly owing to their fragility—some of her attempts with cellulose acetate remain extant (figures 3.1 and 3.2). I maintain that practices of using such materials become "quasi-filmic" or "para-filmic" because they employ various forms of "film" and projection. However, as Michael Betancourt suggests, the gel films lack many traditional features of "motion pictures": they cannot be loaded into a projector, they do not have frames, and they are extremely large in size.[49] Nor were they intended to be projected onto screens. Betancourt is, however, wrong to conclude that these films served as "scores" that were only visible to the performer and not the audience, as is clear from the lengthy discussions of these early performances in Greenewalt's later court cases and her own accounts.[50]

For the early performances from 1911 to 1916 in which she employed these technologies, Greenewalt played the piano and did not directly handle the lighting equipment and films; these tasks were left to an assistant, Miss McBurney. Lines drawn alongside the edge of the surviving examples in the archive demonstrate how the coordination between color sequence and music might have been achieved: each line represents a musical beat, with the first beat of each

[49] Betancourt, "Mary Hallock Greenewalt's Abstract Films," *Millennium Film Journal* 45/46 (Fall 2006), accessed April 1, 2019, http://mfj-online.org/journalPages/MFJ45/Betancourtpage.html. Later in this chapter I explain the numerous erroneous historical claims that Betancourt makes vis-à-vis these films.

[50] Betancourt makes this claim seemingly mainly based on the lines on their edges representing beats, but Greenewalt mentions these lines in conjunction with the rolls' use to project color in live performance. He then cites a patent for this claim (Greenewalt, "United States Patent 1,714,504: Control System for Light and Color Players," filed July 16, 1925, issued May 28, 1929) that he describes as showing the films in a score capacity but in fact this patent suggests the use of film or a "translucent sheet" to change light colors with the express purpose of illuminating an auditorium space. Her book additionally makes clear her comittment to the notation system she patented in her light-score patent (Greenewalt, "United States Patent 1,385,9440: Notation for Indicating Lighting Effects," filed August 18, 1919, issued July 26, 1921). Unfortunately this claim has been repeated in: R. Bruce Elder, *Harmony + Dissent: Film and Avant-garde Art Movements in the Early Twentieth Century* (Waterloo, Ont.: Wilfrid Laurier University Press, 2008, 78); and Sarah Street and Joshua Yumibe, *Chromatic Modernity: Color, Cinema, and Media of the 1920s* (New York: Columbia University Press, 2019).

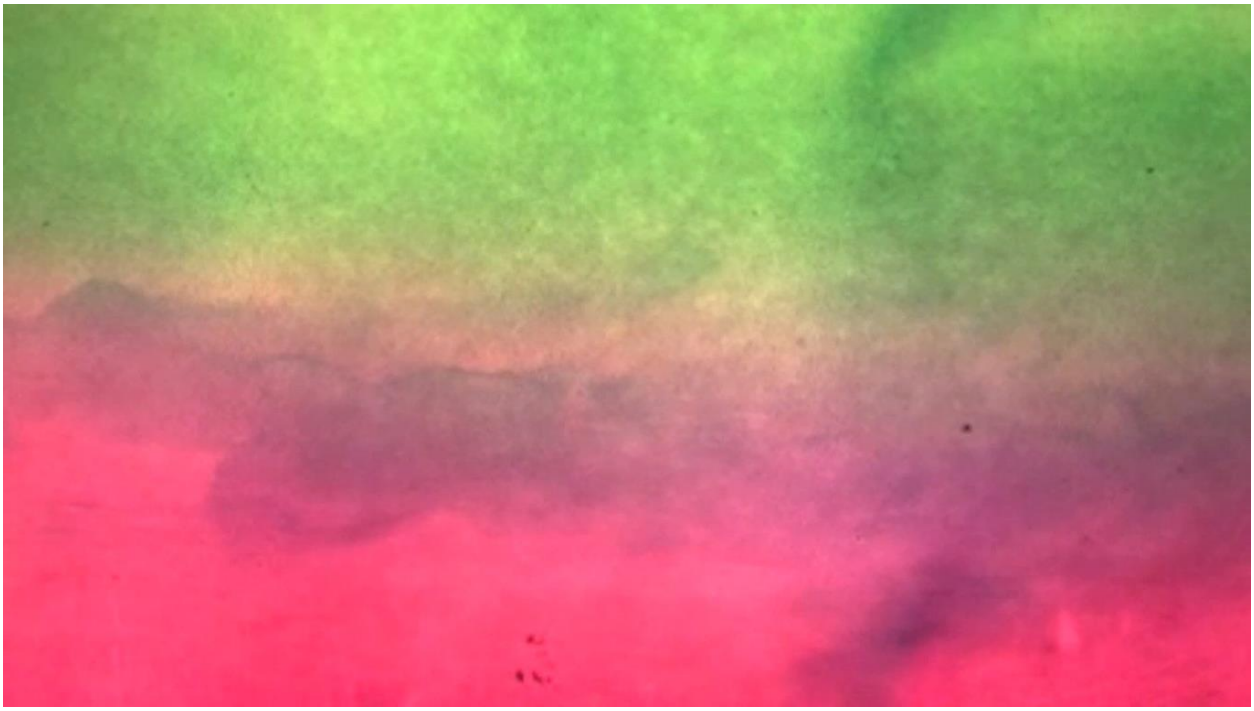

Figure 3.2: Still from a video of the unfurling of acetate film for Debussy's La Lune Descend Sur La Temple Qui Fut *(video provided by the Historical Society of Pennsylvania).*

measure drawn larger. Reports suggest that the light in these early performances was cast over Greenewalt (and the area around her) as she played.[51] She was not entirely satisfied with the results. For example, in the first public exposition of her conception in Wanamaker's Egyptian Hall in 1911, she joined together "pieces of gelatine (sic)… so that there would be gradual changes from color to color" but still found both the color and light patchy.[52] By 1916, when Greenewalt performed for the Convention of Illuminating Engineers, she had devised a long roll of spray-painted cellulose connected at either end to two rolls to be passed in front of a light and a "fan apparatus" that could gradate light intensity.[53] For Greenewalt, the 1916 concert marked a

[51] "Brief for Plaintiff-Appellant," 7–15: Greenewalt's lawyers noted the use of spotlighting instead of floodlighting.

[52] Ibid, 8. Similar materials were employed during concerts in 1914 in Perkiomen Seminary (Pennsburg, Pennsylvania) and Dayton, Ohio.

[53] Ibid, 12–13.

dramatic shift in her use of light because of her new ability to control light intensity; what she had done before was "experimentation," but this performance marked the beginning of what she understood to be her real art.[54] As Greenewalt sought to patent her work, she was advised by a lawyer in 1916 that the colored "films" in isolation were not patentable, but that they could be so in combination with a device for light production.[55] Perhaps for this reason, she repurposed her films in future patents. For example, the films reappear in her design for a sort of "light gramophone" which allowed the pre-conceived color sequences to be drawn automatically in

Figure 3.3: Greenewalt with her "light phonograph" housed in an elaborate sculpture (from "Applying Spectral Colors to Music").

[54] Ibid, 14.

[55] Letter from Charles Butler to Greenewalt, September 25, 1916, Box 36, Folder 9, Greenewalt Papers.

front of a light source in combination with a gramophone.[56] The phonograph and the lighting machinery were to be housed together in an elaborate large dome (figure 3.3). The light was only intended to fill and extend a little beyond the dome. This constituted Greenewalt's only attempt at making an instrument solely designed for the domestic market. Two further patents included a system for automatic lighting that consisted of extra apertures on a perforated player piano roll and for a vague "device or structure" to be attached in some way to a musical instrument such as a piano or organ for light production. These patents were deliberately vague and far-reaching, but

Figure 3.4: Greenewalt at her sarabet (from Nourathar, *159)*

[56] Greenewalt, "U.S. Patent no. 1,345,168: Illuminating Means," filed January 18, 1919, issued June 29, 1920. In Gregory Zinman's dissertation, he confusingly describes this as Greenewalt's *Sarabet*, but she never used the term for this device: Gregory Zinman, "Handmade: The Moving Image In The Artisanal Mode" (PhD Diss., New York University, 2012), 289.

colored films were again mentioned, with the possibility of either manual or automatic control, as a method of reproducing color sequences.[57]

A few years later, however, Greenewalt would abandon film as a medium in favor of her *Sarabet* (figure 3.4). The first model of the instrument appeared in 1918, the accumulation of a number of technologies: rheostats, rotary actuators, and remote-controlled lights.[58] The eventual instrument had three "scales" of luminosity with a smoothly glide-able handle working on a pulley system to move along a rheostat (i.e., a resistor to control current) on a scale that Greenewalt described with reference to natural light, progressing from starlight to moonlight to twilight to auroral to diurnal to superbright (figure 3.5). The number of increments encompassed by these scales depended on the wattage of the light, but at 1,500 watts, the increments would number 267. Foot pedals, either two or four depending on the model, could also be used to control the scales—and thus luminosity—when the hands were otherwise occupied. The rotary

[57] Greenewalt, "U.S. Patent no. 1,481,132 (reissued 16,825)"; and Greenewalt, "U.S. Patent no. 1,714,504." Unlike the phonograph and *Sarabet* there is no record that the devices described and diagrammed in these patents were manufactured.

[58] Greenewalt's patent for her rheostat is the first of her patents to physically resemble the *Sarabet* and to have the ability to control luminosity (Greenewalt, "U.S. Patent no. 1,357,773: Rheostat," filed December 10, 1919, issued November 2, 1920) and therefore might justly be called the first *Sarabet*. This patent was filed in 1919. Michael Betancourt labels patent nos. 1,481,132 (reissued 16,825) and 1,714504 "*Sarabet*s" in his publication of a collection of Greenewalt's patents, but, although the patents are sufficiently wide-reaching in their claims to include the *Sarabet*, Greenewalt did not use the term in the patents and none of the technologies diagrammed or described resembles the *Sarabet*. Betancourt ed., *Mary Hallock Greenewalt: The Complete Patents* (Rockville, MD: Wildside Press, 2005), 39–71.

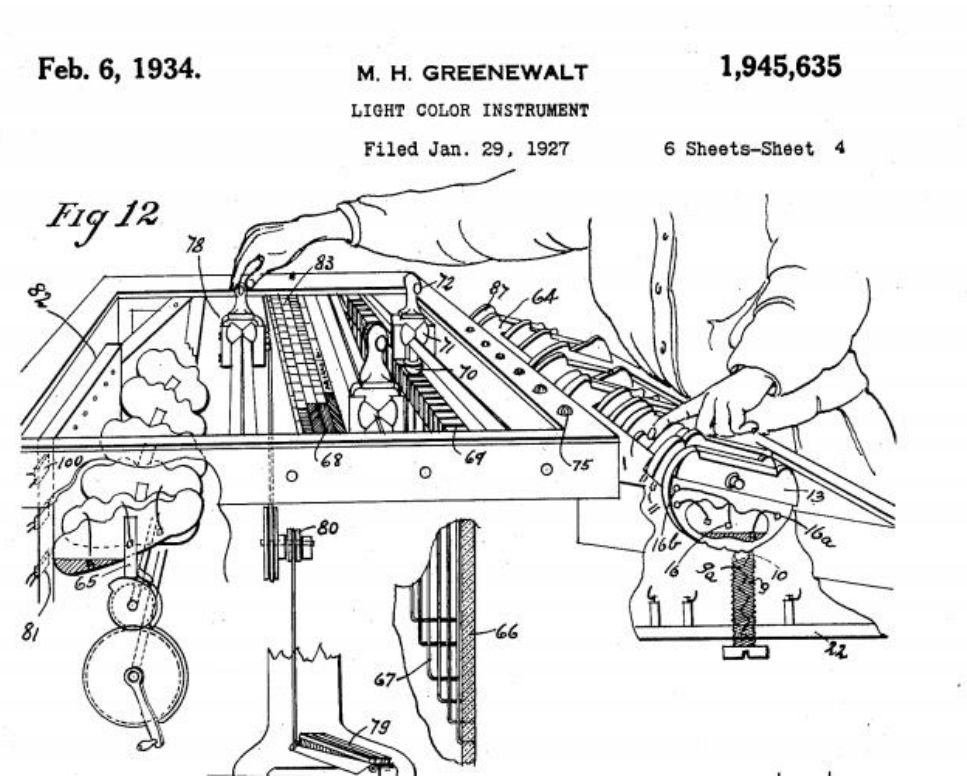

Figure 3.5: Diagram of the sarabet control (From "U.S. Patent 1,945,635").

actuators, placed nearest the player, were forms of mercury switches to redirect the current to different light bulbs, changing the position and color of the light. Greenewalt's switches included liquid for silent operation. The number of rotary actuators depended on the number of lights to be controlled.

The *Sarabet* took the form of a lighting control console. As acoustic musical instruments produce the sounds within the space of the instrument, older color organs had lights appear in or project from part of the instrument. In Greenewalt's instrument, however, the output—light—came from separate and variable equipment. Her instrument thus functioned more like an electronic musical instrument, in as far as what it produced was electricity that was then separately converted into light. Although she named the lights she used "nouralions"—thereby implying their importance to the entire mechanism—the lights could vary in number and wattage

and had to be placed as appropriate for the space in which the *Sarabet* was being played. In her book *Nourathar*, she recommends twenty-two 1500-watt lights (two each for six colors, two for white light, and two for contingency), grouped into three to correspond to the three rheostat scales, but she frequently worked with significantly fewer.[59]

When Greenewalt renewed her 1918 *Sarabet* patent in 1933 she added a disclaimer that distanced herself from film as a medium: "I disclaim the use of stereoptically focused images such as are known as painted pictures and the like, projected between lenses as distinguished from the use of substantially shapeless flood of light."[60] Why did Greenewalt turn away from film? The technologies themselves suggest a general trajectory in her priorities over the 1910s from color (patched together in films and gels) to intensity (varied through the rheostat). The *Sarabet* embodied and enabled the subtle control of light intensity as an analogy for emotional intensity. While the preserved films do not present representational imagery, they do contain rather sharp lines when one color passes to the next, implying a different effect to the gradual and seamless effects that Greenewalt cultivated in her *Sarabet* performance with the aid of her rheostat. Additionally, the *Sarabet* differed from her early phonograph- or player-piano-related conceptions in which the means of light production was directly attached to the means of sound production; the *Sarabet* was on its own a silent instrument, signaling Greenewalt's desire for independence from music.[61]

[59] Greenewalt, *Nourathar*, 149.

[60] Greenewalt, "U.S. Patent no. 1,481,132 (reissued 16,825)." See below for the legal implications of this disclaimer.

[61] Greenewalt was concerned that even the switches in the *Sarabet* would be silent, which explains why she used specially-designed mercury switches.

The *Sarabet* also affirmed Greenewalt's rejection of color-tone parallels and her desire for light-specific instruments and interfaces. Most obviously, this rejection was materialized in the *Sarabet*'s lack of a musical keyboard interface. The instrument thus represented a turn away from the digital in two meanings of the word: firstly, although the hands were still required for performance, independent finger work was not (despite Greenewalt's piano-playing background); secondly, in contrast to the discrete colors represented by the black and white keys of earlier color organs, Greenewalt created a near-continuous scale that was also played in a continuous fashion because of its glideable control. Because of this continuity, Greenewalt's interface may be considered "analog," a word that is also apt because the instrument and its interface were intended to analogize the human emotions in their temporal and subtle changes, particularly as these were expressed in music; Greenewalt felt that the instrument and her art needed this continuity in order for the analogy to work. Smoothness was therefore built into the instrument, not just in the rheostat, but in all its facets—from the slideable handle on the rheostat to the liquid contact in the actuators.

Despite the necessity of new technologies to everything she accomplished, Greenewalt stressed a separation between device and artform: "It [*nourathar*] is nailed to the cross of mechanical parts."[62] Describing light as her medium, rather than acknowledging the specifics of the *Sarabet*'s pulley and keys and mercury switches, Greenewalt affirmed an aspiration towards the pure, understood as the immaterial. In the context in which Greenewalt was working, the existing fine arts (which she enumerated as painting, music, sculpture, architecture, and poetry) probably seemed far removed from electronic technologies; repeatedly claiming light over

[62] Greenewalt, *Nourathar*, 379.

electricity or machine as the medium therefore pre-emptively assuaged any doubts or criticisms about her work's status as art and her status as an artist.

However, the relationship writ large between machines and art form was complex. In prioritizing light over her specific light-producing machines, Greenewalt represented her creative process: she began with the goal of realizing a conception of a light art and devised the technologies to do so only later. Her diverse approaches attest to this: her early forays with dyed film seem far removed from the elaborate lighting controls of her later *Sarabet*. On the other hand, as Guerrieri writes, "her vision realized the machines; the machines realized her vision."[63] Chris Salter talks of practices like this as "entangled," "that consciously and intentionally entangle technologies so that they are inseparable from the form and operation of the work."[64] The machines engendered a specific model of light art, one with an emphasis on large swathes rather than specific form, and one that emphasized subtle control of luminosity over all else. Greenewalt was able to claim that the *Sarabet* perfectly fit the medium of light precisely because her conception of light perfectly fit—and could be produced and realized by—the *Sarabet*.[65] She would eventually discredit the early embodiments of her ideas (the films and gels) as being not true *nourathar*, as they failed to align with her later vision of what this term meant formally and materially.

[63] Guerrieri.

[64] Chris Salter, *Entangled: Technology and the Transformation of Performance* (Cambridge: MIT Press, 2010), xxxv.

[65] Greenewalt, *Nourathar*, 105.

Notating *Nourathar*

Alongside her para-films and *Sarabet*, Greenewalt's notation also constituted an essential technology for *nourathar*, since it was to be a performance art with repeatable results. She acknowledged this in patenting her "light score" method. Greenewalt developed two systems for *nourathar* notation, which align with the two broad stages of technological development in her instruments and practice. The first system (figure 3.6) was devised either alongside or just before the films Greenewalt publicly displayed in the 1910s—and, like those films, her lawyers deemed

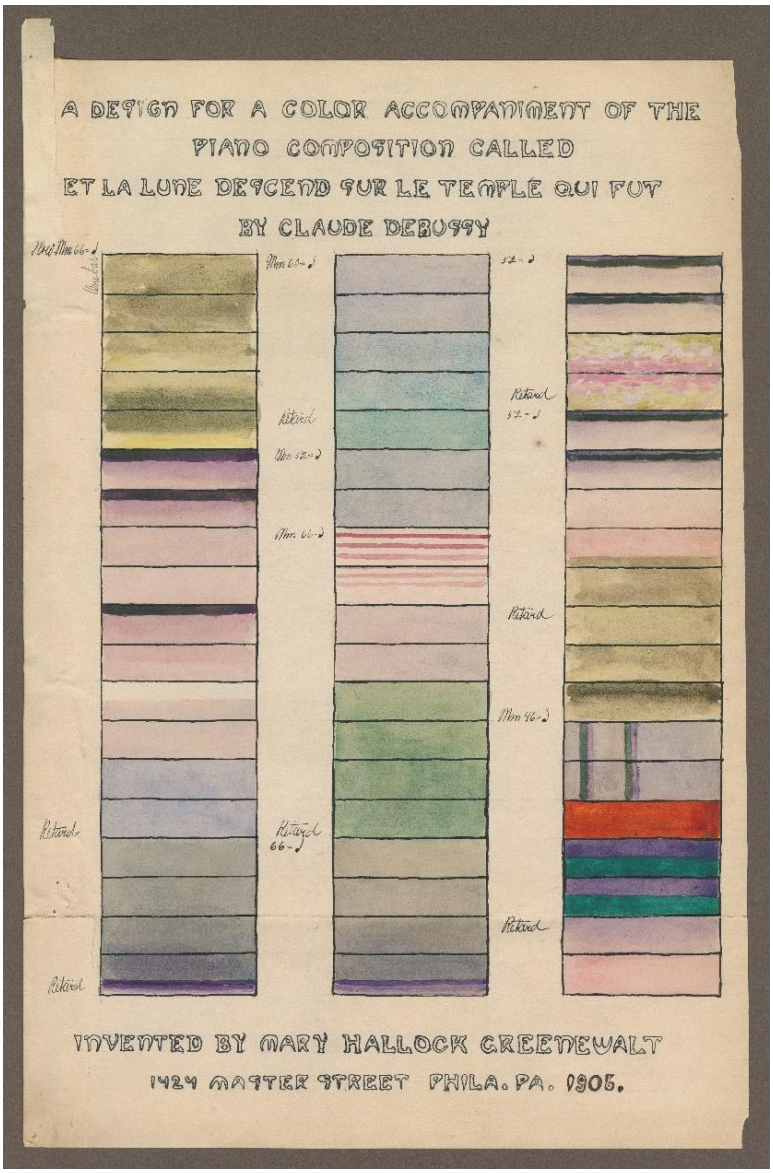

Figure 3.6: "Design for a color accompaniment of the Piano Composition called Et La Lune Descend Sur La Temple Qui Fut," (Box 31, Folder 16, Greenewalt Papers).

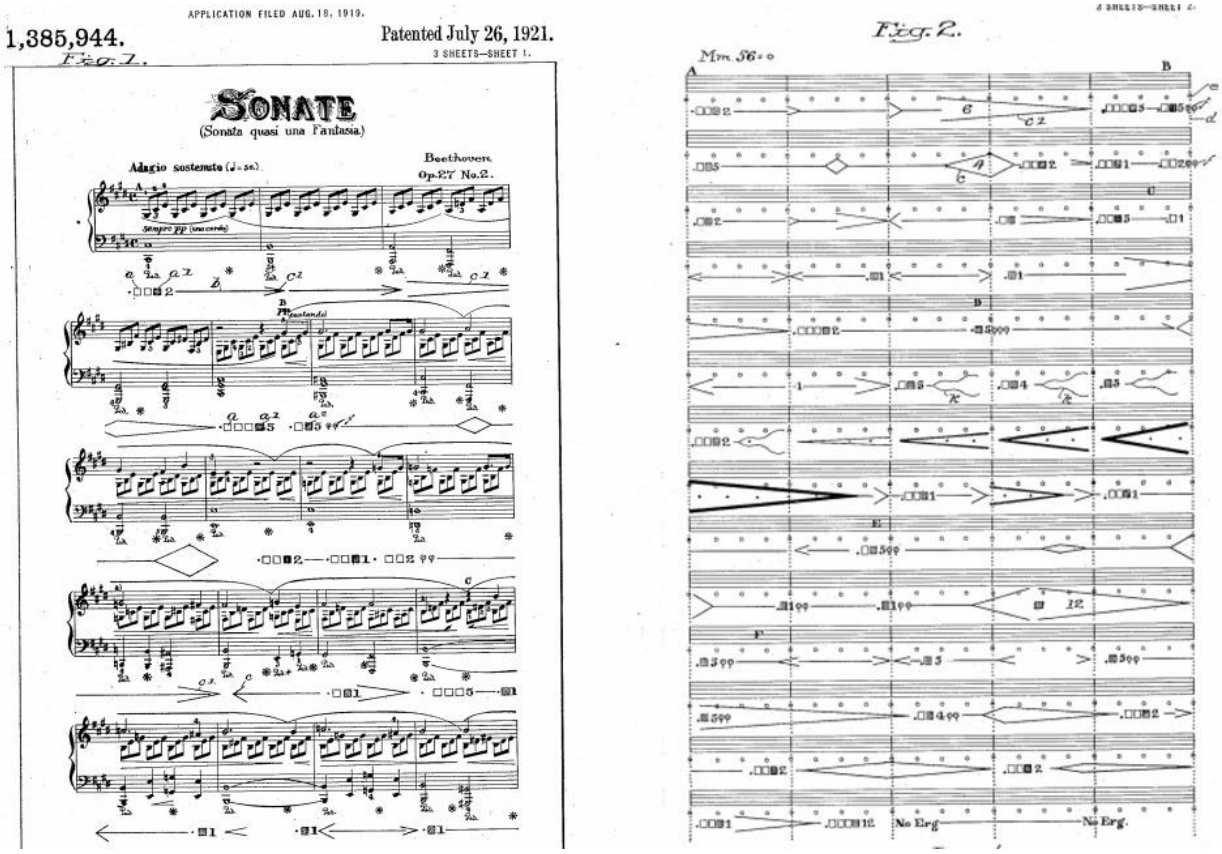

Figure 3.7: Two Light Scores for the first movement of Beethoven's Moonlight Sonata from Greenewalt's U.S. Patent 1,385,944.

this notation system unpatentable.[66] The surviving example of this kind of notation, an accompaniment for Debussy's *Et la lune descend sur le temple qui fut*, consists of a series of watercolored boxes to represent the colors of the proposed light accompaniment; in the case of the Debussy piece, the boxes each represent a measure in 4/4.[67] Despite Greenewalt's constant emphasis on intensity in her later writings, only differences in shade are perceivable in this rendering, reflecting the limited control of luminosity available in her earlier experiments. However, she was granted a patent for a more complex, symbolic notation concept in 1919,

[66] Letter from Howson and Howson to Greenewalt, October 10, 1916, Box 36, Folder 9, Greenewalt Papers.

[67] "A Design for the Color Accompaniment of the Piano Composition Called Et La Lune Descend Sur Le Temple Qui Fut by Claude Debussy," Box 32, Folder 2, Greenewalt Papers.

around the same time as she patented her rheostat design (figure 3.7).[68] Perhaps looking for greater precision—and something that could feasibly be awarded a patent—she turned away from her painting qua graphic score, towards a notation of bars and musical staffs. Greenewalt's patent includes two different (if closely related) examples of lighting notation: one in which the lighting effects are notated under the existing musical staff, and another in which bar lines are preserved and each music/light beat is drawn as a small circle, although the musical notes are absent. In comparison to the rudimentary colored-in boxes she first devised, the notation has multiple means of showing intensity, including light "crescendos" and "diminuendos" and precise indications of luminosity in "lambert" units (although it is unclear that Greenewalt would have reached these with any exactitude). This latter notation system captures the aesthetic of the *Sarabet* and the capabilities of the rheostat.

In some ways, the two notation models are radically different. The contrasting methods, like their concomitant film and *Sarabet* technologies, exhibit a shift in parametric emphasis from color to intensity. They also suggest a different relationship between notation and notated materials. In the terms of Peircean semiotics, the shift might be described as from the iconic to symbolic; the color graph from 1906 was intended to resemble the presentation it represents, while the patented method from 1919 contains multiple lines, dots, and shapes that require a key to decode. The first method, despite its unpatentability, seems particularly radical, as a possible precursor to the graphic scores of the post-second-world-war avant-garde. Precedents do, however, exist: as mentioned in the second chapter, Jameson's 1844 book *Color Music* described a method for notating music in the forms of bars of color. Despite their differences, however,

[68] Greenewalt, "United States Patent 1,385,944."

both of Greenewalt's systems are "medium specific," as neither simply doubles musical notation (in the way that Scriabin, for example, had done for the light keyboard part of his *Prometheus*).

Moonlight and Music: Analyzing Greenewalt's scores for Debussy's *Et la lune descend* and Beethoven's Moonlight Sonata

Since video or film recordings of Greenewalt's light performances do not survive, her notation provides the best evidence of how she related music and light. As well as demonstrating that her break with the color music was not merely rhetorical, two extant notated works provide insight into what she meant when she spoke of combining music and light via "emotion" or "subjectvity." In combination with the limited documentation of her illuminated concerts, they also suggest ways Greenewalt's experiments could have been understood by audiences.

The cruder notation for Debussy's *Et la lune descend* suggests a different aesthetic than Greenwalt generally espoused: despite her attempts to blend and bleed colors to suggest particular shades and transitions between discrete hues, the boxes on the notation of the piece suggest a block-like construction rather than gradually developing and shifting lights. However, the music in question is also sectional by nature, with changes in texture, melody, and scale usage roughly every four measures. Greenewalt's setting mostly employs lighting blocks that match Debussy's musical ones, such that when a musical section repeats, the lighting is same or similar. For example, the harmonically unrelated chords, played as block triads in parallel octaves, that populate measures 6 to 11 are accompanied on each occasion of their recurrence with a lavender shade (figure 3.8). However, not all shifts in the texture and rhythm are equally marked: measures 12 to 16 remain in the lavender of measures 6 to 11 despite the faster rhythm,

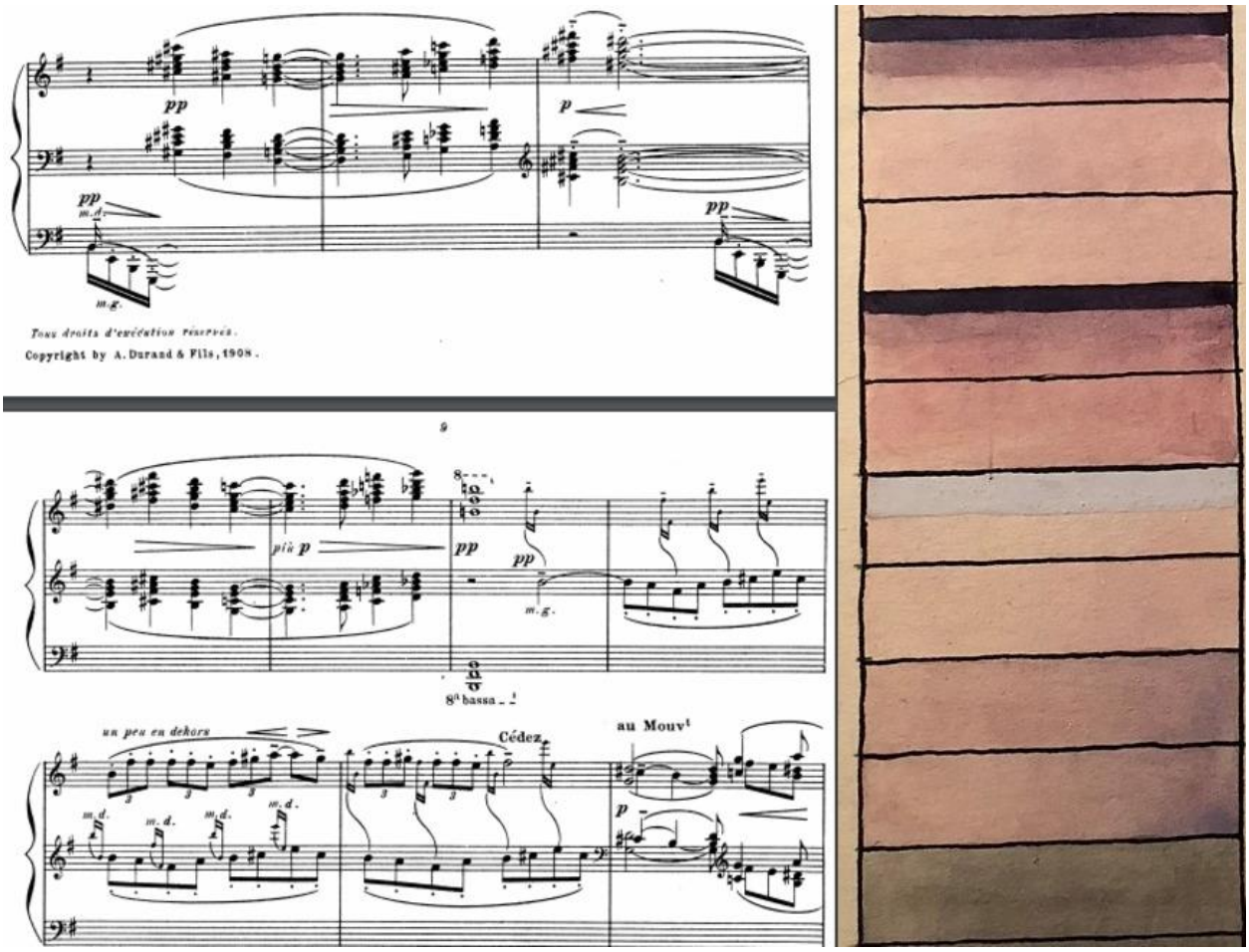

Figure 3.8: Measures 7 to 17 of Debussy's La Lune... *with Greenewalt's setting.*

thinner texture, and move to the E Dorian scale that occur in the music. Additionally, the recurrence of the pentatonic melody from measures 15 and 16 in measures 41 and 42 (figure 3.10) occasions a different color, though this might be musically justified by the new accompaniment/countermelody. Occasionally, smaller gestures are also emphasized through color, such as the broken fifths in the bass in measures 6, 7, and 9 that are represented in dark purple against the lavender shade of the surrounding measures (figure 3.8); the light blue for the widely spaced B minor triad in bar 12; or the individual strikes of red and pink that accompany each staccato note in the rising fifths of the left hand in measures 27 and 28 (figure 3.9). Exposing the limitations of her early film technology, Greenewalt's notation shows largely

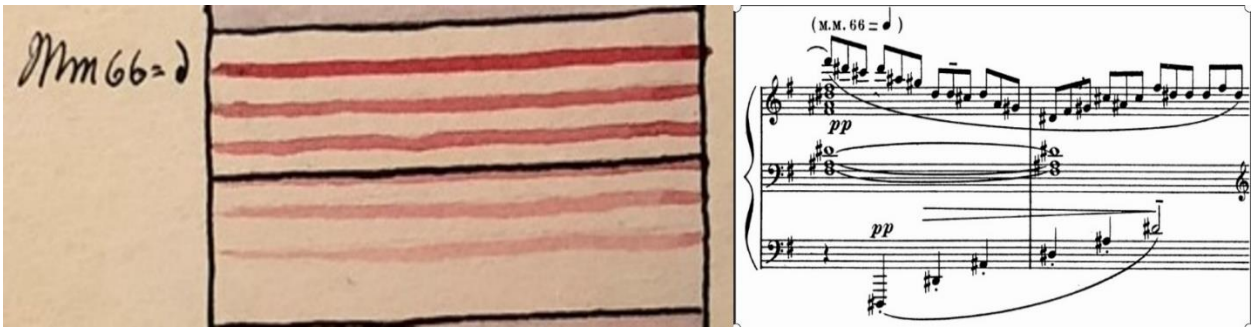

Figure 3.9: Strikes of red and pink for rising fifths in measures 27 and 28.

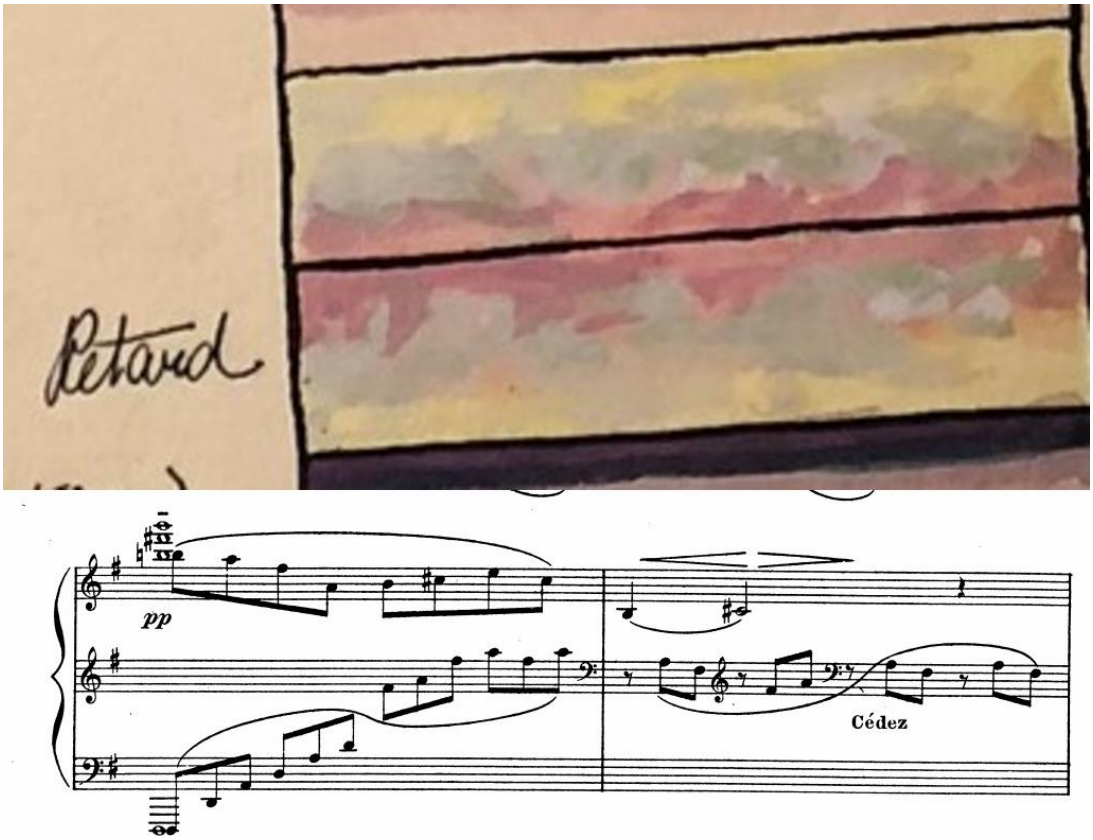

Figure 3.10: Measures 41 and 42 with Greenewalt's setting.

simple block colors with the conspicuous exception of measures 41 and 42 (figure 3.10), in which she pained a mixture of purple, yellow, and blue; the combination here implies a climax to correspond with the relative consonance and tonal clarity of these two measures in the midst of the tonal ambiguity, dissonance, and non-syntactic progressions that surround them. Some of the

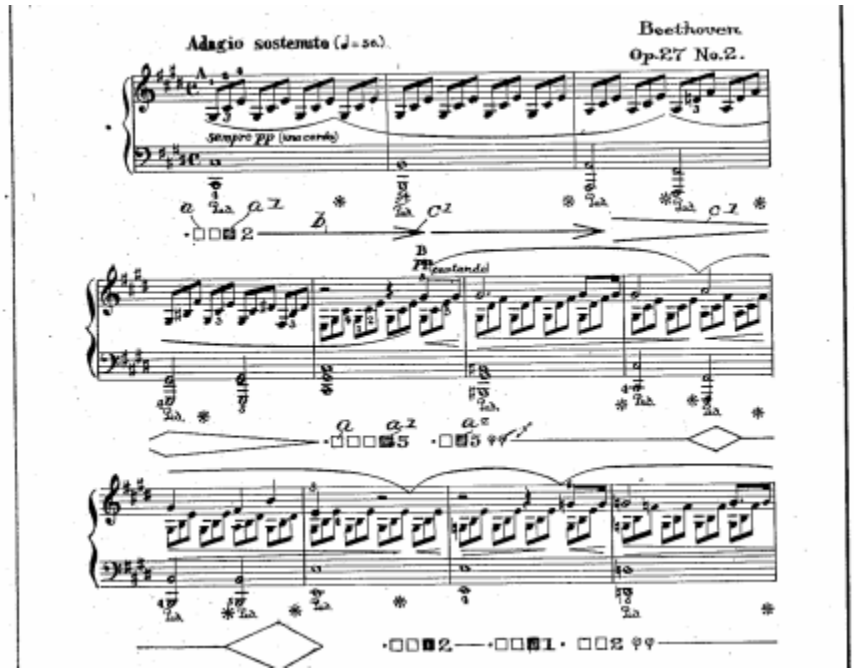

Figure 3.11: Greenewalt's Moonlight Sonata setting, measures 1 to 11 (as demonstrated in U.S. Patent 1,385,944).

color changes within the piece are sudden, such as the striking use of red (for one measure only in the entire piece) to correspond to the piece's barest measure, 53.

The Moonlight Sonata setting (Figure 3.11) reflects the greater control available via Greenewalt's *Sarabet* in comparison to the "films" she earlier used, and its notation emphasizes luminosity over color (although both are indicated—for example, blue light of two thousandths of a lambert for the beginning). In comparison to Greenewalt's setting of the Debussy, the lighting effects in her Beethoven *nourathar* more closely map musical details, particularly melodic contour: for example, small decreases in light intensity at the beginnings of the second and third measures follow the stepwise descent of the bassline and swells accompany ascents in the right-hand melody (e.g. in measures 7 and 8). The relationship with contour is particularly obvious during the middle/development section of the work, in which a repeating ascending

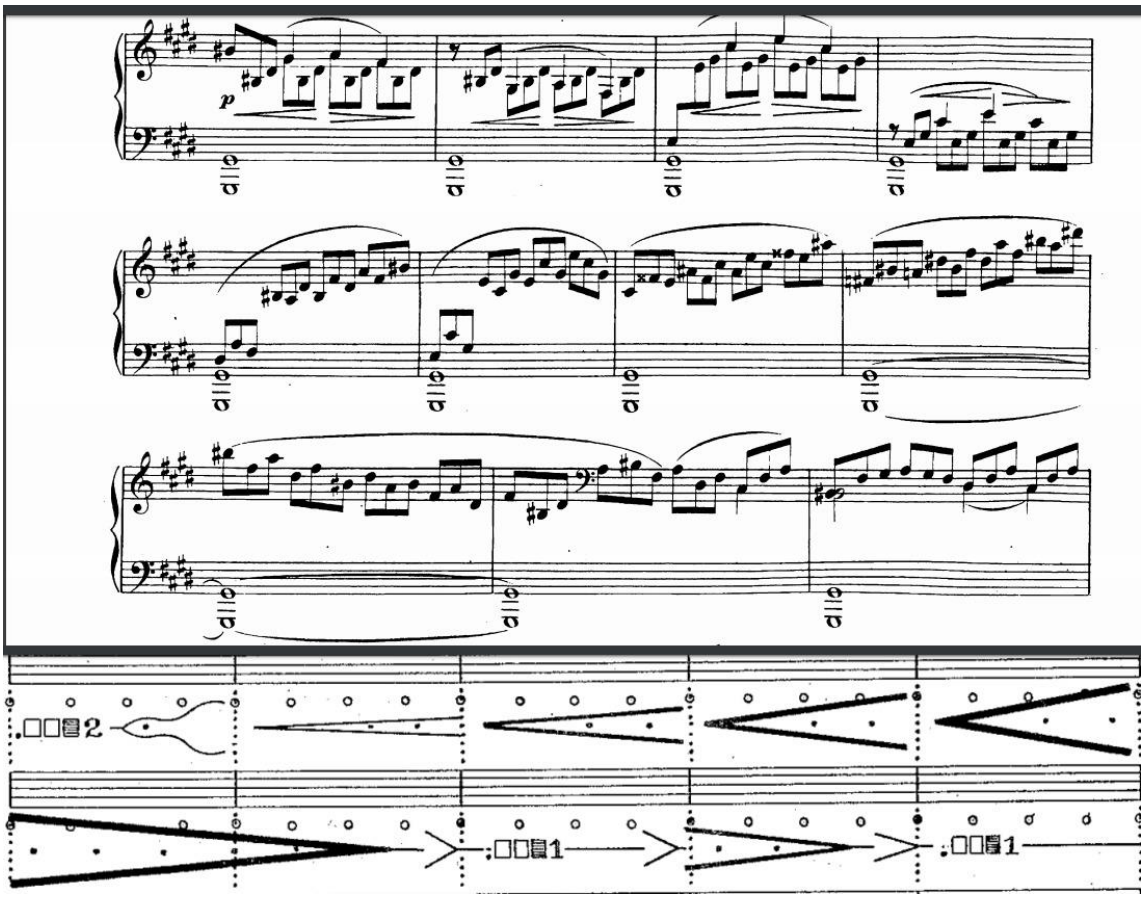

Figure 3.12: light "crescendos" matching the ascents and descents of broken chords in Greenewalt's setting of the middle section/development of Beethoven's Moonlight (Beethoven, measures 28 to 38, and Greenewalt, measures 31 to 40).

broken chord pattern occurs, with each pattern accompanied by its own light crescendo. A larger increase in luminosity and subsequent decrease accompany the ascent to the musical work's highest pitch at the end of measure 35, and the descent of the right hand over the next two measures to the octave below middle C (figure 3.12). Although the score is less precise in regards to luminosity here, it is probable that these increases and decreases matched Greenewalt's dynamic shading in performing the piece. Despite the generally gradual nature of the changes in the setting, a more sudden shift accompanies the entrance of the new right-hand melody with the dotted-note anacrusis in the music's fifth measure: a tenfold increase in light quantity (to five tenths of a mili-lambert) and a change in color to pink. The color of the entire

setting is structured around the contrast between blue and pink—the former associated with the rippling broken chords on their own, the latter associated with the slow, delicate melody on top of this figuration**.** Hence, the middle section (or development) of the movement is rendered entirely blue, while pink returns with recapitulation of the main theme in measure 42.

Greenewalt's lights closely align with obvious musical features, often employing what Nicholas Cook has called "parallelisms of process."[69] In the Beethoven, these parallel processes include luminosity increasing for ascents in pitch and increases in dynamics and the opposite. Since the *sarabet*'s more gradual and continuous operations were not available to Greenewalt, in her setting of the Debussy, the processes in her composition are largely limited to the changes in color that most parallel phrase structure. The one part where a more gradual process unfolds is bars 27 to 28 (figure 3.9), in which the flashes of red that correspond staccato notes in the left-hand part fade gradually to pink as the pitch ascends and the dynamic level decreases. Greenewalt's priorities regarding color perception are manifest in both notated exemplars. In the Debussy, Greenewalt's distaste for quickly changing colors is already apparent, as the colors generally last for measures at a time; in the Beethoven, the color changes are even less frequent, as varying intensity takes priority. Comparing the pieces also shows the continuity of Greenewalt's attempts to match works closely in light, paralleling musical features of contour, dynamics, melody, or form (as defined by melody, harmony, rhythm, and texture). The existence of these color-music homologies demonstrates Greenewalt's thinking of music in larger units than Castel or Rimington, beyond the unit of individual pitch or chord. Cook may be right that "parallelisms of process," such as increases in intensity associated with increases in volume or

[69] Cook, *Analysing Musical Multimedia*, 77. He refers to the "lighting crescendo" of Schoenberg's *Die Glückliche Hand* as an example.

ascents in pitch, are the "most perceptible" of multimedia relationships, but the parallelisms that Greenewalt performed still constituted an intervention in the context of the history of the color organ.

In comparison to these perceptible processes, one might expect the connection between the music and the choice of a specific color to be more allusive. As the previously cited *New York Times* quotation from Greenewalt regarding Beethoven's Moonlight Sonata shows, she associated colors with particular moods and musical features, but she was deliberately non-prescriptive and imprecise on the matter. One journalist described her process as akin to fashion: "something like the choice a woman exercises in choosing a dress of this color for a certain occasion, of another color for an occasion different in kind, or the choice of a man exercises in wearing a necktie of this or that color at this or that time."[70] However, one early review of her work wrote of the "inherent harmony" of colors and music in a performance of Mozart's Turkish Rondo, and a reporter from the *Philadelphia Evening Bulletin* who reviewed an early concert of Greenewalt's from 1916 repeatedly found each color to have been just the "right one" to have expressed a "musical gesture or an image or feeling attached to it."[71]

One explanation of such positive responses could be that these reviewers—and audience members more generally—would have been experiencing the fusion in time of simultaneous sound and image into a single entity, what sound theorist Michel Chion calls "synchresis." The listener-viewers at Greenewalt's concerts could then find the combination of color and music to

[70] "Patent Suit Decided in Favor of Stanley Co.," *Wall Street News*, April 1, 1930, press clipping, box 30, folder 4, Greenewalt Papers. Also cited in Regina Lee Blaszczyk, *The Color Revolution* (Cambridge, Mass.: MIT Press), 196.

[71] "Each Piece a Color in New Melodies," *Evening Bulletin*, September 20, 1916, reprinted in "Transcript of Record."

be apposite, or even perfect, post hoc.[72] The promiscuity of color, its multitudinous associations to various real-world objects and varied possible symbolic readings, combined with the semantic vagueness of music, made Greenewalt's showings particularly receptive to the phenomenon of synchresis. Nonetheless, the confused response to the light used in Scriabin's *Prometheus* during its New York premier suggests limitations to synchresis.[73] The reviewer of her 1916 concert, who had spoken to Greenewalt in an effort to clarify and understand her intentions, interpreted the lights along with Greenewalt's elsewhere-stated goals: as expressing the emotive content of the piece. This emotive linkage was accessible to the concerts' listener-viewers—effecting a sharp contrast to the bemused audiences of the 1915 New York premiere of *Prometheus,* who could not access the more hidden parallel between key areas and color in Scriabin's piece.[74] Greenewalt's music-color relationship was more legible because both tones and colors were tethered to a more accessible feature of both: emotion.[75]

The choice of two moonlight-related pieces to demonstrate Greenewalt's technologies (film, *Sarabet*, notation) can be no coincidence. Although later programs of hers contained a variety of popular classics, these two pieces featured heavily in her earliest performances, the

[72] Michel Chion, *Film, A Sound Art*, trans. Claudia Gorbman (New York: Columbia University Press, 2009), 492.

[73] For the reception of this piece, see James M. Baker, "Prometheus and the Quest for Color-Music: The World Premier of Scriabin's Poem of Fire with Lights, New York, March 20, 1915," in *Music and Modern Art*, ed. James Leggio (New York: Routledge, 2002), 61–95.

[74] On the relationship between light and music in this work, see Kenneth Peacock, "Synesthetic Perception: Alexander Scriabin's Color Hearing," *Music Perception* 2, no, 4 (Summer 1985): 483–506.

[75] Recent research suggests that when non-chromesthetes are asked to associate music and color, they rely on mood or emotion to make the connection: William Griscom and Stephen Palmer, "Emotional Mediation of Cross-Modal Associations in Timbre-Color Synesthesia," *Journal of Vision* 14, no. 10 (August 22, 2014): 1003–1003; Stephen Palmer et al., "Music–color Associations Are Mediated by Emotion," *Proceedings of the National Academy of Sciences* 110, no. 22 (May 28, 2013): 8836–41.

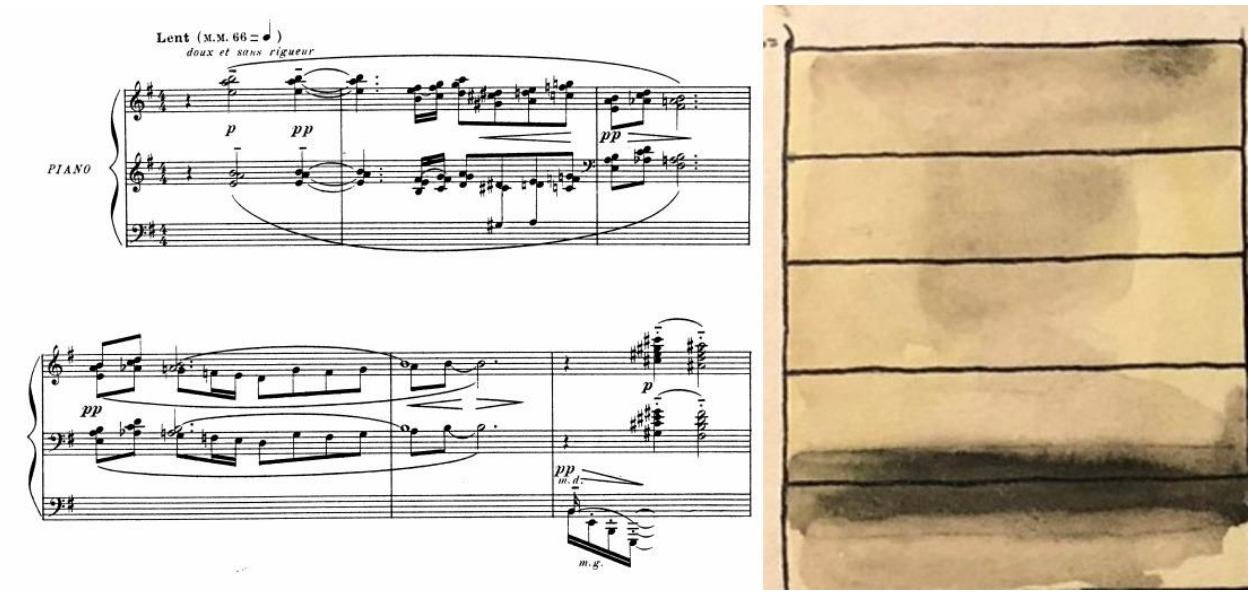

Figure 3.13: Debussy, La Lune*…, measures 1 to 6, and Greenewalt's setting, measures 1 to 5.*

Debussy being the first piece she ever performed with lighting effects in the 1911 concert.[76] The choice of musical works that evoked light could have been one way in which she sought to increase accessibility and understanding of her activities, giving audiences an obvious hermeneutic window onto her relatively novel activities. The lighting for these pieces could be interpreted as depictive. The combined black-yellow of the opening of the Debussy, which reappears for the return of the initial melody and its accompanying quartal harmonies towards the end of the piece (figure 3.13), could suggest faint light in the night sky—a programmatic hearing of these measures as the moonlight of the work's title. Similarly, the grey-blacks prescribed for measures 16 to 19, as well as its musical repetition a tone higher between measures 35 and 38, may suggest the night sky.[77] In contrast to *Et la lune descend*, Greenwalt

[76] A program from 1939 included both Saint-Saens' *The Swan* and Handel's *Largo* but neither Debussy nor Beethoven, for example (Greenewalt, *Nourathar*, 262).

[77] In "Each Piece a Color in New Melodies," the reviewer's interpretation of the work, in which musical gestures are equated with the presence of spirits and ghosts, appears to have been informed by the intentions of Greenwalt, who is quoted throughout; no mention is made of the concrete depiction of either moonlight or temple of Debussy's title.

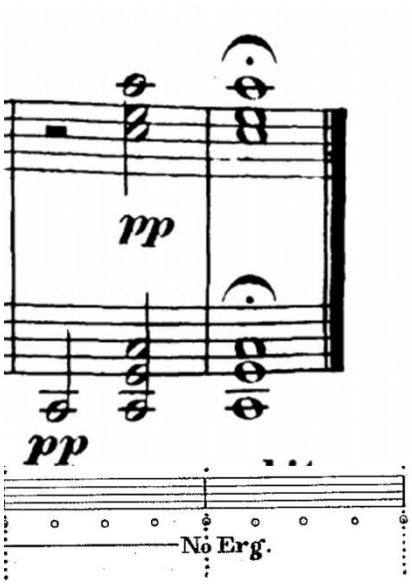

Figure 3.14: Darkness descends at the end of Greenewalt's Moonlight setting.

begins her setting of the Beethoven with the more obvious choice of moonlight blue, a color that reappears along with the simple ostinato (the musical feature most commonly associated with the "moonlight" of the work's popular title).[78] Furthermore, the notation of the Moonlight Sonata suggests darkness for the work's end, the only two measures in the work lacking the triplet ostinato (figure 3.14).

Greenewalt's attraction to programmatic pieces explicitly evoking light in their titles lends credence to one origin story that she later seemed to abandon: an early article about Greenewalt suggested that the idea for her light art had come from an audience member who suggested that she provide a "a quasi-scenic setting, such as a rising moon and cloud effects" during performances of the Moonlight Sonata.[79] This story suggests a first conception of the art

[78] Sarah Waltz describes a common conception that the Moonlight Sonata's title is a "textbook case of illegitimate program association," although she subsequently defends the popular title by establishing what might be called a moonlight "topic" in the form of arpeggiated triplets. Waltz, "In defense of Moonlight," *Beethoven Forum* 14, no. 1 (2007), 1–43.

[79] "Mary Hallock Led in Color Music."

form different from Greenewalt's later descriptions and justifications of it. She would later characterize her lights as "inward impression," contrasting this with "mere exterior panorama," i.e. the scenic or depictive use of lighting in theaters and opera houses to suggest times of day or weather.[80]

Another way that Greenewalt's music and light performances could have been understood was in relation to her ethnic identity. The way the concerts were packaged and presented might have encouraged this: she gave her art an Arabic name, named her instrument after her Syrian mother, and frequently wore middle eastern clothing in performance. Anne Ciecko has written of this as Greenewalt's "self-Orientalizing."[81] Perhaps unsurprisingly, at her piano concerts—with or without lights—she frequently performed Mozart's Turkish Rondo (from Sonata in A major, K. 331 / 300i). Two descriptions exist of Greenewalt's illuminations for this piece, both of which express a perception of the Middle East as a place of abundant and varied color—effectively demonstrating how knowledge of the work's title or program could affect audience perception as much as the relationship between specific sounds and lighting cues:

> The fourth and last selection, Mozart's "Turkish March," was naturally accompanied by lighting effect which symbolized the color belonging to a barbaric people–crude reds, greens, blues, and shimmering yellows.[82]
>
> Imagine a hall, in the background of which hang soft silken draperies. A woman dressed in a costume of Oriental hue, walks in and sits down at the piano. Silence settles upon the audience. The lights grow dim, flicker, and go out. A few minutes later the bass notes of the piano ring out in a martial strain, reminding one of Asiatics in costumes, rich in color and rare in quality, treading to wild drumbeats. At the same instant the stage in some strange fashion, becomes enveloped in the dull, rich glow of reds and purples. You feel at

[80] Ibid.

[81] Ciecko, 34.

[82] "Each Piece a Color in New Melodies."

> once the inherent harmony of the music and the colors. You are listening to Mozart's "Turkish March," a composition noted for its Oriental richness.[83]

These quotations also demonstrate that Greenewalt's colorful lights could have been interpreted as part of her exotic stage persona.

In comparison to Rimington's or Scriabin's lights, Greenewalt's designs were legible and accessible to audiences. This was mostly achieved by associating changes in lights with audible musical changes. Although the distinct technologies used for the light performances of *La lune descend* and the Moonlight Sonata differentiate these settings' relationship to musical detail, both share clear audible and visual parallelism. Greenewalt also appears to have chosen works that would be accessible, not just through their canonic status and familiarity, but also because of ready color associations available either via their programs or titles. However, the association of her lights with obvious musical features or programmatic elements reinforces the extent to which *nourathar* was entangled with music, despite Greenewalt's insistence that *nourathar* be considered a discrete art form.

Patenting an Art Form

Greenewalt believed her concept of an autonomous light art to be novel and unique; she sought to assert her ownership over the concept. Her neologisms—*nourathar* and *Sarabet*—were one way she did this. "The necessity for coining a new word is one proof of invention, of true origination," she wrote. "It is a testimony to the first appearance."[84] Seeking recognition of these

[83] "Colorful Musical Interpretation," *Public Opinion* (Chambersburg, PA), March 23, 1915, press clipping, Box 30, Folder 3, Greenewalt Papers.

[84] Greenewalt, *Nourathar*, 2.

novel terms and, by extension, recognition of herself as artist and innovator, Greenewalt wrote to Webster's in 1937, requesting that they include definitions of her terms "*nourathar*," "*Sarabet*," and "light score." In support of her request, she claimed that these words had repeatedly appeared in print throughout the world, as far afield as South Africa.[85] Elsewhere she wrote, of light art more broadly, that she had "conceived it, originated it, exploited it, developed it, and patented it."[86] As Guerrieri notes, Greenewalt sometimes couched her claims of ownership in gendered terms, referring to herself as the art's mother, the artform as her child.[87]

Greenewalt aimed to obtain legal recognition of the novelty of her work and her ownership over the art form. From early on in her experiments, but particularly with the development of the *Sarabet* and its components, she was keen to patent—even sometimes against the advice of her lawyers. Her legal claims—made in her patents, in threatening letters, and eventually in the courts—are closely chained to her aesthetic claims: that her idea was original in as far as light, in her works, did not correspond to musical pitch; that her lights changed gradually to allow for the effecting of aesthetic expression; that changes in luminosity defined her artform; and that the medium of her art form was light itself, rather than any specific instrument.

Greenewalt wanted to possess patents not only over the technologies she used, but over her aesthetic vision for *nourathar*. The widest claims in her patents amounted to an attempt to

[85] Letter from Greenewalt to the Editors of Webster's Dictionary, 1937, Box 9, Folder 2, Greenewalt Papers.

[86] Greenewalt, *Nourathar*, 2.

[87] Guerrieri. Motherhood was an important theme for Greenewalt, who, while she supported female suffrage, fiercely opposed birth control and abortion.

gain legal ownership over the use of light as a means of expression, that is to say, in Greenewalt's view, as a "fine art." For example, she claims ownership in one patent of:

> The method of combining sound and light for aesthetic expression, consisting in producing audible sounds in timed, rhythmic relationship, flooding with light an area within the area of audibility of the sound and simultaneously producing variations in the color and the intensity of the light in timed relationship with the emotional or aesthetic content of a succession of such sounds.[88]

With claims like the above, Greenewalt's lawyer suggested to her that he did not believe "the same or complimentary aesthetic effects can be produced with music and light simultaneously without infringing your [Greenewalt's] patent" and elsewhere warned New York's Capitol Theater that her patents were not restricted to "particular embodiments" but would "cover any apparatus, score, or methods for producing the same effects."[89]

Her legal struggles began with the Patent Office, which held her broadest claims (such as the above) to be unallowable, in part because they were understood to have been at least partly anticipated by the work of Bishop and Rimington. The Patent Office had even rejected Greenewalt's use of the term "synchronize" to describe the relationship between lights and music, because the patent officer saw the basis of the association as too arbitrary and subjective—i.e., the very attributes that Greenewalt prized as "artistic."[90] Eventually, some of Greenewalt's claims on the combination of music and light were allowed, with the limitation that the combination was "automatic." However, she managed to sneak her broad claims back into her patent when it was reissued, perhaps unnoticed by the Patent Office, despite her earlier

[88] Greenewalt, "U.S. Patent no. 1,481,132 (reissued 16,825).."

[89] Letter from Prindle, Wright, Neal, and Bean to Messmore Kendall, February 19, 1924, Greenewalt Papers.

[90] See several letters in "Transcript of Record." Greenewalt settled eventually on the words "combination" and "association" instead.

agreement to cancel those very claims and limit them to automatic relationships between music and light.[91]

The Patent Office's concerns adumbrated her fruitless efforts in the courts. Greenewalt and her lawyers attempted to exploit her intellectual property rights commercially by contacting various individuals and companies and warning them that they would need to either enter into a contract with Greenewalt or risk being sued. Greenewalt was warned by her lawyer that the former would be preferable over the latter because of doubts he held that her broad claims and vague methods would pass muster in court. Directly or via her lawyers, she threatened to sue more often than she carried through on these threats. As previously mentioned, however, on three occasions did she end up in court, and she lost all three cases: twice in a district court case and subsequent appeal case against the Stanley Corporation and once against the Musical Arts Association. Probably because of her frequent threats of litigation, historical writing on Greenewalt has often inaccurately given accounts of her legal activities. Without citing a case, William Moritz claims in a 1997 article that:

> When other people (including Thomas Wilfred) began infringing on her patents by using adaptations of the rheostat and mercury switch, she tried to sue, but a judge ruled that these electric mechanisms were too complex to have been invented by a woman, and denied her case.[92]

In fact, Greenewalt never sued Wilfred, and the three judges her cases came before gave detailed, technical, and legal reasons for dismissing her claims; if any of them was motivated by sexism,

[91] In her case against Stanley, the defense argued that by previously accepting to limit her claims and then reinserting them, she had legally abandoned those claims. In Betancourt's collection (Betancourt, *Mary Hallock-Greenewalt: The Complete Patents*) of Greenewalt's patents, he confusingly only includes the reissued patent rather than the originally issued patent from 1924.

[92] William Moritz, "The dream of color music, and machines that made it possible," *Animation World Magazine* 2, no. 1 (1997), accessed April 1, 2019, http://www.centerforvisualmusic.org/TAVM.htm.

this was not explicit in their judgments. Scholarship on Greenewalt by Michael Betancourt and R. Bruce Elder—whose description of Greenwalt relies on Betancourt's—regurgitates Moritz's claim, compounding its inaccuracy by further declaring that Greenewalt sued Wilfred and lost. Betancourt, Elder, and Regina Lee Blaszczyk assert that Greenewalt won an appeal against General Electric and/or Westinghouse; however, Greenewalt lost all three of her cases and never sued General Electric or Westinghouse directly in court. Further, these authors back up their claim by referring to laudatory comments the judge made about her in her first case, which she nevertheless lost, was not an appeal, and was against the Stanley Corporation.[93]

The Stanley Corporation operated a Philadelphia movie theater that—Greenewalt was incensed to discover—was using a lighting device during musical interludes in its movie offerings. Greenewalt's complaints against Stanley were summarized by the defendant as being: that they employed the auditorium lights or lights projected from the projection booth when music was being played; that they used gelatin and color wheels to color the light; and that the lighting increased and decreased in intensity by dimmers.[94] The Stanley Corporation's lawyers summed up their objections to Greenewalt's claim: that the association of light and music was not a patentable subject matter; that Greenewalt's claims in the matter were extremely vague; and that both light-music associations and theatrical lighting similar to Greenewalt's invention

[93] Betancourt, *History of Motion Graphics*, 25; Elder, 179; Blaszczyk, 196. The authors give different dates for this "victory." I believe the confusion about this arises primarily from the editorial from the Philadelphia *Evening Bulletin* editorial on the first case, which quotes the compliments the judge made to her in district court case against Stanley, while failing to mention that she actually lost the case. The finding aid for the Mary Elizabeth Hallock Greenewalt Papers also confusingly states that "Greenewalt obtained a legal victory when the courts recognized her unique contribution to the field of color-lighting" in 1932, the year she lost her appeal against the Stanley decision ("Mary Elizabeth Hallock Greenewalt Papers: Finding Aid," accessed April 22, 2017, http://hsp.org/sites/default/files/legacy_files/migrated/findingaid0867greenewalt.pdf). Blaszczyk does correctly note, however, the primary reason (prior use) that Greenewalt lost her first case against Stanley.

[94] "Brief for Defendant Appellee," 67.

substantially predated her ("from time immemorial").[95] Along the way, the defense cited the famed lighting effects of playwright and producer David Belasco, directions in the scores of Richard Wagner, and lighting effects in other movie theater houses, including those owned by Greenewalt's acquaintance, Samuel Rothafel. Their pivotal claim, however, was that public performances by Greenewalt more than two years prior to her patent application amounted to an "abandonment of the claims" therein. Greenewalt's lawyers defended her against this "abandonment" claim by arguing that her early illuminated concerts were fundamentally different from the later ones, as the film technology was more rudimentary and unable to gradate intensity or create a flooding effect.[96]

The judge in the first case against Stanley at the Delaware District Court was sympathetic to Greenewalt: he called her a "true artist" and was willing to accept all her arguments about the insufficiencies of previous attempts at color music, as well as her description of what distinguished her work from all predecessors.[97] Nevertheless, he found Stanley's reasoning that her patent was invalid—owing to its public use for profit more two years before the application had been filed—well-founded, and he dismissed the case without consideration of any other defense.[98] The Appeal Court judge affirmed the lower court's judgment with regard to the public use of her invention but also went further, proclaiming that:

[95] "Brief for Defendant Appellee," 3–4 & 67.

[96] "Brief for Plaintiff Appellant," 8.

[97] This part of the judgment was rereported in the *Philadelphia Evening Bulletin*, which also failed to mention that Greenewalt lost the case. Several copies of the *Bulletin*'s laudatory article can be found in Greenewalt's archive and she also, anonymously, sent a copy of it to Thomas Wilfred.

[98] Greenewalt v. Stanley Co. of America, 39 F.2d 102, 5 U.S.P.Q. 318 (D. Del. 1930), Court Opinion.

> It is apparent from the specifications and claims and the appellant's detailed elucidation of what is meant thereby that the invention depends upon the artistry, caprice, or peculiarities of the performer and the susceptibility of the auditor-spectator. We do not find authority in the law for the issuance of a patent for results dependent upon such intangible, illusory, and nonmaterial things as emotional or aesthetic reactions. An emotional or aesthetic timed relationship between music and light, thus dependent, is not a statutory "art, machine, manufacture, or composition of matter" susceptible of protection under the patent laws.[99]

The judge here affirmed that the "subjective" nature of Greenewalt's enterprise rendered it unpatentable; in fact, if the relationship between light and sound had been automatic or scientific, after the manner of the earlier and contemporaneous devices that she distanced herself from, it would have been more likely to be legally protectable. But, as Greenewalt's lawyers had warned her, proving that music and light were related via "emotion" was difficult.

Perhaps realizing the futility of further action against movie theater companies, Greenewalt brought her next case against the Musical Arts Association, which operated Severance Hall (the home of the Cleveland Orchestra) in Cleveland, Ohio. In what may account for some scholars' confusion about Greenewalt's legal activities, the case was apparently defended by the Westinghouse Company, who had provided the hall a large lighting console—described as a "color organ" in the press—which was used both in symphonic concerts and also as an alternative to traditional scenery in opera performances, including Wagner's *Tristan and Isolde*.[100] Based on descriptions of the lighting format and effect given to her by various informants, Greenewalt concluded that Severance Hall's lighting console was being used in close coordination with music to emotional effect. The Hall's own publicity materials described the console in language reminiscent of her own: the console, it stated, allowed the player to

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[99] Ibid.

[100] "Orchestra Has New Home: Cleveland Dedicates Severance Hall, Said to Be Most Perfect Music Edifice in Country," *Los Angeles Times* (March 22 1931), B17. Donald Rosenberg, *The Cleveland Orchestra Story* (Cleveland: Grey and Company, 2000), 110.

manipulate "the emotions of his audience with mood of color, as the musician affects them with sound."[101] In this case, the judge agreed with the previous judge's findings, citing an unreasonable delay between Greenewalt's first performances in the period of 1911 to 1916 and her patent applications. This decision occurred despite Greenewalt's attempt in 1933 to mitigate the effects of this previous judgment by disclaiming her earliest work ("stereoptically focused images such as are known as painted pictures and the like").[102] In addition, the judge in the Severance Hall case found there to be technical reasons to find fault with Greenewalt's claims: although the ultimate effect in the hall resembled that rendered by Greenewalt's *Sarabet,* the means of achieving them was different.

While Moritz writes that Greenewalt's court cases were hampered by her gender, Greenewalt never described her legal failures in those terms herself. Instead, she construed of herself as an individual confronting the impossible opposition of larger corporations who exerted influence on government and judiciary; this conception seems to have extended to a conspiracy-theory-like interest in judicial corruption. She believed not only the companies she had worked with and judges to be working against her, but she implied that the corruption encompassed her own lawyers. In addition, she expressed an anti-Semitic belief that fundamentally Jewish

[101] "Lighting of Severance Hall," pamphlet, Greenewalt Papers, Box 6, Folder 6. See also "Orchestra Has New Home," which describes the color organ putting "the audience in sympathetic moods preceding and during the music."

[102] Greenewalt, Mary Hallock. "United States Patent Reissue 16,825.' Betancourt adds confusion to this matter by claiming that this disclaimer was the result of a court battle Greenewalt lost against Wilfred but, as previously stated, no such court battle took place (Betancourt, *History of Motion Graphics*, 26). The judge in the case against the Musical Arts Association recognized the disclaimer as a result of her lost case against Stanley, but found that the disclaimer was entered too late after the practices it disclaimed took place (Greenewalt v. Musical Arts Assn., 29 U.S.P.Q. 504 [N.D. Ohio 1936], Court Opinion).

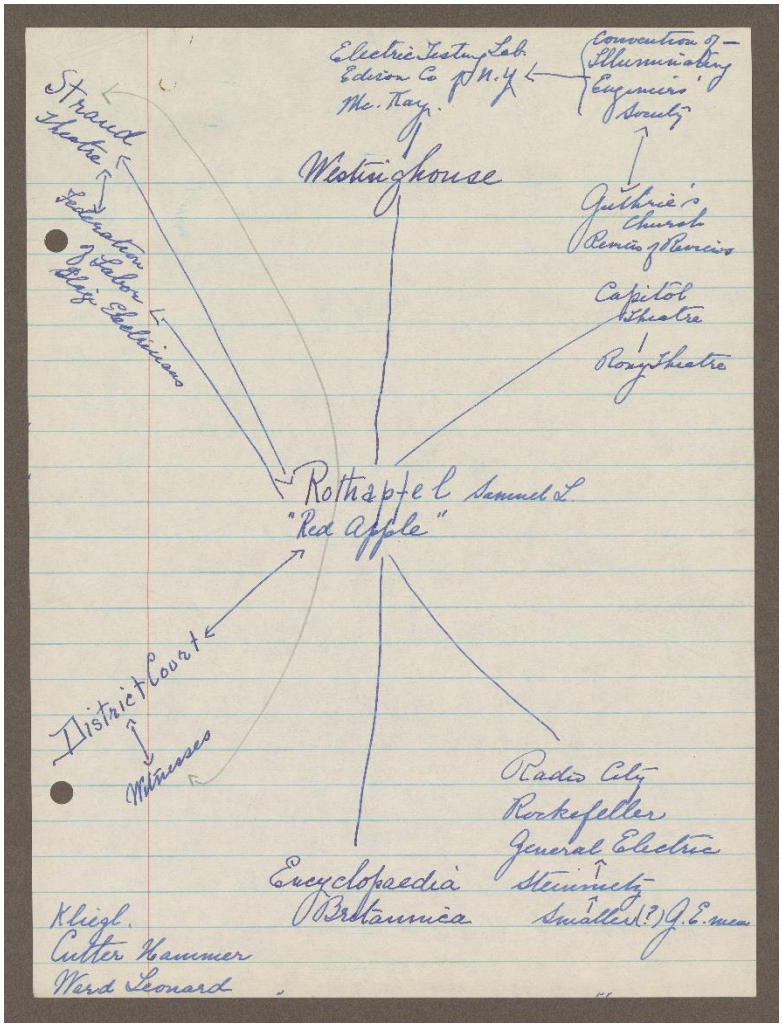

Figure 3.15: Greenewalt's image of those conspiring against her, with Samuel Rothafel in the middle (Box 6, Folder 6, Greenewalt Papers).

interests were holding her back, a "monopoly of Jewish race sticking together."[103] In her archive there exists a chart she drew of the connections between individuals and groups she believed to be working against her **(**figure 3.15**)**; at the center she placed Samuel Rothafel, who gave evidence against her in the Stanley Corporation case, whom she had previously threatened to sue, and in the basement of whose movie theater she had carried out work on her *Sarabet* in 1922. He

[103] "Dates of important disclosure, programs, etc.," handwritten note, no date, Box 6, Folder 6, Greenewalt Papers.

was also Jewish. Her writings suggest that the figures in this imagined "network" of hers partook in whispering campaigns against her, even interrupting her performances.

Greenewalt's legal cases suggest a wider landscape of audiovisual experimentation involving colored light and music during the 1920s. In the sites where this took place, movie theaters and at least one concert hall—Severance Hall—the lighting appears to have largely mirrored *nourathar* in respect to form and intention (expression), and, like *nourathar*, was not based on methodical conversion of pitch to color. Greenewalt was right to observe similarities between her practice and particularly those used in movie theaters, but probably wrong to assert priority, let alone the suggestion that the ideas or techniques were stolen from her.

Several sources from the 1920s demonstrate that coordination between lighting effects and music was common in moving picture houses. Noam Elcott has observed that lighting became an increasingly urgent topic for theater owners and workers in the 1920s, pointing out that James Cameron's widely distributed text on film projection gave increasing space to the issue as the decade progressed.[104] Already in 1922, Cameron stated that "experience and popular approval has shown that high class lighting effects on the stage as well as in the auditorium are absolutely necessary."[105] Although Cameron's emphasis centered on lighting effects to accompany film (the "photoplay"), he nevertheless foregrounds lighting's ability to accentuate a movie's mood, and the importance of dimmers and color mixing to that end.[106] Moreover, he notes the extant practice of many larger theaters of using lighting effects during orchestral

[104] Noam Elcott, *Artificial Darkness* (Chicago: University of Chicago Press, 2016), 69.

[105] Cited in ibid.

[106] James R Cameron, *Motion Picture Projection* (Cameron Publishing Co., 1928 [1922]), 245.

numbers.[107] In a similar vein, Harold Franklin's 1927 manual on cinema management advanced comparisons of light to music and advocated for the use of light to accompany musical interludes, commenting that "melody can be rendered more effectively when accompanied by the playing of lights of different hues."[108] His manual specifically cited color's "emotional value" as the point of contact between light and music. In fact, Franklin choses as his example Greenewalt's own favorite, the first movement of the *Moonlight Sonata*, and, like her, suggested a shimmering blue lighting effect as its accompaniment. Rather than referencing Greenewalt, Franklin mentions her rival Thomas Wilfred—albeit not by name—calling him the "inventive genius" who had "offered the public a program of 'symphonies' in light rather than sound."[109] Further, Siegfried Kracauer's memorable description of cinematic exhibition practices in 1920s Berlin as the "Gesamtkunstwerk der Effekte" ("the total artwork of effects") verifies the ubiquity of the practice:

> This total artwork of effects assaults every one of the senses using every possible means. Spotlights shower their beams into the auditorium, sprinkling across festive drapes or rippling through colorful growth-like glass fixtures. The orchestra asserts itself as an independent power, its acoustic production buttressed by the responsory of the lighting. Every emotion is accorded its own acoustic expression, its color value in the spectrum - an optical and acoustic kaleidoscope which provides the setting for the physical activity on stage, pantomime and ballet.[110]

The above passage demonstrates that lighting effects had made their way to Germany by 1926, imported, Kracauer believed, as part of a larger parcel of spectacular American cinematic

[107] Ibid, 254–255.

[108] Harold B. Franklin, *Motion Picture Theatre Management* (Garden City, N.Y.: Doubleday, Doran, 1927) 273.

[109] Ibid, 276.

[110] Siegfried Kracauer, "Cult of Distraction: On Berlin's Picture Palaces," trans. Thomas Y. Levin, *New German Critique* 40 (Winter, 1987), 92.

exhibition practices. Such a claim in turn implies an earlier date for the implementation of such practices in the USA. Additionally, it associates the lighting not only with the music being played, but with the portrayal of emotions, which Greenewalt considered the novel, distinguishing feature of her light-color play.

While such effects do seem to have been widespread and well known, Greenewalt could claim that hers came first. She maintained that Samuel Rothafel had stolen her ideas when she had been experimenting on her *Sarabet* in the basement of his Strand Theater in 1922. It is true that Rothafel, who once declared that "color and lighting are like music," employed colored lighting in his theaters, alongside music and with the purpose of emotional expression.[111] However, Ross Melnick's research on Rothafel describes him experimenting with mood lighting for movies as early as 1914, and a 1916 advertisement for Rothafel's Rialto theater in New York boasted of "scientific color lighting throughout the house, an innovation in the West, [that] will reflect the mood of the moment."[112] Further, Rothafel claimed he had produced scenic lighting for a performance of the overture to *William Tell* as early as 1910. This suggests that the origins of these practices predate Greenewalt's patents—even if they had been enforceable—as well as predating Rothafel's acquaintance with Greenewalt. It is possible that Rothafel's lighting techniques changed in some way—perhaps in their relationship to music or in the approach to intensity—through his acquaintance with Greenewalt, but the concept of using lights artistically,

[111] "Lights to Be Like Music: Rothafel Explains Purpose of Those in New Roxy Theater," *New York* Times, March 4 1927, 25.

[112] Cited in Ross Melnick, *American Showman: Samuel "Roxy" Rothafel and the Birth of the Entertainment Industry, 1908–1935* (New York: Columbia University Press, 2012), 131. In the trail Greenewalt and her lawyers gave September 1916 as the "birth date" of *nourathar*, which was less than two years prior her first patent and the month of the first performance she gave in which she had a means of controlling luminosity.

associating them with mood or emotion, and employing them together with music appear to have been too widespread to have been solely the result of Greenewalt's influence.

By contrast, the experiment at Severance Hall does not seem to suggest a wider culture of colored light effects at classical music venues. Ultimately, it was not considered particularly successful at the Cleveland venue. Nikolai Sokoloff, the conductor of the Cleveland Symphony Orchestra when Severance Hall was opened in 1931, wrote: "This was the most ghastly thing imaginable, throwing a red light on us when we played Brahms, a blue light when we played Debussy, and so on. A third-rate movie house couldn't have devised a more vulgar effect. Fortunately the public felt as I did and the light organ was abandoned."[113]

Despite her court losses, Greenewalt continued to claim her intellectual rights were being exploited, or at least unrecognized. In a 1941 letter to the publishing company Simon and Shuster—in response to a recently-published a book on *Fantasia*, which itself made grand claims for the novelty of Walt Disney's conception—Greenewalt claimed to have invented abstract cinema, owing to her early use of film as a means of coloring light as early as 1909.[114] While Michael Betancourt suggests that she was dishonest in her dating of these films in an attempt to claim priority falsely, this seems to be based on insufficient archival research.[115] The films in her archive are dated from 1916, according to their accompanying description in Greenewalt's own hand; Betancourt notes this and suggests that the dating of these films is fallacious because they are not featured in any of Greenewalt's patents apart from her patent from the revised patent she

[113] Rosenberg, 109–110.

[114] Letter from Greenewalt to Simon and Shuster, January 12 1941, Box 12, Folder 2, Greenewalt Papers.

[115] Betancourt, "Mary Hallock Greenewalt's Abstract Films."

filed in 1925 for "a control system for light and color players."[116] However, Betancourt is unaware that these films and their use was reported in the press prior to 1916 and, indeed, that they were cited *against* Greenewalt in cases she brought in the 1930s. In these cases, Greenewalt's experimentations with film as 1911 were key to the judgments made as they were cited as prior public use for profit, and therefore forfeiture of intellectual rights.[117] There is therefore no reason to doubt Greenewalt's own dating of the films in her archive—and her claim that she was using films and gels from at least 1911 seems verifiably true. Unfortunately, Betancourt's claims have been repeated widely in scholarship, such as that by R. Bruce Elder and Andrew Johnston, casting broad and lingering aspersions on Greenewalt's honesty.[118]

Conclusions

In this chapter I hope to have shown how Mary Hallock-Greenwalt self-consciously distanced herself from a color music past, both practically and discursively. Abandoning the analogies between color and musical pitch enabled the development of new instruments, new forms, and new types of representation, to aid emotional expression in the form of slowly morphing and intensifying and abating lights. Greenewalt was adamant in distinguishing herself from past inventors, theories, and theorists, although her legal cases demonstrate this was a commercial approach as well as an aesthetic one. Her aesthetic perhaps had more in common with theatrical

[116] Greenewalt, "United States Patent 1,714,504."

[117] Greenewalt v. Stanley Co. of America, 39 F.2d 102, 5 U.S.P.Q. 318 (D. Del. 1930), Court Opinion; Greenewalt v. Stanley Co. of Am., 54 F.2d 195, 12 U.S.P.Q. 122 (3d Cir. 1931), Court Opinion; Greenewalt v. Musical Arts Assn., 29 U.S.P.Q. 504 (N.D. Ohio 1936), Court Opinion.

[118] Elder, 74; Johnston, 74.

or movie theater technologies than with the lineage of color organs into which it has subsequently been subsumed, a similarity she acknowledged—and, at times, crusaded against—in her accusations against theater companies.

However, in spite of these novelties, many of Greenewalt's claims to distinction and autonomy may be challenged. Her patent claims are of interest in demonstrating the limitations of artistic patentability, but were extravagant in their claims of novelty and ownership. Additionally, for all that she preached medium specificity, in practice Greenewalt could not disentangle herself from the anxiety-inducing influence of music. She worked primarily alongside music and produced works that closely paralleled musical structures—albeit without producing a color corollary for each pitch or key area. That her works were considered at the time—and have been categorized since—as "color music" or "visual music" likewise suggests that she failed to distinguish her output and practice fully from those precedents, while her legal cases suggest that similar practices were taking place in other spaces, without pretensions of high-art, medium-specific standing.

As will become clear in the next chapter, the rhetoric of contemporary artist and inventor Thomas Wilfred closely paralleled Greenewalt's, though the two differed in aesthetic goals and claims. Despite its greater influence and wider acknowledgment, however, Wilfred's work has been received and historicized in similar ways to Greenewalt's—despite his similar attempts to distance himself and his artistic output. This parallel narrative suggests some larger truths about the position of light art, particularly in its relationship to music, in the early- to mid-twentieth century, as well as the realities of technological art, and the problems of reception of ambiguous media.

Chapter 4: Visual Music Falls Silent: Thomas Wilfred's *Lumia*

The 2005 collection of essays *Visual Music: Synaesthesia in Art and Music Since 1900* was released to accompany a touring exhibition in the same year; on its spine, the collection features a small photograph of a red form against a black background.[1] The red form does not conform to any geometrical shape or pattern, but is rather a complex of wispy configurations, saturated in a strong red at the bottom and rising to a pink gossamer towards the top. The image in question comes from op. 152 *Study in Depth* by Thomas Wilfred (1889–1968), a piece of mobile art that here is rendered static, a silent piece of visual art epitomizing the concept of "visual music."

As its inclusion on the cover of the essay collection demonstrates, Wilfred's work has been canonized as "color music" or "visual music." However, although Wilfred used the term "visual music" to describe his work, his relationship with both music and theorizations of visual music is a complex one. Others have described Wilfred's creations as intermedia *avant la lettre*, suggesting a relationship with forms of art that appeared around the Fluxus movement in the late 1960s, forms that eschewed conventional divisions between disciplines and mediums.[2] Tina Ryan has placed Wilfred in another lineage, crowning him the "father of light art," drawing on sources from the late 1960s and the 1970s that bestowed historical import on him during a period

[1] Kerry Brougher and Judith Zilczer, eds., *Visual Music: Synaesthesia in Art and Music Since 1900* (London: Thames and Hudson, 2005).

[2] Gene Youngblood, *Expanded Cinema* (New York: P. Dutton & Company, 1970), 345; Stephen Eskilson, "Thomas Wilfred and Intermedia: Seeking a Framework for *Lumia*," *Leonardo* 36, No. 1 (2003): 65–68; Gregory Zinman, "Thomas Wilfred's Aesthetic Legacy," in *Lumia: Thomas Wilfred and the Art of Light*, ed. Keely Orgeman (New Haven: Yale University Press, 2017), 89.

when works incorporating electric lighting became more common in American art galleries.[3] These different historicizations of Wilfred's work are not necessarily contradictory; they do, however expose tensions between how the novel art form—which Wilfred dubbed *lumia*—was idealized and realized by its creator, and how it was later conceived and received.

In an even more thorough and entrenched manner than Greenewalt, whose works and aesthetic goals were discussed in the preceding chapter, Wilfred attempted to bring about an autonomous light art separated both from the historical claims of color music and from music as sound. As I will discuss, he also separated his work from contemporaneous forms of visual music, including film. This chapter therefore problematizes Wilfred's relationship to the antecedent and subsequent practices he has been associated with, concentrating on his claims of autonomy and medium specificity and his theorization of the relationship of *lumia* to other art forms as revealed in various published and unpublished writings. As in the previous chapter on Greenewalt, I point out the inherent tensions in Wilfred's own discourse that nonetheless drew on music in defining light art.

Interfaces and Institutions: An Overview

Light artist Thomas Wilfred was born Richard Løvstrøm in Denmark in 1889. He dated his first experiments with light as an artistic medium to 1905, in the form of a cigar box that he fitted with an electric light and colored glass.[4] He subsequently studied painting in Paris but found

[3] Tina Ryan, *McLuhan's Bulbs: Light Art and the Dawn of New Media* (PhD diss., Columbia University, 2016), 201.

[4] Thomas Wilfred, "Light and the Artist," *Journal of Aesthetics and Art Criticism* 5, no. 4 (June 1947): 250.

little encouragement for his light work in academic settings. Throughout much of the 1910s, including after his move to America in 1916, he was also a professional singer, performing folk songs and early music with an archlute on tour. Wilfred ultimately considered this musical work supplementary to his explorations in the field of light, and in 1919 he gave up professional music-making altogether in favor of his lighting experiments and performances. That same year, along with the impressionist painter Van Dearing Perrine and the architect and esotericist Claude Bragdon, he became part of a group dedicated to the development of light in art. Recalling Scriabin, they called themselves the Prometheans. As Bragdon noted in his autobiography, Wilfred quickly became the dominant and most successful member of the short-lived group, which disbanded in 1921.[5] The same year, Wilfred finished what he called his "first proper instrument" for light production, which he called the *clavilux*.[6] In January of the following year, Wilfred gave his first public performance in New York's Neighborhood Playhouse; he played "four silent [light] compositions," using the *clavilux*.[7]

The *clavilux*'s interface was made up of dials and sliding keys (figure 4.1), each controlling fine steel wires that functioned as pulleys to change the form, color, and motion of the display by causing the lights to tilt and activating the color wheels in front of them. Multiple spotlights were projected onto the center of a screen, and a rheostat, activated by a switchboard, allowed gradual changes in the current. In front of the lights were rotating filaments and/or curved reflective surfaces. This apparatus cast a changing series of abstract forms, owing to the

[5] Claude Bragdon, *More Lives than One* (New York: Alfred A. Knopf, 1938), 120.

[6] Wilfred, "Light and the Artist," 250.

[7] "Concert Held With Your Eyes Officiating as Ears," *New York Tribune*, January 11, 1922, 6.

Figure 4.1: Wilfred at the clavilux model E (Wilfred Papers, Box 16, Folder 220).

combination of a moving source of light and the imposition of a movable three-dimensional object between the light source and the lens. Over the span of his career, Wilfred developed multiple models of the *clavilux*; some earlier models were designed for front projection, but later ones used back projection, with the screen sometimes becoming another component of the instrument. Additionally, aspects of the instruments could be altered to achieve different effects. For example, the model E *clavilux* was made up of four modules, of which only two were required for each work.[8] Beyond the whirring of mechanical parts, however, none of Wilfred's instruments was capable of producing sound or being directly connected to a sound source.

[8] Wilfred invented *clavilux* models A through H. A.J. Epstein (along with his uncle, Eugene Epstein, the foremost *lumia* collector) owns *clavilux* models E and G, although they remain inoperable.

Figure 4.2: Wilfred with a clavilux junior (Wilfred Papers, Box 16, Folder 220).

Wilfred also developed a number of small instruments with self-illuminating screens, as in a television, that were colored by lights which shone through colored or painted glass; these models, which he began developing in the late 1920s, he called "*clavilux* juniors" (figure 4.2). Hoping that these machines could be mass produced for the domestic market, he entered an agreement with the prominent electrical engineer Alfred Goldsmith, to whom he granted exclusive rights to negotiate the sale and manufacture of the *clavilux* junior.[9] Goldsmith contacted the Aeolian Company, Electrical and Musical Industries Ltd., and Electrical Research

[9] Letter from Alfred Goldsmith to Thomas Wilfred, August 8, 1934, Box 2, Folder 24, Thomas Wilfred Papers, MS 1375, Yale University Library, New Haven.

Products Inc., among others, but—believing there was no proven market—none of the companies agreed to manufacture the device.

In spite of his experiments with automatic or recording technologies, Wilfred continued to prefer live performance. He established his own institution—the Art Institute of Light—as a venue for his performances and further experiments for his art, which he began to call "*lumia*." The Art Institute of Light was established as a non-profit in 1930 and was "formally inaugurated" in 1934 at New York City's Grand Central Palace on Lexington Avenue between 46th and 47th Streets.[10] Not even ten years later, the Institute was forced to close when the Grand Central palace was requisitioned for army recruitment in 1942.[11] Nevertheless, Wilfred persisted in offering light art increasingly in the context of art gallery exhibitions, particularly at New York's Museum of Modern Art (MoMA), with which he formed a lasting relationship. A highlight in this regard was his inclusion in MoMA's 1952 "15 Americans" exhibition, which also included work by prominent American abstract painters including Mark Rothko and Jackson Pollock. During the 1950s and 1960s Wilfred also undertook the production of domestic *clavilux* instruments, but these were individually made on commission rather than mass produced. The domestic models, as well as some of his later technologies for domestic use or gallery exhibition, followed the self-illuminating principle; other works for galleries returned to a projection concept with dedicated rooms that required transformers, dimmers, and complicated timing devices alongside sources of light and color.

[10] Thomas Wilfred, *Lumia: The Art of Light* (unpublished, c. 1947–1950), Accession 1995-M-038, Box 1, Wilfred Papers, page 165.

[11] "Army opens biggest induction center in U.S.," *Life*, November 16, 1942, 13 (20), 51, 52, 54, 56, and 58.

Wilfred and Color Music

In many histories, Wilfred is presented as a part of the color music tradition, carrying on from the earlier history of Castel and Rimington. Clark Farmer, for example, describes Wilfred as the "most famous color-music practitioner," in a listing that includes Castel, Bishop, Rimington and Greenewalt.[12] This association occurs not only through the perspective of current scholarship, but also in Wilfred's contemporaneous reception as well; journalists in Wilfred's own time frequently applied the terms "color music" and "color organ" to his work and instrument. Wilfred, however, rejected these associations. He wrote of the "repeated failures of color music," and only made reference to this tradition to distance himself and his work from it.[13] As a result, he considered "color organ" and "color music" egregious misnomers for his work, complaining that "[m]uch against my wish the *clavilux* was christened 'Color organ' by public and press and this name clung tenaciously for years."[14]

[12] Clark Farmer, "'Every Beautiful Sound Also Creates an Equally Beautiful Picture': Color Music and Walt Disney's Fantasia," in *Lowering the Boom: Critical Studies in Film Sound*, ed. Jay Beck and Tony Grajeda (Champaign, IL: University of Illinois Press, 2008), 186. Other works that describe Wilfred as a color musician or his instrument as a color organ include: Kenneth Peacock, "Instruments to Perform Color-Music: Two Centuries of Technological Exploration," *Leonardo* 21, no. 4 (1988): 405; William Moritz, "Visual Music and Film as an Art Before 1950," in *On the Edge of America: California Modernist Art, 1900-1950*, ed. Paul J. Karlstrom (Berkeley: University of California Press, 1996), 230; William Moritz, "The Dream of Color Music and the Machines That Made it Possible," *Animation World Magazine* 2, no. 1 (April 1997), accessed 4 April, 2019, https://www.awn.com/mag/issue2.1/articles/moritz2.1.html; and John Gage, *Color and Culture: Practice and Meaning from Antiquity to Abstraction* (Boston: Little, Brown, and Company, 1990), 246. One recent account that does recognize Wilfred's rejection of this tradition is: Nick Lambert, "Squaring the Circle: Thomas Wilfred's Lumia and his Rejection of 'Color Music,'" in *Music, Art and Performance from Liszt to Riot Grrrl: The Musicalization of Art*, ed. Diane V. Silverthorne (New York: Bloomsbury, 2019), 149–166.

[13] Wilfred, "Light and the Artist," 250.

[14] Wilfred, *Lumia*, 162. The *New York Tribune* used the term "color organ" to describe Wilfred's first concert in 1922 ("Concert Held With Your Eyes Officiating as Ears," *New York Tribune*, January 11, 1922). Many later newspaper articles refer to the *clavilux* as a "color organ" including: "Lecturer 'Paints' On Screen At Avery By Beams Of Light From Color Organ," *The Hartford Courant*, 14 November, 1948, B11; and Edward Alden Jewell, "Thomas Wilfred in *Lumia* Recital" *New York Times*, 10 January, 1942, 16.

One reason for Wilfred's aversion to the "color music" nomenclature was his skepticism towards attempts to establish physical relationships between music and light as the basis of an art form. Wilfred referred to color music as an "unfortunate changeling" that originated in misreadings of Aristotle's *De Sensu*.[15] Considering these attempts as folly or pseudo-science, Wilfred frequently cited Goethe's *Theory of Colors* to the effect that colors and tones act "in wholly different provinces, in different modes, on different elementary mediums, for different senses."[16] Indeed, distancing himself from any such work, Wilfred wrote in his unpublished manuscript *Lumia*: "Art is the individual and free expression of emotion. Science is the collective discovery, definition, classification and co-ordination of verifiable Facts. There can be no scientific art, no artistic science."[17] He thereby epitomized—*avant la lettre*—Latour's "purifying" or "modern" stance, dichotomizing the scientific/natural from the human/artistic, identifying the latter with the expression of emotion and thereby evincing a belief that previous color-music instruments and practices had failed as expressive art.

Wilfred criticized the results of art based on the color-tone analogy as well as its precepts. He believed that no aesthetic satisfaction could be produced by using musical structures in light and color; he implored light artists to employ "light solely in terms of itself."[18] Concomitantly, he believed that the senses required different forms of stimulation, that "eye and ear are two very

[15] Wilfred, "Light and the Artist," 247. Ironically Wilfred misreads Aristotle himself, since he understands Aristotle to be talking about the relationship between colors rather than the harmonies present in individual colors. Wilfred also makes it seem like Aristotle's analogy was vaguer than it was, not mentioning that Aristotle suggested that the same ratios might apply to musical and color harmonies (see chapter 1).

[16] Wilfred, "Light and the Artist," 248; *Lumia*, 148.

[17] Wilfred, *Lumia*, 16.

[18] Edwin M. Blake and Thomas Wilfred, "Letters Pro and Con," *The Journal of Aesthetics and Art Criticism* 6, No. 3 (March 1948): 273.

different receptors, so different that, even if a comparison could be made, it would have no meaning."[19] On this basis he blamed the negative reactions to Rimington's 1895 concerts on Rimington's lack of understanding of what differentiated mediums and senses:

> The draped screen pulsates with changing color; there is no form, only a restless flicker, hue after hue, one for each musical note sounded. As the tempo of the music increases, the accompanying colors succeed one another too rapidly to be caught by the eye, while the ear readily accepts and enjoys the most rapid passage in the music.
>
> The eye seeks an anchorage, a scrap of form to focus on, but none appears. Questions are whispered, heads shaken. Is there really a color for each note? There must be—Rimington is Professor of Art at Queen's. But it hurts my eyes!
>
> The London critics were not kind to Rimington; in other English cities they were even less kind. All commented on the "restless flicker" on the screen, while the music fell smoothly and with clear meaning on the ear. Rimington, who, strangely enough, was a painter, realized too late that form is an indispensable factor in a visual art.[20]

In this passage, Wilfred suggested that Rimington did not understand either the temporal or the spatial nature of the media of colored light. On the temporal front, Wilfred concurred with the critics of Castel and Rimington, that the eyes were not able to comprehend a quick succession of colors the way the ears make sense of quickly changing pitches, and that such quick movement was instead confusing and unpleasant. Meanwhile, he implied that Rimington, thinking only in overly musical terms, had failed to account for the spatial aspect of light altogether. As a solution, Wilfred suggested that light artists must look to painting and adopt distinct, "anchoring" forms to provide something that respected the nature of sight rather than hearing. Later in the same 1947 article, he wrote that the basic components of light art must be color,

[19] Wilfred, *Lumia*, 45.

[20] Wilfred, "Light and the Artist," 249. I suspect Wilfred's perceptions of Rimington's reception come from Klein's book. It is not clear that Wilfred understood that Rimington's colors corresponded to chords.

motion, and form. In contradistinction to Rimington, he stressed that motion and form took precedence over color.[21]

By criticizing color music, Wilfred was not merely distinguishing his art from forms of the past; he also sought to differentiate himself from newer automatized gadgetry that visualized music. In 1931, an engineer from the Victor Company wrote of a new "automatic color organ," commercialized as the "telecolor," to be hooked up to the radio or phonograph to create fiery musical visualizations; publicity for this device even mentioned Wilfred by stating it was different from the *clavilux* because of its automatic operation.[22] In 1964, Wilfred was made aware of a device called "audio color" manufactured by Conar Instruments,[23] selling for less than $50 a unit and offering customers "a color spectacular" that could be attached to radios, hi-fi sets, stereos, and tape recorders.[24] In fact by the 1950s, the meaning of the term "color organ" had broadened to include multi-channel sets of three (or sometimes four) lightbulbs, each of which lit up in response to a particular frequency range. Instruction on how to build these "color organs," which presaged the disco lighting of the 1970s, appear in DIY magazines for electronics enthusiasts across the 1950s and 1960s.[25] It was all these devices that Wilfred referred to when

[21] Wilfred, "Light and the Artist," 252.

[22] Edward B. Patterson, "Automatic Color Organ," *Proceedings of the Institute of Radio Engineers* 19, No. 8 (August 1931), 1334–1346; "The 'Telecolor' Translates Music into Light," *Science and Mechanics* (November 1931), 711; "Radio Music Turns to Color in Your Home," *Popular Mechanics* (October 1931), 534–535.

[23] Letter from Roy Martin to Thomas Wilfred, August 4, 1964, Box 2, Folder 39, Wilfred Papers.

[24] *Conar Electronic Kits and Assembled Products: 1966 Edition* (New York, 1966), 9.

[25] "Medium Power Color Organ," *Radio & TV News* (October 1957), 44–45; Daniel Meyer, "Build the Sonolite," *Popular Electronics* (May 1968), 27–30.

he wrote, “Every so often, a new electronic horror is unveiled as a brand new idea—and as quickly relegated to limbo.”[26]

Wilfred’s New Art

Since “color organ” and “color music” carried the baggage of aesthetic failure and scientific wrongheadedness for Wilfred, he asserted the importance of new terminology in his own productions and practice. Although he experimented with numerous neologisms for his light instrument (e.g., “kromorgan” and “clavikrom”), he settled on *clavilux* before the device’s first public outing in 1922, and by 1931 was using the term *lumia* for his light art works.[27] Wilfred pressed the importance of uniformity of terminology—that is, the adoption of his terms—on many of his correspondents. In one letter to a fellow experimenter with light, Joseph Fox, he called for Fox’s help in permanently “eradicating” the expression “color organ.”[28] In a letter to his protégé, Christian Sidenius, he recalled an interaction with the New York light artist Earl Reiback: “I have impressed on Reiback that we must use the word *LUMIA* only to designate the art form itself, and not to speak of a work as ‘a *lumia*.’”[29] To further spread his terminology, he successfully applied to write an entry for “*clavilux*” for the *Encyclopedia Britannica*, a fact he sometimes cited to prove both his and the term’s legitimacy.[30] Since the first syllable of *clavilux*

[26] Letter from Wilfred to Joseph Fox, January 30, 1961, Box 1, Folder 19, Wilfred Papers.

[27] Since most of these rejected names included reference to “color,” it is significant that Wilfred chose the term that foregrounded light (“lux”) rather than color (“krom”). Untitled note (“Kromorgan…”), undated, Box 3, Folder 47, Wilfred Papers.

[28] Letter from Wilfred to Joseph Fox, October 25, 1952, Box 1, Folder 19, Wilfred Papers.

[29] Letter from Wilfred to Christian Sidenius, January 6, 1967, Box 4, Folder 61, Wilfred Papers.

[30] “Art Institute of Light” (booklet), Box 5, Folder 79, Wilfred Papers.

was derived from the Latin word for key ("clavis"), it still recalled the musical keyboard, especially the clavichord, but Wilfred seemed satisfied enough with having jettisoned the "organ" appellation. The second syllable "lux" and the term "*lumia*" both come from the word "light," symbolizing Wilfred's concern with light as a medium distinct from music.

Both in his adoption of new terms and in his critiques of color music, Wilfred expressed a desire that light be considered autonomously from music or other media. While the history of color music suggested intermedial hybridity, Wilfred claimed throughout his entire history that *lumia* was the "independent art of light"—and, as such, the "eighth fine art."[31] He justified *lumia*'s inclusion in the pantheon of the arts by referencing its specific medium: "Its basic medium is new. For the first time the artist employs light solely in terms of itself, as a musician employs sound, a painter pigment, a sculptor marble."[32] He distinguished, as Lessing had done, between the spatial (architecture, sculpture, painting) and temporal (poetry and music) arts, but he also allowed for some (dance and theatre) to be both; he placed *lumia* with these latter two arts in the "spatio-temporal" category.[33] Wilfred continued to assert *lumia*'s status as the eighth fine art in the 1960s, even as a curator of New York's Museum of Modern Art (MoMA) told him she found the notion contentious—not to mention old-fashioned—when he wanted to include the assertion in a program note for an exhibition at her gallery.[34]

[31] Wilfred, "Light and the Artist," 252.

[32] Wilfred & Blake, "Pro and Con," 273.

[33] Wilfred, *Lumia*, 14.

[34] Letter from Dorothy Miller to Wilfred, June 6, 1960, Box 3, Folder 44, Wilfred Papers.

Through the use of novel terminology and the insistence on medial independence, Wilfred distanced himself from color music, and from music more generally. Color musicians (according to Wilfred) had failed to produce anything of aesthetic worth "because they could not visualize light as important enough to become an independent new medium of expression" and had therefore kept their work dependent on music.[35] For him, the musical analogy represented a failed past rather than a hopeful future for artists using light art. Light did not need to be a parasite on music; Wilfred proclaimed that the light artist "must shun all imitation and deal with *Lumia* in terms of itself."[36] As a result, his understanding of how *lumia* should look and sound were highly differentiated from his color music predecessors, as will be shown below. He justified these innovations as necessarily arising out of the use of light as an independent medium. Descriptions of *lumia* as "intermedia," a term that implies the breaking down of boundaries between artistic mediums, therefore conflict with Wilfred's own conceptualization of his work. Rather than bringing down aesthetic barriers and mixing media in the manner of the Fluxus artists, Wilfred erected further barriers and perpetuated medium specificity.

Lumia **as Art of Cosmic Consciousness**

Wilfred sometimes described *lumia* as a form of "cosmic art." The medium of light, described by Wilfred as a "universal, interstellar phenomenon," was ideally suited for a transcendent experience.[37] He wrote, "Is it not therefore logical to conceive of the noblest esthetic use of light

[35] Wilfred, *Lumia*, 65.

[36] Wilfred, "Composing in the Art of *Lumia*," *The Journal of Aesthetics and Art Criticism* 7, No. 2 (December 1948), 79–93.

[37] Letter from Wilfred to Donna Stein, June 18, 1965, Box 16, Folder 219, Wilfred Papers.

in just this direction, and first of all express the human longing which light has always symbolized—a longing for a greater reality, a cosmic consciousness, that we may balance the human entity against the great common denominator—the universal rhythmic flow."[38] The term "cosmic consciousness" is the title of a 1901 book by the Canadian psychiatrist Richard Maurice Bucke, and the same term appeared earlier in the theosophical writings of Helena Blavatsky. These authors proposed a "higher form of consciousness" that mankind can attain, whereby the connectedness of all things becomes apparent.[39] As Keely Orgeman demonstrates, Wilfred's suggestion of a cosmic connection could also be more literal: *lumia* compositions could be understood as depicting the cosmos, and some critics drew on astronomical vocabulary to describe *lumia*.[40] Wilfred drew on the same imagery; his description of an idealized *lumia* experience in his *Lumia* manuscript adumbrates the "stargate" sequence from Stanley Kubrick's 1968 film *2001: A Space Odyssey*:

> We are shooting through a huge tunnel of light with a speed that makes us grip the arms of our seat, but at the same time we experience a strange intoxicating exhilaration – we have been made free of space and time as we rush through the radiant tunnel with a velocity seemingly beyond human endurance, yet constantly increasing.[41]

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[38] Wilfred, *Lumia*, 66. This quotation also appears in Youngblood, *Expanded Cinema*, 345.

[39] Richard Maurice Bucke, *Cosmic Consciousness: A Study in the Evolution of the Human Mind* (New York: E.P. Dutton and Company, 1901); Helena Blavatsky, *The Secret Doctrine* (New York: Theosophical University Press, 1888), 328. Although Wilfred is sometimes labelled a "theosophist" by virtue of some of his acquaintances, he did not generally cite theosophists, and this is a rare example of a possible theosophical idea in his work. His emphasis on the separation of the senses, the arts, and art and science certainly contradicts theosophical doctrine.

[40] Keely Orgeman, "A Radiant Manifestation in Space: Wilfred, *Lumia* and Light," in *Thomas Wilfred and The Art of Light*, 38. Nebulae were in fact first photographed in the 1880s.

[41] Wilfred, *Lumia*, 58.

The appearance of Wilfred's op. 161 in Terrence Malick's 2011 film *The Tree of Life* at the very beginning of a scene that depicts the creation of the universe also draws on this association. *Lumia* was meant to be an art form offered this spiritual or extraterrestrial experience by virtue of its "interstellar" medium.

Wilfred believed that, as a visual art, *lumia* required distinct forms; the forms also took on particular "cosmic" significance. In practical terms, Wilfred's works were created by a caustic network that resulted from placing reflective and refractive objects between the light source and the screen. In this sense, Wilfred's art is, in Chris Salter's terminology, "entangled," as the new art is dependent on specific new technologies, even though Wilfred downplayed this dimension by describing light as his medium, rather than discursively centering the *clavilux* or any combination of technologies.[42] The forms of *lumia* were distinct (figure 4.3), if diaphanous and nebulous, remaining (with few exceptions) abstract. In contrast to the visual music filmmakers who followed in Wilfred's wake (such as Oskar Fischinger), as well as musically-influenced painters (such as Kandinsky and Kupka), Wilfred avoided geometric shapes, saying in an interview that he had "never believed in too-hard edges."[43] When the mathematician Edwin Blake suggested he study geometry to develop his art, Wilfred responded by doubling down on his suggestion that art was free expression, necessarily antithetical to science.[44] The hazy forms of *lumia* thus better align with the impressionist paintings of Monet or Turner's proto-

[42] Chris Salter, *Entangled: Technology and the Transformation of Performance* (Cambridge, Mass.: MIT Press, 2010). For Wilfred, the chasm between ends and means represents the gulf between the metaphysical and physical (Wilfred, "Light and the Artist," 16): "Like its seven older sisters *Lumia* is an aesthetic concept, expressed through a physical basis of method, materials and tools."

[43] Wilfred, "Thomas Wilfred and the Music of Light," interview by Patricia Marx, accessed April 5, 2019, https://www.wnyc.org/story/thomas-wilfred-and-art-light/.

[44] Blake & Wilfred, "Pro and Con," 275.

impressionism, an association made by critic George Vail in his 1922 article on Wilfred. More recently, Orgeman has suggested that the form of Wilfred's late work bears a likeness to photographs of star nebulae that were abundant in astronomy texts of the 30s and 40s.[45]

An analogy with fog and clouds helps elucidate the connection between Wilfred's forms and the interpretations he hoped they would inspire. Steven Connor has written on the attraction of haze and fog and related meteorological phenomena for modernist artists, for whom haze's indistinctness symbolized the elusiveness of representation.[46] Moreover, as John Durham Peters

Figure 4.3: Screenshot from: Wilfred, Lumia Suite, *op. 158, accessed April 9, 2019, https://www.youtube.com/watch?v=LZkmYS5eG5s.*

[45] George Vail, "Visible Music: The Birth of a New Art," *Nation*, August 2, 1922, 12. Orgeman, 38.

[46] Steven Connor, *The Matter of Air: Science and Art of the Ethereal* (London: Reaktion Books, 2010), 175–194.

writes, although clouds are often considered things of whimsy, the epitome of meaninglessness, "neither icon, index, nor symbol," they often become imbued with great meaning, albeit vague.[47] Wilfred intended for his forms to inspire association rather than be understood as pure, idealized abstraction; their indefiniteness, like clouds, constituted an appeal to the imagination. This strategically indistinct evocation was also reflected in the titles of some works, such as *Enchanted Forest* and *Chalice (treatment of the holy grail legend).*

Wilfred's forms also connected more broadly to the cosmic aspirations he harbored. He imagined the forms on the screen as part of a larger whole. In Wilfred's terms, the screen—what the audience could see—was the "first field"; but artists in the medium had to, he claimed, remain cognizant of the "second field"—the part of the composition invisible to spectators at any one point.[48] In this conception, Wilfred repeatedly compared the screen with a window and the auditorium with a spaceship.[49] The forms of Wilfred's compositions also recall the moment of epiphany in Bucke's *Cosmic Consciousness*: "the moment of revelation in relation to cosmic consciousness is described like a flame, cloud, or haze—a moment of revelation—a revelation of the connectedness of all things, that the whole universe is alive."[50] As with Wilfred, obnubilation leads to lucidity, leading from abstraction to the cosmic and universal. Wilfred imagined his

[47] John Durham Peters, *The Marvelous Clouds* (Chicago: University of Chicago Press, 2015), 257. Wilfred considered that the ambiguity of *lumia*'s forms might be useful in clinical settings. He worked with Dr. Norman Cameron, who was head of the department of psychology at the University of Wisconsin, on using *lumia* as an alternative to the Rorschach test in psychiatric testing and developed a special instrument for this purpose, which he called the "fantascope." Wilfred, *Lumia*, 142: "The Fantascope was synchronized with a sound recorder, and each remark and exclamation could thus later be identified with a definite visual development on the screen. The procedure may therefore be termed a mobile Rorschach test."

[48] Wilfred, "Composing in the Art of *Lumia*," 40–41.

[49] E.g. Wilfred, *Lumia*, 40.

[50] Bucke, 72.

performances as immersive and transportive, but given the limitations of the assembled technologies (the screen, auditorium, projector), the immersion would be imagined—first by the *lumia* artist and second by his ideal audience. During the 1940s he placed his faith in the future of 3-D technology as it was then being developed for the cinema to perfect the effect.[51]

As Wilfred's spatial forms were characterized by a cloudiness or haziness, his temporal forms were characterized by slow movements generally and, in his later works, by long durations. While his speeds contrasted with the "flickering" that Wilfred had criticized in Rimington's works, they were much slower than might be considered "visually necessary," notably slower, for example, than the rhythms of an Oskar Fischinger or even a Stan Brakhage animation. The movements instead recalled Gurnemanz's proclamation in Wagner's *Parsifal* that, "Zum Raum wird hier die Zeit" ("Here time turns into space"). Wilfred advocated "even flow" over "climaxes," "no beginning and no end" as "in nature."[52]

When Wilfred showed his later works in art galleries, his works were no longer bound by the attention span of an audience, and could thus be more aligned with his cosmic aspirations. Wilfred's *Counterpoint in Space,* op. 146, has a duration of 44 hours, 31 minutes, and 50 seconds; *Study in Depth*, op. 152, lasts 142 days, 2 hours, and 10 minutes; *Luccata,* op. 162, is infinite. What does it mean for these works to have such durations? Each was written for Wilfred's later automatic instruments, which could be turned off or moved at any time, or left to play on and on. For Wilfred, the work "ended" when the spatial and color forms literally repeated; in *Luccata,* this repetition never occurs. Although John Gage and Kevin Dann imply

[51] Wilfred, *Lumia,* 23.

[52] "Thomas Wilfred and the Music of Light."

that Wilfred was hubristic in conceiving works on such a grand scale, Wilfred naturally never imagined spectators viewing his works in their entirety.[53] He stated:" I consider these works as closed sequences without beginning or end, to be enjoyed at any point and for any length of time, like phenomena in nature."[54] Just as the visual image seen by viewers on the screen—the "first field"—was to be imagined as part of a larger even infinite space—the "second field"—the viewer could perceive only part of the entire, and possibly infinite, work.

The Silence of *Lumia*

Slow-moving vague shapes characterized the visual dimension of *lumia*; the sonic dimension was characterized by silence. Wilfred usually included "silent" in definitions of the art form, and he stressed its importance on prospective light artists who wrote to him and on people who bought his machines.[55] A *Time* magazine review from 1924 suggests that in Wilfred's early performances, the audiences abided by his desire for stillness: "When an enthusiastic dolt began to clap, they hissed him down as if he had interrupted the first movement of a sonata. But at the concert's end they, too, clapped long for inventor Wilfred."[56]

Wilfred was keen that the silence be understood as asset rather than absence. He complained of one viewer, who on experiencing his work exclaimed, "Let's get out of here, the

[53] Gage, 246. Kevin T. Dann, *Bright Colors Falsely Seen: Synaesthesia and the Search for Transcendental Knowledge* (New Haven: Yale University Press, 1998), 92.

[54] Letter from Thomas Wilfred to John Carrol Busby, September 16, 1967, Box 1, Folder 2, Wilfred Papers.

[55] E.g. "Light and the Artist," 250.

[56] "Music: *Clavilux*," *Time*, January 5, 1924: http://www.time.com/time/magazine/article/0,9171,719721,00.html

record player must have broken down," adding mordantly that "to her silence must be something you only tolerate when you go to sleep at night."[57] Wilfred described the silence of *lumia* as an escape from the urban soundscape: pure stillness amid the city's noise, a separation from the quotidian. "The universe is silent; a cosmic experience should be silent!" he wrote to Eugen Epstein, the *lumia* collector.[58] If the sound of silence in the city was in fact the hum of traffic, as John Cage professed, Wilfred sought the transcendent silence of space, in which light could travel but sound could not.[59]

Wilfred's conception of *lumia* as "respite" for "abused ears" came amid concern about noise levels in New York and other cities,[60] a concern that lead to the establishment of anti-noise movements (such as Julia Barnett Rice's Society for the Suppression of Unnecessary Noise in New York, which spearheaded the campaign for quiet zones around schools and hospitals) and led to innovations in sound proofing.[61] Wilfred and his collaborator Alfred Goldsmith repeatedly attempted to create a partnership with the Johns Manville Company, the world's biggest producer of asbestos products and a leader in the manufacture of sound-proofing materials.[62] Goldsmith suggested that the company might desire a *lumia* installation in their main office, since "silence is one of the most valuable things that the Johns Manville Company has for sale,"

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[57] Letter from Wilfred to Eugene Epstein, March 24, 1965, Box 1, Folder 17, Wilfred Papers.

[58] Letter form Wilfred to Eugene Epstein, January 30, 1965, Box 1, Folder 17, Wilfred Papers.

[59] "John Cage about Silence," accessed April 1, 2019, https://www.youtube.com/watch?v=pcHnL7aS64Y.

[60] Wilfred, *Lumia*, 112B.

[61] Raymond W. Smilor, "The Urban Environment: The Legal Attack on Noise 1865-1930," *Environmental Review: ER* 3, No. 3 (Spring 1979): 24–36; Smilor, "Cacophony at 34th and 6th: The Noise Problem in America, 1900-1930," *American Studies* 18, No. 1 (Spring 1977): 23–38.

[62] Emily Thompson, *The Soundscape of Modernity: Architectural Acoustics and the Culture of Listening in America, 1900-1933* (Cambridge, Mass.: MIT Press, 2002), 176 and 194–196.

and elsewhere suggested that the company provide the sound-proofing for *lumia* recitals.[63] In this regard, the silence of Wilfred's works might also be considered a way of transcending the everyday of modern, urbanized noise. Together with the slowness and transcendent experience the works cultivated, *lumia*'s silence made it an aesthetic (if also technological) antidote to "the increasing noise and tempo of modern life."[64]

Wilfred's demand for silence should be considered as much an opposition to *music* as to urban *noise*. The insistence on silence in performance contexts distinguished Wilfred's output from both its historical precedents and contemporary rivals, and helped maintain the art of light's "independence"—as light untarnished by either by musical pollution or the trope of rendering musical pitch as color. Wilfred feared that rather than giving "flight to the imagination," music might pin it down: through the process that Michel Chion calls "synchresis," audience members would associate the music and *lumia* together and, given the history of color music, might understand the lights as being "caused" by the music.[65] Wilfred's point of view was echoed in an essay by a Kansas State College student who had attended a *lumia* "recital": "I was glad when the music [which preceded the *lumia* performance] stopped and gave me free range of imagination."[66]

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[63] Letter from Alfred Goldsmith to W. J. Hodge, May 20, 1936, Box 1, Folder 25, Wilfred Papers. Letter from Alfred Goldsmith to W. J. Hodge, April 24, 1936, Box 1, Folder 25, Wilfred Papers.

[64] Wilfred, *Lumia*, 175.

[65] Michel Chion, *Film, A Sound Art*, trans. Claudia Gorbman (New York: Columbia University Press, 2009), 492: "Synchresis consists in perceiving the concomitance of a discrete sound event and discrete visual event as a single phenomenon."

[66] Elsa Bartel, "Lumia," Box 15, Folder 204, Wilfred Papers.

Considering the importance Wilfred placed on "silence," however, it is strange that sound is indeed present in a fantasy of a future *lumia* recital recounted in Wilfred's *Lumia* manuscript. However, rather than "music," Wilfred suggests that a new "art of sound" is required. The description that follows alludes to the then-inchoate notion of electronic music—a pure manifestation of sound unrestricted by conventional pitches or conventional instruments.[67] This "new art," he writes, "may compare to music as the great outdoors to a carefully tended formal garden."[68] In this description, tones contribute to the imagined spaces that *lumia* creates, as does a new art of smell producing artificial fragrances (in a turn that recalls the "scent organ" of Aldous Huxley's *Brave New World*). The articulation of these future potential media suggest that Wilfred's objection was therefore to particular extant forms and understandings of music; his objection functioned, I would suggest, as another means for him to assert distinction from the color music past.

Separating *Lumia* from Film

While Wilfred's approach to both the sonic and visual aspects of *lumia* suggest significant and self-conscious breaks with the history of color music, his rejection of film as a means of realizing light art marks an incompatibility with another branch of the work considered "visual music." In classifying Wilfred under the "visual music" banner, historians have grouped his work together not only with color organs but with the history of the "visual music film" or animation. Animation and visual music films have frequently been associated with color organs owing to

[67] Wilfred, *Lumia*, 192.

[68] Wilfred & Blake, "Pro and Con," 274.

their shared features: experimental, abstract, mobile art forms based on musical and sonic analogy. Several contemporary writers on visual music have also cast color organs as a predecessor to abstract animation, implying a technological teleology in which the former is necessarily replaced by the clearly superior latter.[69]

It is certainly true that Wilfred borrowed aspects of the cinematic assemblage in his instruments and works: he employed a horizontal screen in his early live performances; he projected his images; and, according to Andrew Johnston, he based his projectors on a patent for color projection by famed film director and producer D.W. Griffith.[70] However, Wilfred avowedly rejected the idea that film was superior to *lumia* and rebuffed any suggestion that he abandon the *clavilux* in favor of film as a medium. Wilfred was forthright in asserting that film, unlike *lumia*, did not represent a new art form, but was rather a continuation of drama (or, in the case of animation, painting).[71] He would not allow his *lumia* to be filmed, not even for publicity purposes. The stated reason for his hostility was the 24-frames-per-second rate of film; the *clavilux*, by contrast, could achieve complete continuity, according to Wilfred. In a statement that seems to clash with the profound slowness of his works, he uses a description of his *Unfolding* (op. 127), to suggest the material and aesthetic drawbacks of film:

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[69] E.g. Dieter Daniels, "Hybrids of Art, Science, Technology, Perception, Entertainment and Commerce at the Interface of Sound And Vision," in *See This Sound: Audiovisuology Essays 2: Histories and Theories of Audiovisual Media and Art*, ed. Dieter Daniels, Sandra Naumann, and Jan Thoben (Cologne: Verlag der Buchhandlung Walter König, 2011), 21; Aimee Mollaghan, *The Visual Music Film* (New York: Palgrave Macmillan, 2015) 27–38; and Simon Shaw-Millar, "Synaesthesia," in *The Routledge Companion to Music and Visual Culture*, ed. Tim Shephard and Anne Leonard (New York: Routledge, 2014), 19.

[70] Andrew Robert Johnston, "The Color of Prometheus: Thomas Wilfred's *Lumia* and the Projection of Transcendence," in *Color and the Moving Image: History, Theory, Aesthetics, Archive*, ed. Simon Brown, Sarah Street, and Liz Watkins (New York: Routledge 2013), 74.

[71] Wilfred & Blake, "Letters Pro and Con," 271.

> At the climax, slender curved tendrils of light travel from the bottom of the screen to its top in less than one second and the result is a graceful and spirited sweep, as of a soaring bird, easily followed by the eye, sharp and distinct throughout. A motion picture of this passage—for simplicity, assuming the screen to be twenty-four feet high—would transform the continuous motion into twenty-four one-foot jumps.[72]

Wilfred also blamed the cinema industry's adoption of non-diegetic music for creating the impression that moving images were incomplete without the presence of music.[73] Yet another discrepancy between film and *lumia* was ontological. In one article Wilfred claimed that *lumia* constituted a new fine art not only by virtue of its specific medium but also because it was a performance art—made up of works that could be performed live and interpreted differently by different performers.[74] Film would have not allowed for live performance, instead requiring a collapse of Wilfred's division of work and performance.

Although Wilfred defined *lumia* exclusively in aesthetic terms and ascribed its autonomy in relationship to its independent medium, in reality he had to recognize that institutions bestowed "autonomy" as well. The Art Institute of Light represented Wilfred's attempt to create an independent network through which light art could be propagated, its own "art world" or "field of cultural production." The Institute functioned through most of the 1930s and by 1935 it boasted as many as 400 members. Wilfred set out the aims of the Institute as follows: to provide studios and laboratories for inventors and artists interested in "the use of LIGHT (sic) as an independent medium for Esthetic Expression"; to establish a library on relevant topics; to found a museum for the retention of older instruments and plans; to "perfect and standardize" *lumia* technologies; to provide *lumia* "recitals" and lectures; to send players and lecturers further afield

[72] Ibid, 272.

[73] Ibid, 273.

[74] Ibid.

to proselytize for *lumia*; to build a membership for the Institute; and to bring about general recognition of "*lumia* – the art of light."[75] Wilfred hoped eventually for a departmentalized institution with separate divisions dedicated to *lumia*'s various possible applications and the Institute's different aims. While the Institute might never have fully achieved Wilfred's ambitions, it reified his vision of *lumia* as an art, allowing him to perform *lumia* in the "recital" format for the best part of a decade.

Wilfred's conceptualization of *lumia* as "an independent means of expression" manifests itself throughout his writings, but it also stamped the forms, technologies, and institutional arrangements he made. His concept of "independence" must be understood as "independence from"; his concern with articulating the public image of *lumia*, which he often posed in essentialist terms as a matter of necessity arising out of the medium of light, was also a concern with articulating what *lumia* was not. A sympathetic critic from the *New York Times*, Edward Jewell, recognized this, writing that "what Thomas Wilfred has done, among other things of prime pioneering importance, is firmly and clearly to establish this art of light as an art altogether independent of music."[76] Both in discourse and in practice, Wilfred attempted to purify light by dissociating it from music generally and color music specifically. Only when light art was true to light as a medium could it fulfill its potential and offer a transcendent aesthetic experience.

[75] Wilfred, "Art Institute of Light: Aims," undated (late 1930s?), Box 5, Folder 29, Wilfred Papers.

[76] Edward Alden Jewell, "What Thomas Wilfred Has Accomplished With His *Clavilux* at Art Institute of Light—Abstraction in a New Major Medium," *New York Times*, June 16, 1935, X8.

Music's Echoes in *Lumia*: Collaboration and Ontology

Thus far in this chapter I have shown how Wilfred's own idealization of his *lumia* as a "pure art form" and his rejection of color music and much of what has been called "visual music" should give pause to attempts to include his work in these canons. Nevertheless, music has a way of "creeping back" into understandings of *lumia*. Most obviously and concretely, this occurred when Wilfred performed with music despite his avowed preference for silence, but as I will suggest, the *idea* of music retains an importance in the ontology of *lumia* that rivals its importance to earlier color musicians.

Considering the precedence of color organs, and considering that Wilfred, himself a lapsed musician, first considered *lumia* primarily a performance art, it is of little surprise that Wilfred was sometimes approached to work with music and explored this avenue. Wilfred thought it was possible to coordinate *lumia* with music if the *lumia* was understood as an individual light artist's response to the musical work in question; on more than one occasion he compared this to different composers' settings of the same poetic text.[77] Most notably, in 1926, Wilfred performed alongside the Philadelphia Orchestra and Leopold Stokowski playing Rimsky-Korsakov's *Scheherazade*. During the performance, the orchestra was obscured by a large screen, against which Wilfred's lights were projected. Stokowski, an admirer and supporter of light art and musical visualization long before his turn in Disney's 1940 *Fantasia*, had discussed with Wilfred the possibility of providing a setting for Arthur Bliss's *Color Symphony*, but the two ultimately settled on a performance of Rimsky-Korsakov's popular symphonic

[77] Wilfred & Blake, "Pro and Con," 273.

poem.[78] Although Bliss's symphony might have posed its own problems, such as the fact that each movement is associated only with one color, the choice of Rimsky-Korsakov's work was interesting for two reasons, namely its position as a piece of program music and its Orientalist nature. Rimsky-Korsakov was ambivalent about the importance of the work's program, and certain sections of the piece are more clearly descriptive than others. Nevertheless, I would contend that the choice suggests that Stokowski and Wilfred thought that the light would be more easily graspable if it could be understood in relation to a musical work with pre-existing visual referents. Wilfred's attempts to illustrate fairly concretely certain aspects of the work tend to confirm this. Secondly, the choice capitalized on and perpetuated the Orientalist trope of the bounteous, brilliantly hued Middle East.

In the program book, Wilfred clearly stressed the independence of his setting from the work's musical features: "in several passages a crescendo in the music is accompanied by a visual diminuendo, and certain abrupt changes in the music have no immediate corresponding changes in Light."[79] However, clear nonmusical correspondences were present between light and narrative; in various parts of the setting, the *lumia* performance was clearly intended to represent aspects of the work's program, even without the use of pictorial elements. In the first movement, Wilfred chose a double white crescent shape to suggest Sinbad's ship and its sails; in the third movement ("The Young Prince and Princess"), the "visual theme" was "an Oriental garden"; in the same movement, a "delicate motive of slender light-forms moving around each other" might have been meant to suggest the titular lovers; and in the last movement, the return of the sea

[78] Lawrence Gilman, "Mr. Wilfred Paints the Lily in Scheherazade's Oriental Garden," *The New York Herald Tribune*, January 6, 1926, 15.

[79] Philadelphia Orchestra Program, January 5, 1926, Box 10, Folder 156, Wilfred Papers.

motive from the opening movement brought not only the return of the crescent motives, but additional visual suggestions of cliffs and waves.

By contrast to these more narrative evocations, the prevalent visual motive of the second movement was an abstract form, the spiral, that possibly suggested the contour of the spiraling contour of the movement's prominent woodwind solos. For Rimsky Korsakov's most obvious programmatic elements, the musical motives and orchestral effects that sonically embody the characters of the sultan and the eponymous storyteller, Wilfred employed recurring visual motives in parallel. Wilfred describes the former as soft and changing with "opalescent colorings," while the "stern, bloody" (presumably red) motive played the visual counterpart of the sultan's theme. The adjective "bloody" here suggests that the story on which the piece is based (the murderous sultan assuaged by the storytelling genius of his wife) plays at least as large a part as its musical characteristics in Wilfred's settings.

The music critics who attended this performance were curious but unconvinced. Despite Wilfred's own emphasis on *lumia*'s ability to provoke the imaginative powers of its audiences, Lawrence Gilman, who described the light art as otherwise "beautiful" and "engrossing," lamented that it had "the curious effect of diminishing the imaginative power and suggestiveness of the music."[80] Gilman ultimately suggested that the addition of *lumia* to Rimsky-Korsakov's work amounted to "an irrelevant decoration," implying that the musical work, for all its programmatic associations, was complete in itself, a point reiterated by Olin Downes, the music critic from the *New York Times*, who described the lights as "distracting" from or even

[80] Gilman, 15.

"nullifying" the music.[81] Downes, citing Nietzsche's critique of Wagner's *Gesamtkunstwerk,* questioned whether appealing to more senses could really be the means to achieve "perfect and complete" art. Additionally, Eugene Epstein has suggested (based on a personal conversation with Stokowski's widow, Gloria Vanderbilt) that neither Stokowski nor Wilfred considered the performance a complete success.[82]

Nevertheless, Wilfred performed with music on a number of other occasions in the 1930s and 1940s. In 1933, Wilfred collaborated in a Carnegie Hall concert with the soprano Julia Peters in a program that featured musical works by Schubert, Brahms, Weber, Strauss, Gretchaninoff, and Verdi. Wilfred played light "interpretations" for each song, as well as groups of silent *lumia* compositions. The programming of a light and music concert was touted by George Leyden Colledge, the concert manager at Carnegie Hall, as a means to provide classical music audiences with "more complete aesthetic satisfaction than is currently offered."[83] Suggesting that Wilfred's approach to music had changed little since his coordination with the Philadelphia Orchestra, the *New York Times* reported that Wilfred's performance oscillated between total abstraction and representational episodes depicting "a definite seashore, cliffs and sky, or trees in silhouette against a landscape," while also noting that the correspondence between music and *lumia* was vague—without obvious connections in tempo or intensity.[84] Elsewhere, one letter to Wilfred

[81] Olin Downes, "Music: Philadelphia Orchestra," *New York Times,* January 6, 1926, 17. Downes, "The Return of Arturo Toscanini—Color, Music and the Lyric Drama," *New York Times*, January 10, 1926, X6.

[82] "Discussion: Collecting *Lumia*," accessed April 1, 2019, https://americanart.si.edu/videos/discussion-collecting-*lumia*-154407

[83] "First Music and *Lumia* recital to be given at Carnegie Hall," press release, Box 10, Folder 156, Wilfred Papers.

[84] "Julia Peters, Soprano, in Recital, With Visual Accompaniment by the *Clavilux*, or Color Organ," *New York Times,* Mar 9, 1933, 19.

from an attendee to the Art Institute of Light suggests that music did breach even the dedicated silent sanctum of Wilfred's own institution, with eclectic choices (both Bach and "quarter- and eighth-tone music") referenced as having been played in a recital of Wilfred's. This letter suggests that music was used sometimes only for sections of light works, such as the beginning or end.[85] Furthermore, two of the works on Wilfred's opus list were designed as accompaniments or responses to musical works: his *Gothic Suite*, op. 78, is a setting of Widor's *Symphonie Gothique* and his *Visual Setting*, op. 127, was designed to accompany Sibelius's tone poem, *The Swan of Tuonela* (although it was also performed silently).

Wilfred suggested that audience preconceptions of what canonic musical pieces "looked like" was the reason for the lukewarm reception of his musical accompaniment and collaborative endeavors. Referring to the concert with Stokowski, he wrote that: "One lesson learned from the experiment was that we should have selected a musical composition never before heard—preferably one written with a visual accompaniment in mind. Most of us form mental images when we hear music and these are shattered by the actual visual one, necessarily different from our own."[86] This also indicates that Wilfred's own choices in these matters were based on the mental images a piece provoked in him. The evidence further suggests that the light paralleled elements of the musical program when one was present. The exact relationship to musical structures is less clear. On the one hand, Wilfred appears to have aimed for suitable atmospheres for the piece's affect; on the other hand, some of the criticisms of the concert suggested the relationship was not clear or close enough. Nevertheless, it seems that he aimed for some sort of

[85] Letter from Johanna Gjerulff to Wilfred, 17 December, 1939, Box 15, Folder 204, Wilfred Papers.

[86] Wilfred, *Lumia*, 120.

conformance between media; despite his insistence on medium specificity, his multimedia work differed from the montage aesthetic of haute European modernism.

Although Wilfred was dissatisfied with some of his musical performances, and although he clearly stated that silence was the sound of *lumia*, music was essential to his ontology of *lumia*, affecting how it was performed, written, and the technologies that were used, as well as its description. *Lumia* was a performance art; it took the form of discrete, repeatable works—complete with opus numbers! These were composed in advance of performance by a genius composer, recorded in notation, played by a performer who interpreted the composer's work, and received by an audience in a silent and darkened auditorium. Wilfred referred to his performances as either "concerts" or "recitals," in which he would play a selection of opus numbers, often performed as a program split into two halves with an intermission. This format might be understood as a form of remediation; even though Wilfred went out his way to avoid representing music in the *content* of his works, he favored packaging his art in musical terminology and presenting it in a musical environment.

Given his reliance on musical forms and formats in conceiving *lumia*, it is also unsurprising that Wilfred also looked to music with his first major attempts to commercialize *lumia* in the 1920s and 1930s: his *clavilux* Junior model of this period was a sort of *lumia* gramophone contained in a Victrola-like wooden cabinet, which obscured its mechanical innards from the bourgeois gaze. The instrument, as Wilfred conceived of it, would come with six changeable color records—painted clear discs in the shape of phonograph discs—and six clear discs on which the owners could paint and produce their own *lumia* works.[87] Wilfred's

[87] Letter from Wilfred to Alfred Goldsmith, 1934, Box 2, Folder 24, Wilfred Papers.

correspondent George Vail also referred to the possibility of the famed gramophone manufacturer Victor taking control of production of the *Clavilux* Junior.[88] Continuing the musical analogy, Wilfred considered his original *lumia* discs as records of works; the works themselves existed as separate entities, even as he continued to valorize live performance.

As well as his defining his practice, music arguably affected some of Wilfred's claims that *lumia* was "a fine art." His claim that light was his medium rather than the instruments and technologies he employed is comparable to what Emily Dolan calls the "commonly held belief" that sound (as opposed to instruments or vocal chords) is the medium of music.[89] Wilfred's imagined division of labor in a future iteration of the Art Institute of Light also recalled music: the instrument-making would be the task of a technician, while the aesthetic labor of composing and performing would be the work of a creative artist. Although he detested the term "color organ," Wilfred still considered the word "instrument" apt for his *clavilux*. Wilfred requested that fellow light artist Earl Rieback refer to his "instrument" and never to a "machine" or a "box," suggesting that to his chagrin, Rieback had been employing these terms.[90] The word functioned as a para-musical marker of the *clavilux*'s aesthetic status. Stephen Eskilson proposes that Wilfred embraced a musical analogy "because his idea for an 'Eighth Fine Art' did not take

[88] Letter from George Vail to Thomas Wilfred, no date, Box 4, Folder 73, Wilfred Papers.

[89] Emily Dolan, "Toward a Musicology of Interfaces," *Keyboard Perspectives* 5 (2012), 3. Philosophers who argue that sound is music's medium (rather than the causes the sound) include Schopenhauer and Ernst Bloch. Brian Kane, in the tradition of Marx and Adorno, refers to this as the "phantasmagoric" in musical aesthetics": Brian Kane, *Sounds Unseen: Acousmatic Music in Theory and Practice* (New York: Oxford University Press, 2014), 97–118.

[90] Letter from Wilfred to Christian Sidenius, January 6, 1967, Box 4, Folder 61, Wilfred Papers.

hold"—but it seems evident that Wilfred's "idea for an Eighth Fine Art" was in fact already steeped in music.[91]

Eskilson interprets Wilfred's music-like practices as a career move, in which his use of musical terms or concepts can be understood as a publicity strategy: music's abstraction justified the abstraction of Wilfred's art, and gave audiences a means by which they could understand something new through something old. Wilfred explained how music might be a gateway to *lumia*: "A short musical prelude while the houselights are being dimmed is very helpful; the familiar art of sound is a good bridge over which to approach the less known art of light, especially for those who experience *lumia* for the first time."[92] In this arrangement, music was an audible *lumia,* and *lumia* was a visual music, with Wilfred presenting the two as equivalents or analogues to ease comprehension. Such a strategy resembles that of other artists and critics who justified abstract visual art through a comparison with music, such as Roger Fry, who used the term "visual music" in describing and legitimating post-impressionist painting.[93]

Wilfred even described his work as "music" in publicity materials—but only in conjunction with the word "silent," as either "silent music" or "silent visual music."[94] Although the term "color music" and "visual music" are usually considered synonymous, and although the art of "color organs" is associated with both, Wilfred used the "[silent] visual music" term while shunning the descriptors "color music" and "color organ." Although Roger Fry's employment of

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[91] Eskilson, 65.

[92] Wilfred, *Lumia,* 107.

[93] Leah Dickerman, "Inventing Abstraction," in *Inventing Abstraction: A Radical Idea 1910–1925,* ed. Leah Dickerman (New York: Museum of Modern Art, 2012), 26.

[94] E.g. Letter from Wilfred to Jack Shor, September 17, 1959, Box 3, Folder 55, Wilfred Papers.

the term seems to predate Wilfred's, "visual music" was not as common a term as either "color music" or "color organ" in the 1920s when Wilfred was using it. Wilfred's use of the term therefore implies that he considered it quite distinct from these latter expressions, and therefore lacking some of their baggage while still leaving open the possibility of a musical understanding of his light art.

Nevertheless, Wilfred followed the views of his fellow member of the Promethean club, Claude Bragdon, in attributing to light a higher status than that of sound, because of light's greater universality. Both Bragdon and Wilfred meant this in a physical sense: as was known from the seventeenth century on, sound is reliant on another medium (air) for its transportation and is therefore limited to within the earth's atmosphere; light, by contrast transcended this limitation. When asked why light surpassed sound, Wilfred responded in these terms: "Light is a universal interstellar phenomenon, the source and maintainer of all life. Sound is a phenomenon limited to the thin atmospheric layer around the earth. Light is by far the greatest and most important of the two." [95] The implication was that a fully realized art of light would surpass music.

Wilfred was not alone in suggesting the possibility of the usurping of music's status by light art: Michael Luckiesh, leader of General Electric's lighting research department**,** stated that: "If mobile light becomes a fine art, it may be incomparably finer and more ethereal than music."[96] In his review of Wilfred's first public performance in 1922, Stark Young also noted the potential:

[95] Letter from Wilfred to Donna Stein, June 18, 1965, Box 3, Folder 44, Wilfred Papers; Bragdon, *Art and Democracy* (New York: A. A. Knopf, 1926), 122.

[96] Michael Luckiesh, *Artificial light: its influence upon civilization* (New York: The Century Co., 1920), 355.

> Music has long held its place as the most ideal of the arts. Which is to say that where other arts depend on some phenomenon, as in painting, or some concept, as in poetry, to express the idea, music conveys the idea direct and general; can put, for example, marching itself into our very feet. Mobile color has the same claim to ideality. It too without any intervening medium can convey a pure abstraction not to the ear but to the eye.[97]

Similarly, George Vail, rhapsodized in reviewing an early *lumia* recital:

> Music alone, in its purest form, is unhampered by limitations other than those inherent in itself. Is its monopoly of the Absolute, so eloquently proclaimed by Schopenhauer, to become a thing of the past? After witnessing a performance on the *Clavilux*, it is difficult to avoid the conclusion that here we may have a new art form—that of mobile color-as pure and unconditioned, as limitless in its possibilities, as the medium of Bach and Beethoven.[98]

No less a musical grandee than the conductor Leopold Stokowski also saw in *lumia* the potential to better music, a potential that he, like Wilfred, located in the "pure" nature of the medium itself:

> Every art has its medium of expression. The dramatist—stage, actors, lights, costumes, decoration in color and form. The sculptor—stone or wood; the poet words; the painter--canvas and pigment; the musician—air vibration. It seems to me that music is the least material of the arts, and perhaps we could even conceive of an art still subtler than that. I was very impressed by a light-color organ called the "*Clavilux*'," invented by Thomas Wilfred of New York. He has developed what seems to me a new art of color in form and motion, and it occurred to me that there are aspects of music that are extremely immaterial, that are almost pure spirit—and that some day an art might develop that would be immaterial, pure spirit.[99]

Surveying people who had attended his *lumia* shows, Wilfred asked both whether *lumia* was more or less "spiritual" than music, and whether attendees expected it to gain equal status or

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[97] Stark Young, "The Color Organ and the Theatre," *The New Republic*, January 18, 1922, 225.

[98] George Vail, "Visible Music," *The Nation*, August 22, 1922, 120.

[99] Jiddu Krishnamurti, "Early Writings: A Conversation with Stokowski" (1928), accessed March 24, 2019: http://jiddu-krishnamurti.net/en/1927-1928-1929-early-writings/krishnamurti-early-writings-12-a-conversation-with-stokowski.

even to surpass music.[100] Wilfred's own stance is clear enough, even if some of his audience members disagreed.[101]

Wilfred's rhetoric of purity, abstraction, and autonomy is familiar to musicologists from the much-discussed concept of absolute music—a concept that has also been applied to "visual music films," first by experimental filmmakers in 1920s Berlin, and more recently in Aimee Mollaghan's book *The Visual Music Film*.[102] The concept of "absolute music" generally places music on a pedestal as the highest art by virtue of its apparent superiority in terms of abstraction and autonomy—its non-specificity and incorporeality turned into a virtue**.** Wilfred perpetuated the aesthetic priorities that had enabled the glorification of absolute music, for example that the less tangible and referential the medium or the art form, the more spiritual and powerful the aesthetic experience. However, he used these ideas to the end of adulating light and light art as yet superior, replacing music on the highest rung of the purity ladder.

Lumia as "a new type of painting"

Wilfred's ideal of a medium specific light art obumbrated the musical influences on his thought, but it was also compromised in practice through continuous hybridizing. The reality of the organization of a field of cultural production required this; despite his attempt at creating an independent artworld in the Art Institute of Light, more obvious opportunities arose by adapting

[100] "Results of Questionnaires Given to 200 Men and Women," Wilfred Papers. Reprinted in *Lumia: Thomas Wilfred and the Art of Light*, 161.

[101] Only one person of the 155 who answered the question of whether *lumia* was equal, inferior, or superior to music chose the last option.

[102] Mollaghan.

lumia to pre-existing artworlds. Wilfred himself, in *Lumia*, listed a number of possible contexts that *lumia* might appear in. The first, of course, was *lumia* as a "pure art form," i.e. in the more-or-less silent, solo recital format. Other options he considered included the provision of stage lighting effects; in interaction with music—but also dance, religious service, and motion pictures; "murals" in public or private buildings; for the purpose of teaching design; and a psychological or "therapeutic" instrument for mind or body.[103] As discussed in the previous section, Wilfred did carry out work with musicians. He also worked alongside the Denishawn Dancers and, following the example of Adolphe Appia, he provided scenic lighting and projected scenery for the American premiere of Henrik Ibsen's difficult-to-stage play, *The Vikings of Helgeland*.[104] In spite of his objections to film, Wilfred was willing also to work with television companies, developing a special instrument specifically for the purpose of televising *lumia* in coordination with NBC in the late 1930s (after a single transmission the experiment was not continued owing to money and personnel problems).[105] One particularly successful hybridization for *lumia* though came in the presentation of *lumia* as a form of painting. On the one hand, this required changes to the technologies involved and to the ontology of "the work" in *lumia*, severing *lumia* from its musical basis. On the other hand, I argue that aspects of *lumia* that had been key to Wilfred's claims of autonomy for the art in fact enabled it to be presented and received as a form of painting.

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[103] Wilfred, "Some of the Various Uses of *Clavilux* Instruments," Box 5, Folder 79, Wilfred Papers.

[104] Adolphe Appia was a Swiss architect and lighting designer who provided projected set design particularly for Wagner's operas from the 1890s. On Appia, see David Roesner, *Musicality in Theatre: Music as Model, Method and Metaphor in Theatre-Making* (Burlington, VT: Ashgate, 2014).

[105] Letter from Wilfred to Jane Ashman, July 28, 1949; Letter from Thom H Hutchinson of NBC to Wilfred, February 28, 1941; Letter from Thomas Wilfred to Hutchinson, February 1,3 1941. All Box 16, Folder 223, Wilfred Papers.

Even as Wilfred prioritized music-like performance in concerts, he began to experiment with situating his work in relation to painting rather than music. In the 1920s the art critic Sheldon Cheney dedicated an entire chapter to Wilfred in his *A Primer of Modern Art*, in which he wrote about Wilfred together with famous painters and sculptors and suggested *lumia* as an exciting avenue for modern (visual) art to explore.[106] Wilfred created a *lumia* mural that was installed in the ballroom of Chicago's Sherman Hotel in the spring of 1929 and operated there for at least 33 years.[107] Wilfred and his collaborator Goldsmith also made a concerted effort in 1935 to convince The Rockefeller Center to install a *lumia* mural—albeit unsuccessfully.[108] In 1931, *The New York Times* reported that Wilfred had created a "new type of painting."[109] In a manner unlike the *clavilux* junior models, but similar to the *clavilux* recitals, the image was projected out from the mechanism. The *Times* article referred to the surface projected onto not as a *screen*, but rather as a *canvas*. As with the gramophone-like *clavilux* junior, this "light painting" was intended to penetrate domestic markets, "hung in home as are oil paintings," according to Wilfred.[110]

After Grand Central Palace was requisitioned by the army in 1942 and Wilfred's institution no longer had a space, his home in West Nyack functioned as "The Art Institute of Light," but without a recital space or even adequate storage space for his largest instruments, even if the letterhead continued to exist. After being evicted from its Manhattan location, the Art

[106] Sheldon Cheney, *A Primer of Modern Art* (New York: Liveright, inc., 1932).

[107] Wilfred, *Lumia*, 134.

[108] Letter from H. McA. Schley to Wilfred, November 7, 1935, Box 2, Folder 25, Wilfred Papers.

[109] "New Kind of Painting Uses Light as a Medium," *New York Times*, December 8, 1931, 34.

[110] Ibid.

Institute failed to regain substantial financial support and the original *claviluxes*—those designed for live performance—remained in storage. This material and institutional shift had substantial implications on the performance, manufacture, and commercialization of *lumia*—and on the ontology of *lumia* as an art form—ultimately furthering *lumia*'s reformation as a "new type of painting."

When Wilfred articulated the uses of *clavilux* in *Lumia*, one unmentioned possibility was art gallery exhibition. Building on the painting-like potential he began to articulate around 1930, in 1942 Wilfred first lent three works to MoMA (*Tranquil Study, Abstract*, and *Vertical Sequence*). This initiated a relationship between him and the gallery, which later led to his inclusion in the 1952 "15 Americans" exhibition (curated by Dorothy Millar). Although critical reception to Wilfred's work in the exhibition was mixed, the inclusion of his work itself proved pivotal in positioning Wilfred comfortably within the world of the institutionally recognized visual arts, legitimizing the equation of his creations with painting. Wilfred's work was later exhibited at the Whitney Museum, the San Francisco Museum of Art, the Moderne Museum in Stockholm, the Louisiana Museum in Denmark, and the Howard Wise Gallery in New York, which would become the premier venue for light art in the 1960s and 1970s. Additionally, Wilfred was able to continue in the vein of his work at the Sherman Hotel; in 1960 he was able to install a *lumia* mural in a public space, his op. 152, *Study in Depth* taking up its home in the waiting room of the Clairol Company's offices.

The exposure from the "15 Americans" exhibition and further displays of Wilfred works in MoMA created a burgeoning interest in *lumia*, resulting in a substantial quantity of fan mail and purchase requests or inquiries. As Wilfred acknowledged in one letter: "The *lumia* compositions I have been executing in recent years are original signed works of art comparable

to works in painting and sculpture. They are performed by player attachments and no changes are possible."[111] He repurposed and modified the model of self-illuminating, automatic domestic models to serve as independent artworks. In this new conception, each instrument no longer simply afforded performance, producing or reproducing a work; rather, each instrument *was* the artwork, the "original signed work," in itself. It is ironic that these new devices could be recast as similar to paintings, as this type of instrument's original guise had been the *clavilux* junior, the nearly-musical, *lumia* equivalent to the gramophone. In his success following the "15 Americans" exhibit, Wilfred had re-ontologized his art form, with instrument/machine recast as artwork, not separable from it, and with each device/artwork being technologically distinct as well (he had by this point long given up patenting his devices). When Wilfred began selling these new types of *lumia* compositions—each of which still received an opus number—they went for around $4000 each. Contradicting his and Goldsmith's commercialization attempts in the 1920s and 1930s, he came to claim that it was "impossible" to mass produce *lumia*.[112] Instead, he maintained the aura of high art by adopting one form of what Bourdieu refers to as the visual artworld's "restricted production," by which scarcity generates both cultural and financial capital.[113]

Eskilson has also pointed out this shift in Wilfred's framework, from a musical analogy to one grounded in visual art.[114] Placing pressure on Eskilson's notion that this represents a new

[111] Letter from Thomas Wilfred to Dr. E N. Pareis, August 26, 1965, Box 3, Folder 47, Wilfred Papers.

[112] Letter from Thomas Wilfred to Alfred Johnson, November 26, 1962, Box 2, Folder 29, Wilfred Papers.

[113] Pierre Bourdieu, *The Field of Cultural Production: Essays on Art and Literature* (New York: Columbia University Press, 1993), 36.

[114] Eskilson, 65–68.

watershed in terms of Wilfred's own conception of his art form, even late in life, it is worth noting that Wilfred continued to idealize live, music-esque performances, as can be heard in a radio interview that was recorded only shortly before his death.[115] Gallery exhibition and the creation of unchangeable works of art might be more accurately understood as a compromise with the realities of the organization of the field of cultural production, rather than as a change in Wilfred's personal vision of *lumia*.

Given his relative success in this visual art context, it is curious that Wilfred should claim to have been ignored by the artistic establishment: what he referred to as the "silent treatment" by the "international art cartel."[116] Since late in his career, he only marketed his works and devices to this art world, his complaints come across as exaggerated, if not disingenuous. In one letter, he claims to have been subject to technophobia from people who thought that "machines" had no place in art or art galleries.[117] One review from the *New Yorker* would support Wilfred's suspicion that of not being taken seriously by the art establishment:

> The *Clavilux* is a device for 'playing light as one plays a piano,' but despite the pretty effects it permits, it seems too notional to be classed as an art form, and so do the *Lumia*. Their inclusion in the affair is an indication of the basic capriciousness of the undertaking. That there are some good pieces in the collection is almost incidental. For the most part, the exhibition is a reflection of a rather supercilious attitude the Museum has shown before toward contemporary American art—that it's a field of no great consequence or validity, fun to cull through for oddments and curiosities but hardly worth serious investigation.[118]

[115] "Thomas Wilfred and the Music of Light."

[116] Letter from Wilfred to Richard Manville, 1961, Box 2, Folder 39, Wilfred Papers.

[117] Ibid.

[118] Robert M. Coates, "The Art Galleries," *The New Yorker*, May 3, 1952, 97.

For this reviewer Wilfred belonged to "oddments and curiosities" rather than the serious mainstream of visual art.

While *The New Yorker*'s Robert Coates and others might have rejected Wilfred's "machines" for their lack of resemblance to painting and sculpture, what they produced well afforded the possibility of art gallery exhibition. His abstract forms ultimately fit quite comfortably next to the abstract forms of, among others, Pollock and Rothko in the "15 Americans" exhibition in MoMA. Although they involve motion, their extreme slowness almost approaches the stationary nature of painting. Furthermore, the screens could be considered and presented as "canvases." Gregory Zinman writes that Wilfred's work blazed a path "for the museum's eventual embrace of single-channel video and multimedia installation."[119] However, I would argue that it was *lumia*'s *lack* of multimedia—the specificity, silence, and pure visuality that Wilfred had cultivated in opposition to color music—that allowed for its art gallery acceptance. Holly Rogers argues that the introduction of sound into art galleries via video art in the late 1960s "required a radical re-evaluation of art exhibition practice and the defining parameters of art itself."[120] *Lumia* might have posed exhibition difficulties and been a curiosity, but it did not necessitate quite such a shift. On the other hand, exhibiting Wilfred can still be considered precedent-setting, as an early example of time-based media and acceptance of electronic artworks in a major gallery before the more widespread appearance and adoption of video art and installation art.

[119] Zinman, 81.

[120] Holly Rogers, *Sounding the gallery: video and the rise of art-music* (Oxford: Oxford University Press, 2013), 5.

Conclusion

Although Wilfred has been described as belonging to an intermedia field, or as a pioneer in breaking down distinctions between the arts, we might also recognize his simultaneous investment in and rejection of that ideology. He did not use new technologies or the concept of a new medium to reimagine what art was or could do. His technologies or artistic forms were not innately conservative, but his medium-specific discourse and marketing strategies could be. Nevertheless, Wilfred faced problems that also confronted later artists who worked in intermedia or with art and technology. He had to recognize that separate art forms did not exist as separate idealized types, but also as independent cultural fields or artworlds. In order to establish himself professionally, Wilfred undertook negotiations and adaptations of his art and practice in attempts to join of gain recognition in pre-existing fields.

Additionally, maintaining the status of a new art form became increasingly difficult owing to the proliferation of an array of light gadgets. As previously mentioned, Wilfred's lifetime saw the emergence of a variety of color music technologies, some of which were also referred to as "color organs." Now, clearly situating Wilfred's work and legacy has become even harder, as variegated media constellations of lava lamps, screen savers, computer music visualizers, and liquid light shows have reterritorialized Wilfred's cosmically-inclined oeuvre. As Eskilson has suggested, the "15 Americans" exhibition at MoMA in 1952 could have brought Wilfred into the abstract expressionist fold, but his work has been rejected from that canon, sidelined. Caroline Jones writes that Wilfred's work has become "somehow kitschy."[121] This might be one reason that Wilfred, despite being the "father of light art" maintains a rather

[121] Caroline Jones, *Clement Greenberg's modernism and the bureaucratization of the senses* (Chicago: University of Chicago Press, 2005), 125.

marginal position in the canon of modernist visual art. Recapturing Wilfred's ambitions can perhaps suggest a different mode of reception.

Even while performing in his ideal circumstances, without the obstacles of commercial realities or wartime upheaval, Wilfred could not fully disentwine himself from the anxiety-inducing influence of music**.** The tendency of both later writers and contemporaneous commentators to describe Wilfred's work in reference to music suggests the failure of Wilfred's discursive distancing strategies. While I have suggested this reception was partly caused by musical thinking and the perpetuation of the idealization of music in Wilfred's writings and practices, it also reflects the continued use of an analogy with sound in the understanding of light, which had been sustained in art by the color music tradition after the comparison was no longer upheld in the scientific mainstream. To speak of light as an artistic medium was to speak of music, perfectly encapsulated in the descriptive use of the colon in the title of Adrian Klein's 1926 book, "Color Music: The Art of Light."[122] Music was also a byword for abstraction, purity, and the ineffable in the cultural milieu of the early twentieth century; it did not simply stand for "organized sound." Deems Taylor suggests this in his review of a 1924 Wilfred performance:

> The fact that Thomas Wilfred's *Clavilux* is commonly known as the color-organ is not the only reason why a music reviewer should have attended his recital last night in Aeolian Hall. For this new color-art might very aptly be called music for the eye…it is color and light and form and motion, but it is not painting, nor sculpture, nor pantomime. It is difficult to convey in words. Describing the *Clavilux* to one who has not seen it is like describing an orange to an Esquimo.

The characteristics that Wilfred and his audiences imbued *lumia* with were the same characteristics prized in music and considered inextricably musical. Even when music was absent, as in the vast majority of Wilfred's work, music could be a hermeneutic window for his

[122] Adrian Bernard Leopold Klein, *Color Music: The Art of Light* (London: C. Lookwood & Son, 1930).

audience to look through**.** This suggests that art not created as "intermedia" might still have been perceived as such. In fact, in distancing *lumia* from music, Wilfred was simultaneously aiming to approach the musical—where the latter is understood to denote the pure, non-referential, and medium-specific, as in Walter Pater's famous phrase, "aspire to the condition of music."[123] Ironically, detaching *lumia* from music as sound lent it precisely these musical qualities.

That Wilfred could not dispatch the term "color organ" was partly because of his musical thinking and partly because of historical precedent. "Color organ" became a wandering signifier, encompassing technologies like Wilfred's *claviluxe*s and even disco light units—far removed from the keyboard instruments of Castel and Rimington. Furthermore, the term seems to have been fairly widely understood. "Color organ" was even employed as a metaphor. In 1934 a writer from *Popular Mechanics* employed to explain the effect of viewing the northern lights:

> If you live in the northern half of the United States and have been fortunate, you stepped outside some night and saw painted on the dark sky a moving, colorful spectacle of such sheer beauty as to take your breath away. Bright lights with draperies of a greenish hue, perhaps bordered with red at the bottom, dance and flickered before your eyes, changing in form as though blown by the winds. Again you may have observed crowns of blue rays, arches and other fantastic effect, wavering and shimmering as though manipulated by a master at the control board of a giant color organ.[124]

In this passage, we see hints of Wilfred's own celestial ambitions—tied to an expression he had hoped to consign to history.

[123] Walter Pater, "The School of Giorgione" (1877), in *The Renaissance* (New York [n.d.]), 111.

[124] "The Mystery of the Northern Lights," *Popular Mechanics* (January 1934), 28.

Wilfred and Greenewalt in Comparison

Greenewalt and Wilfred never met in person, but in 1922 she threatened to sue him for infringing on her "light-score" patent, having spotted a publicity photograph of the inventor at his *clavilux* with notation in front of him in *Theater Arts* magazine. The notation featured does not in fact resemble Wilfred's standard notation practices (which in no way resemble musical notation); his lawyers claimed the notation was merely for publicity purposes.[125] They further rejected the legitimacy of Greenewalt's patent and asserted that even if the patent was valid, it would be limited to the specific form she employed, and not to light notation generally.[126] Despite Michael Betancourt's claims to the contrary, this was the only ground on which Greenewalt threatened to sue Wilfred and it never came to court.[127] Later, Wilfred volunteered to help the legal team for the Stanley Corporation in providing them with information and literature about previous color organ and color music, such as the work of Bainbridge Bishop and Rimington, but in doing so he noted that, "The woman in question has never bothered me beyond a number of empty threats, although I have time and again invited her to bring suit so the matter may be settled once and for all," proving that their case never made it to court.[128] His decision to help Stanley probably resulted from residual bad blood over Greenewalt's earlier threats. Aside from this, there is no

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[125] Letter from Rogers, Kennedy & Campbell to Howson and Howson, March 2, 1922, Box 10, Folder 9, Greenewalt Papers.

[126] Letter from Rogers, Kennedy & Campbell to Howson and Howson, April 24, 1922, Box 10, Folder 9, Greenewalt Papers.

[127] Michael Betancourt, *The History of Motion Graphics: From Avant-Garde to Industry in the United States* (Rockville, MD: Wildside Press, 2013), 25. Betancourt claims that Greenewalt sued Wilfred for infringing on her patent for a means of associating light and music; he further claims that Wilfred won this case. He does not provide a case citation and there is no record of any legal action between them.

[128] Letter from Wilfred to Frank Buehler, May 28, 1926, Box 9, Folder 140, Wilfred Papers.

mention of Greenewalt in Wilfred's archive and writings, although she, more scrupulously attentive to perceived threats to her intellectual property, referenced and compared his work to hers. She was aware, for example, of publicity that touted him as "the inventor of the color organ," an unjustifiable claim that doubtlessly riled her.

The two make an instructive pairing because, though their discursive strategies and ambitions had so much in common, their practices and careers differed significantly. They both criticized the color music tradition and did so on similar grounds: rejecting the physical analogy between sound and color, rejecting that an analogy could be the basis of an art form, and rejecting the aesthetic results of color organs (epitomized for them both in the quickly flashing colors of Rimington's instrument). They both then provided new terms for their creative endeavors that they defined as medium-specific arts of light. While Greenewalt labelled her *nourathar* "fine art the sixth," Wilfred, also considering the arts numerable, spoke of *lumia* as the "eighth fine art." In the process, they both centered light as a medium rather than color and both asserted that this medium was superior to previous artistic media, particularly sound, owing to its purity or transcendent quality. Their commonalities do not point to influence. Wilfred and Greenewalt gave the same year as the starting point of their work on light. It would appear that Greenewalt first became aware of Wilfred when he began giving public performances after 1922. By this time, she had already constructed and patented her first sarabet. Wilfred first seemingly became aware of Greenewalt when her lawyers contacted him. This means that, despite claims of primacy and authorship, it would be futile to give one priority over the other with regard to originality.

One aspect in which they self-consciously diverged from their predecessors was form. Both of them suggested that a new approach to form was an essential component of their arts: for

Wilfred, *lumia* required distinct spatial forms because it was a visual art; for Greenewalt, *nourathar* had to envelop a space because light was an enveloping medium. Yet it was in relationship to form and space that their arts most clearly differed from one another. As she did not produce any distinct forms, Greenewalt's work was more radically abstract than Wilfred's. Indeed, on this basis she argued that his light art was not medium specific or abstract enough. She cast aspersions on the novelty of his work in a 1922 letter to *Musical America*, claiming that having any forms at all, even of the abstract, nebulous, discarnate types favored by her New York rival, reduced light art to a copy of previous visual arts:

> With one exception, Mr. Wilfred's achievement so far sticks to the field of painting. It is not a color organ. It is a colored shape and form organ. It does not use the rhythms of the arts of succession. Shapes and forms manifestly interfere with this use. It cannot 'flood an entire auditorium' with fluid light intensities and color without departing from the field belonging to it. It expresses emotion as painting expresses it and not as an art extended into time. Anybody is welcome to paint. We included form of this kind in our public performances in 1911 and 1914... It is quite another thing to use light intensities and their color in the timing of the arts of succession, for the purposes of emotional and abstract expression![129]

While Wilfred cast his *lumia* as belonging to a third combined spatial and temporal category, Greenewalt claimed that *nourathar* was purely the latter. Spatial forms therefore polluted light art, detracting from the purity of light. While in the *Musical America* letter she compared Wilfred's works to painting, she elsewhere compared his works to nineteenth-century visual gadgetry—drawing into question his artistry and novelty as well as his dedication to medium specificity. She likened Wilfred's works to a "kaleidoscope," a "stereopticon," and, seemingly on one occasion, more obliquely, to phantasmagoria.[130] Although "colored shape and form organ" is

[129] Greenewalt, letter, *Musical America*, February 2, 1922, cited in Johnston, 'Pulses of Abstraction: Episodes from a History of Animation" (PhD Diss., University of Chicago, 2011), 46.

[130] "This salt cellar under these circumstances could cause Conan Doyle audiences to think that their very spirits were floating up heaven-ward before them." Greenewalt, "Mr Pfeiffer's Deposition: The Wilfred Stereopticon"

meant to be derogatory in the above quotation, it is in fact a fairly good summary of how Wilfred's technologies and aesthetic differed from Greenewalt and the longer history of color organs. Wilfred perhaps had Greenewalt in mind when he gibed (some years after her death) in a 1968 radio interview that "if it's just a display of changing color, it doesn't mean anything to anybody." If his oblique forms were intended to provoke the free play of the imagination and thereby a form of transcendence, color on its own could not enable such an experience.[131] It was probable that Greenewalt only threatened to sue him on the grounds of notation because, in comparison to the effects at movie theaters and at the Severance Hall, the effects produced in Wilfred's *lumia* were so different from her own.

Their attempts to make careers as light artists also diverged significantly. Greenewalt attempted to make a career in the commercial rather than the artistic world. Although both of them spoke of their respective art forms as performance arts, Greenewalt stayed perhaps more wedded to this idea than Wilfred, and she never considered art gallery exhibition an option. Additionally, she lacked anything resembling painterly forms in her work. The silence, shapes, and screens of Wilfred's *lumia* afforded its gallery exhibition, but Greenewalt's *nourathar* shared none of these characteristics. Nevertheless, although *nourathar* might not have been considered suitable for gallery exhibition during her lifetime, as Matthew Guerrieri notes, Greenewalt's work might retrospectively be considered a predecessor of art installations as her colored light filled the spaces in which she performed.[132] Although the contemporary light artist

(handwritten note), May 15, 1922, Box 10, Folder 8, Greenewalt Papers. See also Greenewalt, *Light: Fine Art the Sixth*, 16.

[131] "Thomas Wilfred and the Music of Light."

[132] Matthew Guerrieri, "Mary Hallock Greenewalt's Illuminated Music," accessed April 5, 2019, http://daily.redbullmusicacademy.com/2017/09/mary-hallock-greenewalt-feature.

James Turrell cites Wilfred as an influence, his aesthetic of single colors saturating a space potentially resembles Greenewalt's work to a greater degree than it does Wilfred's.[133]

Another difference that put Wilfred outside the scope of Greenewalt's patent claims was their relationship to sound and music, though both shared an understanding of light art as separate (or at least separable) from music, sometimes construing music as a mere marketing device. In her works, Greenewalt viewed silence as merely *possible*, and considered the presentation of self-sufficient works in *nourathar* a potential future development. Her work developed out of a coordination with music before she began to separate light out from this multimedia relationship and describe it as independent. Even then, she mostly worked in tandem with music. In contrast, Wilfred's first recital in 1922 was a silent one, and though his repeated work with music suggested a continued attraction towards the idea, the comingling of music and light remained a sideline for him, apart from the silence he idealized. While Wilfred, following abstract painters, found music a useful metaphor for his art, Greenewalt found music a necessary component to ease audience and patent office understanding.

I have suggested that the analogy between sound and light remained a strong reference in defining Greenewalt and Wilfred's new arts even as they outwardly rejected it. Both bestowed on light characteristics they associated with music: in Greenewalt's case, the timed presentation of emotions expressed in intensity; in Wilfred's case, the ontology of a performance art form with a pure, abstract medium. Neither Wilfred's nor Greenwalt's intentions need overdetermine

[133] Zinman, 89. As Zinman notes, Turrell has given contradictory statements on Wilfred. Earlier in his career, Turrell said, "The works of Thomas Wilfred and that kind of swirling light never interested me" (ibid).

how we historicize them, but the gap between their own descriptions of their art and how it was presented and how it has been received creates an interesting tension.

In their bid to recast older forms of light and color art based on a direct analogy to musical structures as obsolete, neither Wilfred nor Greenewalt recognized that both Rimington, whose writings they were aware of, and Castel, whom they knew more vaguely, had already articulated visions of an independent art of color. The possibility that colors and/or lights could be a more perfect medium than music was already present in Castel's and Rimington's discourse. Ironically then, their desire for independence is one aspect in which Wilfred and Greenewalt fit into this lineage, attempting to fulfill an ambition of these earlier experimenters.

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