

UNIVERSITY OF CALIFORNIA
Santa Barbara

Part One:
Paintings as a Source of Musical Material and Form

Part Two:
A Portfolio of Compositions

A Dissertation submitted in partial satisfaction
of the requirements for the degree of Doctor of
Philosophy in Music

by

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March 2016

Paintings as a Source of Musical Material and Form

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David E. Gordon

To Wassily Kandinsky.

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Curriculum Vitæ

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2015 "Geospatial Collage," College of Creative Studies Gallery, Santa Barbara, CA.

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Abstract

Part One:

Paintings as a Source of Musical Material and Form

Part Two:

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Part One:

While paintings, drawings, and sculptures have inspired composers and musicians since ancient times, before the modern era, they were rarely used specifically to *generate* musical material or forms. However, in the late 19th and early 20th centuries, new technologies allowed avant-garde movements to increasingly incorporate the actual structure and language of visual art into music. The development of film and the advent of digital computers enabled new interdisciplinary and transdisciplinary approaches to music, hardly imaginable in the past.

This paper investigates the use of visual art to generate musical material and form. In particular, it studies the use of algorithmic processes, aided by computers, to translate visual elements in paintings, such as line, color and shape, into

musical parameters, such as rhythm, pitch, harmony and timbre. The next chapter provides a brief overview of historical methods for obtaining musical content and structure from paintings. The following chapter analyzes four of the author's compositions that derive musical material and form from paintings, including two instrumental works, a fixed media electronics piece, and a live audiovisual performance.

Part Two:

Scores of:

Evaporation, for Solo Piano

Three Sketches, for Flute and Piano

Reflection, for Solo Viola

Portrait, for Solo Violin

Six Mondrian Paintings, for Four Percussionists

Sonata, for Viola and Piano

AIFF files including:

Refracted Light, for Fixed Media

Modulations, for Fixed Media

Transformation, for Fixed Media

MOV files including:

Echo, for Fixed Media and Video

Parallels, for Fixed Media and Video

All works are available at the author's website: www.spatializedmusic.com

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Part One:

Paintings as a Source of Musical Material and Form

I. Introduction

Since ancient times and across diverse cultural traditions, music has been closely tied to other arts, especially poetry, theater, and dance. Basic musical concepts such as meter, phrasing, and articulation are rooted in speech and the movements of the body. The dramatic arc, embodied in the three parts of the classical sonata form: exposition, development and recapitulation, is closely related to Aristotle's division of dramatic structure into three parts outlined in his *Poetics* (c. 335 BCE): the *protasis*, *epitasis*, and *catastrophe*.

Plastic arts, broadly speaking, such as painting, drawing, sculpture, and ceramics, have also influenced composers throughout history, though often less directly. For example, Modest Mussorgsky's popular piano suite *Pictures at an Exhibition* (1874) depicts a walk through an exhibition of paintings by the composer's friend Viktor Hartmann. Each movement in the suite corresponds to a particular painting, on which its musical style and character are based.

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Visual art also plays an important role in the work of German composer Richard Wagner. In his famous operatic cycle *Der Ring des Nibelungen*, Wagner realized his comprehensive vision of the "total work of art," in which the dramatic impact of music is enhanced by its integration with scene painting, costumes and set design. Rather than being mere inspiration, visual art in Wagner's operas is incorporated as an integral part of the musical experience.

Often called the "father of multimedia," Wagner's expansion of the role of visual art in music directly prefigures the development of cinema. His proposal of a synthesis of art forms pushed for a greater role of the plastic arts in music, whose influence, arguably, remained largely indirect until that point. His use of multisensory experience to enhance the dramatic effect of music anticipates the increasingly far-reaching impact of the visual arts on music during the late 19th and early 20th centuries.

Around the time of Wagner's death, the emerging science of psychology, paralleled by philosophical movements such as phenomenology and existentialism, placed an increasing importance on subjective perception. These developments, along with several widely reported cases of cross-sensory perception, or *synaesthesia*, contributed to a growing interest among composers and artists in mining deeper connections between the auditory and visual senses. Composers searched for innovative solutions to the challenge of translating visual qualities such as

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form, color and texture into the time-based language of music. At the same time, visual artists as diverse as Kandinsky, Mondrian, Klee, and the Cubists sought to incorporate musical ideas of movement, development, and variation in their paintings.

In 1910, Russian composer Alexander Scriabin (1872-1915) famously incorporated a notated part for projected color in his groundbreaking symphonic poem, *Prometheus: The Poem of Fire*. During the same year, Wassily Kandinsky, painted his first abstract watercolor, motivated by the creation of a direct link between abstract painting and the language of music. Kandinsky's search for parallels between music and visual art culminated in his 1926 treatise, *Point and Line to Plane*, which includes a pitch graph of two short excerpts from Beethoven's *Fifth Symphony*, one of the earliest examples of music visualization. Along with other pioneers of the Modernist avant-garde, Scriabin and Kandinsky laid the foundations for the systematic investigation of connections between visual art and music that took place in the 20th century and continues to the present.

The development of film and computer technologies made significant contributions to this search for a transdisciplinary art, which merges the auditory and visual senses. By introducing motion to static images, film overcame one of the most significant obstacles dividing music and visual art: the lack of time. This new medium laid the foundation for a field of "visual music" to emerge during

I. Introduction

the 20th century, in which animators such as Oskar Fischinger and John Whitney created groundbreaking films linking abstract animated visuals to music.

As with film, the advent of computers enabled many new possibilities for transdisciplinary musical and artistic research. Vast improvements in the speed and precision of mathematical calculations enabled composers and artists to further bridge the gap between the auditory and visual senses through new areas of research, including sonification, interactive digital installations, and generative audiovisual works.

Computers not only have led to increased speed and convenience, but also have enabled radically new paradigms for music composition. Many innovative approaches to composition fall under the category of "algorithmic music," which has many different forms. Some composers, such as John Cage, rely on algorithms for most or all aspects of a work, while others employ them only in the generation of material, sound processing, or ordering of musical events. While algorithms are commonly associated with computers, at bottom, an algorithm is simply a process or set of steps to be taken in solving a problem.

In the author's own work, several recent compositions investigate intersections between music and visual art. This paper analyzes four works that use algorithmic methods to generate musical material and structure from paintings. It begins with a brief overview of the history of transdisciplinary works linking visual art to mu-

I. Introduction

sic, followed by the analysis of the four compositions, with a detailed description of the algorithmic methods used.

II. Background

Interest in the mathematical basis for connections between music and painting dates as far back as Leonardo da Vinci's writings. In his *Trattato della pittura*, or "Treatise on Painting," ca. 1542, he proclaims: "Music is not to be regarded as other than the sister of painting, in as much as she is dependent on hearing, second sense behind that of sight. She composes harmony from the conjunction of her proportional parts, which make their effect instantaneously, being constrained to arise and die in one or more harmonic intervals" [8]. Linking the proportions inherent in musical intervals to human beauty as embodied in the "linear contours of the limbs," he notes that "just like music and geometry... [painting] considers the proportions of continuous quantities, while arithmetic considers discontinuous quantities" [8].

This chapter provides a brief history of the use of algorithmic methods to translate visual art into musical material and form. While early pioneers such as

Scriabin, Kandinsky and Cage worked by hand, many later composers and artists have relied on computers as an indispensable tool.

1. Alexander Scriabin, *Prometheus: The Poem of Fire*

One of the landmarks of the emerging field of "visual music" was Alexander Scriabin's symphonic poem, *Prometheus: The Poem of Fire*, Op. 60 (1910), including a part for *clavier lumires*, or "keyboard with lights," in which the color spectrum is mapped onto the twelve tones of the keyboard using the circle of fifths. Although the original keyboard was performed only once, at the New York premiere of *Prometheus* in 1915, Scriabin's idea of systematically relating colors to tones greatly influenced subsequent composers interested in incorporating visual art into music.

2. Wassily Kandinsky

One of the most significant artists and theorists in the history of abstract art, Wassily Kandinsky is often credited with creating the first abstract painting. In fact, his earliest known abstract watercolor was antedated by three years by

II. Background

a series of abstract paintings by Swedish artist Hilma af Klint. Nevertheless, Kandinsky holds a well-deserved place in the history of art, not least due to his pioneering investigations of the relationship between visual form, color and texture and music.

In his *Concerning the Spiritual in Art* (1911), Kandinsky writes: "Colour is the keyboard, the eyes are the hammers, the soul is the piano with many strings. The artist is the hand which plays, touching one key or another, to cause vibrations in the soul" [7]. In *Point and Line To Plane* (1926), he describes this connection between the painter and musician more systematically, beginning with the geometric point, the "initial collision of the tool with the material plane" [6]. He discusses many facets of this most basic pictorial element, which he considers the "most singular union of silence and speech" [6], including size, color and placement.

In his analysis, Kandinsky directly links aspects of visual art to music, for instance, in the section "Single Sound as Composition," he defines two elements of a single point on a canvas: "1. absolute sound of the point" and "2. sound of the given location in the basic plane." He illustrates these concepts with a translation of two motifs from Beethoven's *Fifth Symphony* into points: one of the earliest examples of music visualization. Kandinsky extends his analysis to the repetition of points, which leads to a "source of elementary rhythm," from

II. Background

which a number of different "sounds" arise, due to the multiplication of the two elements of the single point, its "absolute" and "relative" sounds [6].

In contrast to the point, the line is the "track made by the moving point," which is "the greatest antithesis to the pictorial proto-element – the point" [6]. Kandinsky distinguishes two aspects of this movement, "tension" and "direction." He further remarks that "[t]he element of time, in general, is discernible in the line to a much greater extent than... in the case of the point: length is a concept of time" [6]. In the final chapter, "Basic Plane," Kandinsky describes how the interaction of points and lines leads to the creation of planes, whose "sequence" and "tension" define the basic structure of the abstract picture, similar to the properties of "direction" and "tension" ascribed to line. Kandinsky's paintings, rooted in his theory of the "movements" and "sounds" of abstract geometric forms, have greatly influenced not only visual artists but composers throughout the Modern period[6].

3. Film Music

During the 20th century, film music rose to prominence as one of the most popular musical genres, often building upon earlier classical and folk traditions, but also following its own trajectory in important ways. Shaped by an integral

II. Background

relationship between music and character, plot and setting, film soundtracks have played a pivotal role in the integration of music and visual art, foreshadowed by Wagner's concept of the "total work of art."

In many cases, film music plays a largely functional role: as accompaniment to the visual drama, such as setting a mood or revealing a subtext. However, films also employ visuals as an accompaniment to the soundtrack, most notably Disney's *Fantasia* (1940). Through its groundbreaking use of animation to dramatize classic orchestral works, such as Mussorgsky's *Night on Bald Mountain*, *Fantasia* not only introduced classical music to a wider popular audience, but also served as a cornerstone in the field of "visual music," anticipating the concepts and techniques of many contemporary forms of multimedia, such as music videos or the field of music visualization.

4. John Whitney

Digital technology, like film, provided both new methods and new paradigms for imagining the relationship between music and visual art. From the 1940s through the 1980s, John Whitney's computer-generated animations investigated connections between abstract visual motion and the language of music. These films build upon the work of previous visual music pioneers, in particular Os-

II. Background

kar Fischinger, whose many groundbreaking films include the original animation sequence for Bach's *Tocatta and Fugue in D Minor* sequence in *Fantasia*, later rejected by the studio and redone to be more representational.

Whitney initially used a mechanical analogue computer created from the repurposed director of a World War II M-5 anti-aircraft gun to make his visual effects. In realizing the animated title sequence designs by Saul Bass for the classic film *Vertigo*, his instrument produced precise graphs of parametric equations, such as the Lissajous spiral. Whitney later became a pioneer of digital computer graphics, elaborating his ideas on the connections between music and visual art in his seminal book *Digital Harmony: On the Complementarity of Music and Visual Art*.

In the chapter "Problem - How Shall Motion Pattern Time?", Whitney describes visual movement, pattern and structure, in terms familiar to any Western composer, including "meter," "resonance," "harmony," "resolution." Specifically, he relates resonance and harmony to the differential motion of visual elements: "For example, if one element were set to move at a given rate, the next element might be moved two times that rate. Then the third would move at three times that rate and so on.... So long as all elements obey a rule of direction and rate, and none drifts about aimlessly or randomly, then pattern configurations form

II. Background

and reform. This is harmonic resonance, and it echoes musical harmony, stated in explicit terms” [5].

Whitney further elucidates the relationship between differential, resonance and harmony: ”First, motion becomes pattern if objects move *differentially*. Second, a resolution to order in patterns of motion occurs at points of *resonance*. And third, this resolution at resonant events, especially at the whole number ratios, characterizes the differential resonant phenomena of visual *harmony*” [5]. While not a trained composer, Whitney’s pioneering works, rooted in his theory of ”digital harmony,” laid the groundwork for future investigations of the relationship between music and visual motion .

Just as film removed a major obstacle to pairing music and visuals by allowing pictures to change over time, the advent of computers removed technical barriers to even more direct links between music and visuals by allowing mathematical calculations to be performed exponentially faster than by a human.

5. John Cage

John Cage, one of the most prolific and innovative transdisciplinary 20th century composers, investigated connections between the auditory and visual senses in several major works. Regarded as a pioneer in the field of *indeterminate music*,

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Cage often incorporated processes intended to replace the composer's intention with elements of chance. The earliest of his fully indeterminate works is his groundbreaking, *Music of Changes* (1951), in which the compositional process involved making decisions using the *I Ching*, a Chinese classic text, commonly used as a divination system.[4]

In his pioneering indeterminate works, Cage not only turned to literature, but also to visual art, as a source of musical material and form. In his *Atlas Eclipticales* (1961), Cage used a star atlas to derive musical pitches, following elaborate chance operations to produce tracings of the stars on music paper. The piece contains a series of musical "events," each built from one to ten notes. Tracings from the maps also determined the position of orchestral events, or "constellations," in the piece over time.[3]

6. Clarence Barlow

One of the pioneers of computer music, Clarence Barlow has written several major works investigating the translation of visual art into music. *Kuri Suti Bekar* (1998), for piano and visual projection, was composed for pianist Kristi Becker for her 50th birthday. The piece contains two movements: a Prelude and Chaconne. The Prelude translates the pianist's name in Japanese script into twelve seconds

II. Background

of music, using a graph where the X axis represents time and the Y axis represents pitch. The Chaconne movement's ten sections each are composed using a similar process on a portion of the pixels of a black-and-white photograph of the pianist's face. Through superimposing these fragments as the movements are performed, an animation illustrates the structural relationship between the music and the gradually revealed image[2].

Barlow composed the piece *ertur*((2015), for flute, clarinet, violin, cello and piano, and video for an exhibition of Raj Dhawan's collection of Alphonse Mucha (1860-1939) paintings. The work consists of 37 movements, each based on a different painting by Mucha, with music consisting of excerpts by composer Leo Janek (1854-1928). Small paintings are represented by short musical excerpts, whereas larger paintings have longer musical selections. Musically, each movement follows a process of expanding pitch range, from a minor 7th out to just over four octaves. This pitch expansion is reflected visually in a shift from a narrow to a wide color range. At first, each painting is shown only in its most predominant color hue, with the rest in gray. Gradually, however, "the colors... are expanded in range, starting at the middle of the image, to finally include all original colors" [1]. In *Kuri Suti Bekar*, *ertur*(, and other works, Barlow develops sophisticated algorithmic methods for deriving music from visual art, using computers to expand upon the transdisciplinary innovations of the Modernist avant-garde.

7. Voice of Sisyphus

Sonification, or the auditory display of data, has received increasing attention in recent years, both in artistic and scientific applications. A recent multimedia installation, *Voice of Sisyphus* (2012), by Ryan McGee, Joshua Dickinson and George Legrady, investigates image pixel sonification using custom software and a 4-channel audio system. While sonification systems commonly use a "spectrograph approach," which maps vertical or horizontal position to *frequency*, McGee's custom software uses *raster scanning* of pixel data. In this method, grayscale image pixels are read into a buffer, filtered, and read as an audio wavetable.

Since the horizontal axis of the image is not related to time, musical form must depend on some other input: in *Voice of Sisyphus*, "the composer must move or probe different regions of the image to advance the time of the composition" [9]. Through this method of "probing," the authors composed a sort of digital "score" for the installation, through selecting different image portions over time. Unlike Barlow's *ertur*(, in which different paintings are used to structure the music over time, *Voice of Sisyphus* "unfolds as several regions within the image are filtered, subdivided, and repositioned over time[9]". The ability to make multiple selections allows for moving between monophonic and polyphonic musical textures.

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McGee's VOSIS iPhone app turns this raster scanning method into an interactive compositional and performance tool.

III. Analysis of Works

This chapter gives an analysis of four works by the author that use algorithmic processes to derive musical material and form from paintings: *Five Color Studies* (2012), *Refracted Light* (2013), *Six Mondrian Paintings* (2015) and *Fluid Motion* (2016). Two of the works, *Five Color Studies* and *Six Mondrian Paintings*, are scored for live performers. *Refracted Light* is for fixed media electronics, while *Fluid Motion* is a performance combining live painting and electronic music using custom image sonification software written in Max/MSP.

1. Refracted Light (2011)

A single movement work, *Refracted Light* (2011), for fixed media electronics, was the author's first attempt to derive musical form and material from a painting. The piece was composed for a concert organized by Clarence Barlow in conjunction with the exhibit *Picasso and Braque: The Cubist Experiment, 1910-1912* at the Santa Barbara Museum of Art. The piece derives its sonic material entirely from

III. Analysis of Works

the painting *Man with a Pipe*, using the software Metasynt, which turns grayscale pixels into sounds where position on the X axis is time, position on the Y axis is pitch, and brightness determines the volume of the sound. By fine-tuning of frequency range, timbre, envelope and a wide range of other settings, the composer can generate a range of different musical outputs via sonification of a single image.

In composing *Refracted Light*, first, a high quality digital image of the painting was obtained from the Museum. Using image editing software, the painting was split into three separate images by isolating its three color channels: red, green and blue. These three images, along with the original, were sonified in all four rotations using Metasynt, for a total of twelve eight-second sound clips. These sound files were



Figure III.1: *Man with a Pipe*, Pablo Picasso (1911)

then layered in four continuous sections, each containing six to twelve of these sound "images." The first contains only sounds from the red channel image, while subsequent sections, in order, correspond to green, blue, and the original images.

Although using algorithmically generated material and following a systematic progression over four sections, *Refracted Light* is not a strictly algorithmic piece.

Each section itself was composed using a largely intuitive process of ordering and layering the audio files, followed by applying some digital filters and effects, including reverberation and pitch shifting. Another break from a strictly algorithmic approach was the decision to create an overlap between the movements. In early versions of the piece, clear pauses between the sections seemed to break the momentum of the music. This issue was avoided by overlapping them briefly, creating a single movement with four continuous sections.

2. Five Color Studies (2012)

Inspired by da Vinci's idea that mathematical proportion might constitute a link between the instantaneous effect of a painting and the temporal experience of music, *Five Color Studies* (2012) is the author's second major composition using visual art as a basis for generating musical form. Scored for Clarinet in Bb, Baritone Saxophone, Percussion, Viola and Contrabass, the piece consists of five movements, each based on a different early 20th century abstract painting.

Sections within each movement consist of freely composed material, which correspond to individual color regions in that movement's associated painting. The material within sections is based on intuitive associations between musical parameters such as pitch, harmony, and timbre and color. These correspondences

III. Analysis of Works

are indicated in the score by color names in boxed text, for example, "Light Blue" or "Black."

In *Five Color Studies*, if a painting has sharp distinctions in hue, saturation or brightness, musical contrasts between sections are heightened. For example, in Movement II, *Ellsworth Kelly, "Line Form and Color: Purple and Orange,"* sharp differences in hue are marked by a large contrast between rhythmic, atonal, staccato "Orange" sections and the intervening arrhythmic, legato "Purple" section, in which an open fifth between the high A on bowed vibraphone and the fundamental D in wide octaves played by the strings and saxophone carries strong tonal implications. Likewise, in Movement IV, *Ad Reinhardt, "Abstract Painting, Blue" (1952),* subtle differences in shades of blue are reflected in more restrained contrasts in musical material between alternating "Light Blue" and "Dark Blue" sections, as well as smoother section transitions.

While musical material in each section is composed through an intuitive process, section lengths are mathematically determined from each corresponding painting using an algorithmic method based on proportions between the size of distinct color areas. Though different in color content and arrangement, each of the five paintings was specifically chosen to consist of straight geometric lines, in order to facilitate accurate measurement of distinct areas of color. A detailed

III. Analysis of Works

description of this algorithmic method for deriving section lengths from the color proportions follows.

First, the pixel width and height of each color area are measured using an image editor. Second, the ratio between each area and the total painting area is calculated. Third, movement lengths are chosen intuitively, since the focus of the work is on mapping visual proportions, rather than absolute values, to music. Finally, as individual sections are composed, their lengths and tempi are adjusted so that their performance times correspond to the associated color area ratios.

While color area sizes are algorithmically mapped to section lengths, section number and order corresponds more loosely to the structure of the paintings. Whereas in simpler paintings with few color areas there is a direct correspondence between sections and individual color areas, in more complex paintings, smaller rectangles are merged into larger sections, mainly to avoid constant shifts between sections, while the proportions between colors and lengths of merged sections are preserved.

For instance, in the *Ellsworth Kelly* movement, the purple square is 27% of the total rectangle, meaning that the remaining orange area is 73%. In the score, the "Purple" section is 7 measures long, while the "Orange" sections add up to 27 measures. Since the sections have the same tempo, the "Purple" section length is $7/27$, or 26% of the total movement length, a result deemed acceptably close

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to the calculated 27% ratio between the sizes of the purple square and the total painting area.

In Movement III, *Paul Klee, "Ancient Sound: Abstract on Black, (1925)"*, over 100 separate rectangles make the painting one of the more complex of the set. Since over 100 separate sections would seem to pose for the listener an almost insurmountable challenge, both in distinguishing them as individual units and in grasping their proportions, the movement contains only nine sections. Since the painting is predominantly green, with the second most predominant color being brown, four "Green" sections are interleaved with two "Brown," one "Orange," one "Yellow," and one "Black."

One challenge in composing this movement was that the painting's many green squares appear in many different shades, including some bordering on brown, yellow or black. Since these subtle ambiguities of color contribute significantly to the aesthetic and psychological impact of the painting, the potential inaccuracies in measurement, as well as a more flexible approach to ordering the movement's sections, seemed justified. Fig. III.2 shows the "Brown" section of Movement III projected during the premier performance by the Now Hear Ensemble.

In contrast, Movements II and V, have only, respectively, two and four quite distinct color areas. Therefore, the number and order of sections directly corresponds to the structure of the paintings. In Movement II, since the purple square

is contained within the orange area, the opening and closing "Orange" sections are structured to "contain" the "Purple" section. For Movement V, *Josef Albers, "Homage to the Square: Soft Spoken" (1969)*, in which a series of squares of decreasing size are contained within one another, seeming to move inward toward the dark blue center square, the four sections, "Light Blue," "Light Green," "Dark Green," and "Dark Blue," are ordered so that the listener moves from the outer edge of the painting towards the center, passing through each of them.

As the author's first composition investigating the use of an algorithmic method to derive musical form from paintings, *Five Color Studies* is closely linked to sonification. In contrast to most digital sonification methods, however, the generation of

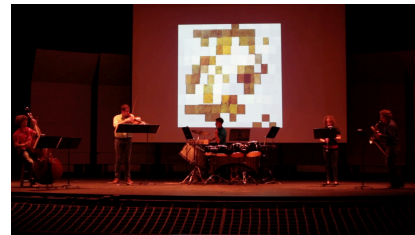


Figure III.2: *Five Color Studies*, performed by Now Hear Ensemble

material within sections was left to the composer. In this sense, the piece is an hybrid work: an experiment to find the best musical analogy for the proportions of color, which da Vinci poetically linked to musical intervals.

3. Six Mondrian Paintings (2015)

III. Analysis of Works

Six Mondrian Paintings (2015) builds on the ideas of proportion investigated in *Five Color Studies*, while also deriving musical material from a painting, similar to the process used in composing *Refracted Light*. Like *Five Color Studies*, *Six Mondrian Paintings* consists of a series of movements, each based on a particular painting. Rather than different 20th century painters, however, each of the movements is a different work by renowned Dutch painter Piet Mondrian (1872-1944).

The rhythmic material for each movement is derived by applying a grid to each corresponding painting, where every cell represents one measure of $2/4$ time, with the smallest possible rhythmic unit being an eighth note triplet. As an example, consider the painting *Composition with Yellow, Blue and Red* (Fig. III.3), which corresponds to the Third Movement. The rhythmic

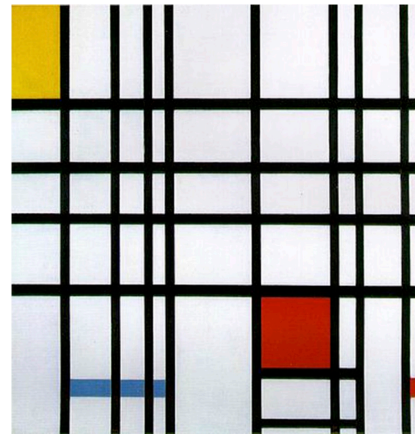


Figure III.3: *Composition with Yellow, Blue, and Red*, Piet Mondrian (1937-42)

derivation is achieved by applying a 9×9 grid to the painting (Fig. III.4). Using this grid, the painting is read from top to bottom, treating each horizontal line as a note. Applying the same process to the vertical lines produces two rhythms in $2/4$ time of nine measures each.

Since each of these rhythms on their own does not produce a particularly interesting result, both vertical and horizontal rhythms are combined to produce a more interesting rhythmic figure. The rhythms for the entire Third Movement are based on this combined rhythmic figure. Fig. III.5 presents the top-to-bottom, left-to-right, and combined rhythms in descending order. Rhythmic material derived from the paintings was developed freely within each movements, but without any extraneous rhythms added.

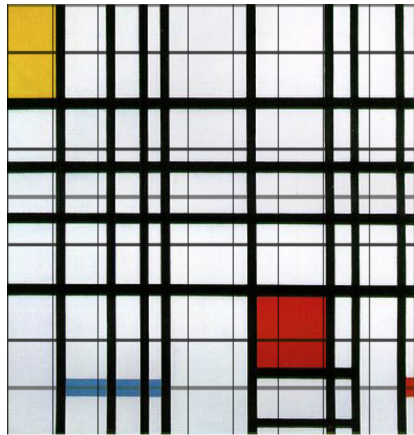


Figure III.4: Rhythmic grid applied to *Composition with Yellow, Blue, and Red*, Piet Mondrian (1937-42)

Not only the rhythmic material, but also the form of each movement is derived from its corresponding painting. In particular, the lengths of each movement's subsections are derived from the arrangement of lines in the corresponding painting. Except for the first movement, which is read left-to-right, the length of each section in a movement is determined by reading the image top-to-bottom. Specifically, each space

between horizontal lines becomes a subsection of the piece, while the black lines become rests of approximately 1.5 seconds. The proportion of the height of each space to the image's total height determines the ratio between that section's length

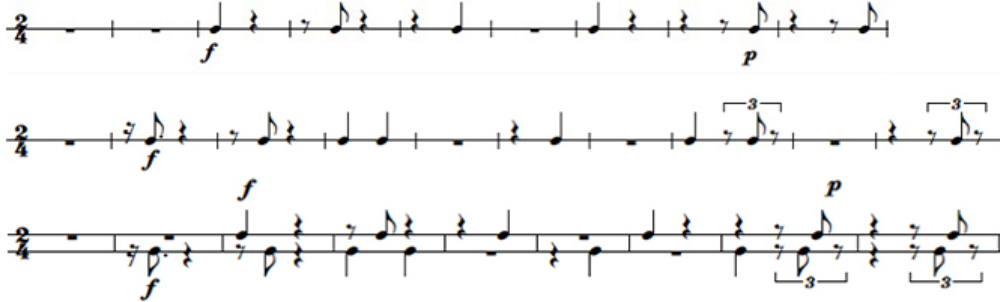


Figure III.5: Rhythm derived from *Composition with Yellow, Blue, and Red*, Piet Mondrian (1937-42)

and the movement’s total length. As in *Five Color Studies*, visual proportions are mapped to musical section lengths; however, Mondrian’s largely uniform, geometric style using only vertical and horizontal lines allows a systematic method to be used across all the paintings.

Colors determine whether a section is either pitched or unpitched. Pitched material corresponds to the colored rectangles within that space, while unpitched material corresponds to the white rectangles. In each section with pitched material, pitches themselves are determined by intuitive color associations.

The performance of *Six Mondrian Paintings* by the UCSB Percussion Ensemble, directed by Jon Nathan, in Lotte Lehman Hall, was accompanied by a video projection, in which the current movement’s corresponding painting was visualized on screen. The current section was shown in the visualization by darkening the other portions of the painting. This video projection was controlled during

the performance by the author, so as to allow some flexibility of timing by the ensemble.

4. Fluid Motion (2016)

Fluid Motion (2016) was a transdisciplinary performance with live painting, electronic sound and video projection, presented at the Santa Barbara Center for Art, Science and Technology on May 5th, 2016. A series of paintings were created live by the author, while a webcam sent live video of the painted surface to a laptop running custom software written in Max/MSP. This software then generated live electronic sound from the shapes and colors.

Rather than using a brush and mounting the canvas on an easel, each painting was created by laying a wet canvas flat against a table, applying small amounts of fluid acrylic paint of different colors, then slightly tilting the canvas back and forth. Since this paint has a consistency similar to water, yet has different densities depending on color and pigment type, the colors largely do not blend. Instead, they interact to produce complex patterns, often evoking aerial landscapes, astronomical photos, or microscopic processes. This painting process is similar to traditional Japanese *suminagashi*, or "floating ink" painting, which produces in-

III. Analysis of Works

tricate marbling patterns by suspending ink on water, which is then soaked up by white rice paper laid across the top.

Two processes are used to turn the image into sound: sonification and audification. The sonification algorithm reads through the largest shapes or "blobs" in the current video frame and plays them, similarly to reading notes in a score, where vertical position determines pitch. This method is similar to the "spectrograph approach" used by Metasynth. The audification process turns the image directly into sound by feeding pixels from red, green and blue channels into three sound buffers, filtering the result, and outputting all three channels of audio simultaneously to the speakers.

During the performance, these two processes occurred both independently and simultaneously. While inspired by Ryan McGee's software for the *Voice of Sisyphus* installation, this audification method also featured important differences, including the use of separate color channels, rather than starting with a grayscale image, and the ability of the performer to control the volume of each color channel separately.

As the author's first live painting performance, *Fluid Motion* translates painting into music in a highly different way than the other works previously discussed. By sonifying the movement of fluid paint as it moves over time, the piece entirely avoids the problem of translating from a static to a dynamic medium. However,

III. Analysis of Works

with this advantage comes additional challenges, including the need to perform live painting while also controlling the sonification software. In future performances, one possible solution would be collaboration with a second sound artist or painter. Another option would be allowing viewers to interact with the painting themselves, freeing the author to operate the sonification software.

IV. Conclusions

This paper has examined several algorithmic methods for deriving the form and material of musical works from paintings. The electronic works, *Refracted Light* and *Fluid Motion*, present two distinct methods of deriving musical content and structure from paint: one for fixed media electronics and the other an interactive audiovisual performance. In creating fixed media image sonification works, the compositional process may be largely similar to that of traditional electroacoustic composers, only using sonification as source material. In contrast, live sonification settings demand that the composer take on the role of a performer and improviser.

The instrumental chamber work *Five Color Studies* investigates a systematic approach to linking musical proportions to the proportions of colors in paintings. This method is further elaborated in *Six Mondrian Paintings*, for percussion ensemble, with the incorporation of an additional algorithm for translating visual rhythms into musical rhythms. In spite of being performed on traditional instruments, both are highly transdisciplinary works, not only due to their process of

IV. Conclusions

composition, but also due to their incorporation of video projection during performances, highlighting portions of paintings corresponding to particular musical sections as they are played.

Just as some musicians suggest that electronic instruments can replace acoustic instruments, a few digital artists claim that computers have made painting an "outmoded" medium. In a fast-paced world of increasingly ephemeral media, the static, permanent, physical medium of painting may seem hardly of interest to audiovisual composers with advanced digital graphics capabilities at their fingertips. On the other hand, another interpretation of recent technologies is that advances in digital art *highlight*, rather than supplant, painting's distinct qualities; just as electronic instruments might be seen to *emphasize*, rather than compete with, the unique qualities of acoustic instruments. Along these lines, perhaps it is precisely the static, permanent, "timeless" qualities of painting, one of humanity's oldest art forms, that make it a worthy challenge for the composer to investigate as a source of musical material and structure.

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Part Two:

A Portfolio of Compositions

V. Evaporation

(2013)

for Solo Piano

for Leslie Cain

Evaporation

David E. Gordon

Moderato ♩ = 76

with ferocity

Piano

8va
f
mf
8vb

Pno.

3
ff
sfz
8va
8vb
sfz

Pno.

6
8va
15ma
fff
rit. Lento ♩ = 60
8va
15ma
sfz 8vb

9 **A Tempo** ♩. = 76

Pno. *f*

strangely calm

8^{va}

11 Pno. *p*

8^{vb}

14 **Lento** ♩. = 60 **molto rit.**

Pno. *> pp* *p* *ppp*

(8).....

36

VI. Three Sketches

(2013)

for Flute and Piano

Three Sketches

for Flute and Piano

I. Lines

David E. Gordon

Allegro $\text{♩} = 120$

Flute

Piano

dark, massive

f *p* *f* *mp* *ff*

8^{sub} 8^{sub}

Detailed description: This system contains measures 1 through 10 of the piece. The Flute part (top staff) is mostly silent, with a few notes in measures 1, 2, 3, and 4. The Piano part (bottom staff) is the primary focus. It begins with a dynamic of *f* and *p* in measure 1, then *f* in measure 2, *mp* in measure 3, and *ff* in measure 4. The piano part features a complex rhythmic pattern with many sixteenth and thirty-second notes. There are two instances of an 8^{sub} (octave below) marking in measures 5 and 9. The key signature has one sharp (F#).

Fl.

Pno.

f *sub. p* *fff*

8^{sub} 8^{sub}

11

Detailed description: This system contains measures 11 through 20. The Flute part (top staff) becomes more active, with notes in measures 11, 12, 13, 14, 15, 16, 17, 18, 19, and 20. The Piano part (bottom staff) continues with a dynamic of *f* in measure 11, *sub. p* (sub-piano) in measure 12, and *fff* (fortississimo) in measure 13. The piano part features a complex rhythmic pattern with many sixteenth and thirty-second notes. There are two instances of an 8^{sub} (octave below) marking in measures 14 and 18. The key signature has one sharp (F#).

18

Fl. *f* *ff* *fp*

Pno. *sfz* *ff* *fff* *f*

(4) *8va*

(b) *8va*

(8).....|

27

Fl. *f*

Pno. *fff* *p cresc.* *espressivo*

accel.

rit.

A Tempo ♩ = 120

34 Presto ♩ = 140

Fl. *fff*

stormy

Pno. *f* *ff* *dim.*

40 *espressivo*

Fl. *f* *ff*

Pno. *p* *f* *ff*

46

Fl. *fff*

Pno. *f* *ff* *mf*

ethereal

8^{va}

50

Fl. *calm* *p* *cresc.*

Pno. *p* *cresc.*

8^{va}

building intensity

55 Fl. *rit.* *f* *ff* *p*

Pno. *sfz* *ff* *8va* *8va* *sfz*

Moderato $\text{♩} = 80$ A Tempo $\text{♩} = 120$

60 Fl. *birdlike* *p* *f*

Pno. *p* *f* *pp* *mf* *8va*

68

Fl. *sub. p* *f* *p*

Pno. *mf* *mp*

71

Fl. *f* *sfz*

Pno. *p* *mf* *fff* *p*

87

Fl. flutter *fff* *f* # *tr*

Pno. *f* *fff* *f* *8^{vb}*

rit.

93

Fl. *fff* *f* flutter

Pno. *fff* *f* *8^{vb}*

II. Pale Sleep

97 **Moderato** ♩ = 80
calm

Musical score for measures 97-105. The Flute part (Fl.) features a melodic line with glissando markings and dynamic markings of *p*, *mp*, and *p*. The Piano part (Pno.) includes a *sub.* marking and dynamic markings of *p*, *mp*, and *mf*. The score is written for Flute and Piano.

106

Musical score for measures 106-114. The Flute part (Fl.) includes a *calm* marking and dynamic markings of *mf*, *pp*, and *p*. The Piano part (Pno.) features dynamic markings of *f*, *ppp*, and *sf*. The score is written for Flute and Piano.

115

Fl. *mp* *gliss.* *p* *gliss.* *mf*

Pno. *mp* *pp* *p*

124

Fl. *p* *gliss.* *f* *gliss.* *p*

Pno. *mf* *p*

129

Fl. *gliss.*

pp

mp

gliss.

Pno. (4)

pp 3

mp

rit. Adagio ♩ = 60 attacca

135

Fl. *gliss.*

ppp

ppp

Pno.

III. Reflected in Water

Allegro ♩ = 120
clear, flowing

139

Fl. *pp* *mp* *mf* *p* *f* *mf* *ff* *p*

Pno. *mf* *mf* *mp* *pluck string l.v.* *slide thumb between strings* *l.v.* *pluck string l.v.* *mp* *p*

150

Fl. *mf* *f* *mp* *ff* *mf* *pluck string l.v.* *slap tongue* *sfz* *mf* *mp* *pluck string l.v.* *p*

Pno. *mf* *f* *mp* *pluck string l.v.* *f* *mp* *pluck string l.v.* *p*

158

Fl. flutter

p *ff* *fp* *ff*

Pno.

f *pp* *f*

clear, flowing

167

Fl. clear, flowing

ppp *mp* *pp* *mf* *p*

Pno.

mf *f* *mp* *f* *p*

p *p*

176 Fl. *tr*
p *mf*
f *mp* *ff sfz*
 slap tongue

Pno.
f *mf* *p*
 pluck string i.v. *mf*
 pluck string i.v. *mf*
f

185 Fl. *sub.* *p* *fp* *mf* *mp*
f
 building intensity *8va*

Pno.
p
3 *3* *3* *5*

192 Fl. *ff* *f* *mf* *mf < f*

8va

8

Pno.

199 Fl. *sfz*

8

Pno.

205

Fl. *f* *ff* *sfz* *sfz* *sfz* *sfz* *fp* *fff* *sfz*

Pno. *ff*

Moderato $\text{♩} = 80$
slightly hesitant

210

Fl. *sub. pp* *ppp* *p* *f sfz* *sub. p* *cresc.*

Pno. *mf* *sed.* *f* *p*

218

Fl. *mp* *p* *pp*

Pno. *ped.*

224

Fl. *mp* *p* *ppp*

Pno. *f* *mf* *p* *ppp*

slide thumb between strings

VII. Reflection

(2015)

for Solo Viola

Reflection

for Viola

Moderato ♩ = 100

David E. Gordon

Musical notation for measures 1-5. The piece begins in 3/4 time, then changes to 4/4. Dynamics include *mf*, *f*, *p*, *f sfz*, and *sub. p*.

6

Musical notation for measures 6-11. Dynamics include *ppp*, *p*, *mf*, *p*, *pp*, *mf*, and *ff*.

12

Musical notation for measures 12-17. Dynamics include *p*, *mf*, *pp*, *mp*, *f*, *mp*, and *pp*.

Andante ♩ = 76

18

Musical notation for measures 18-22. Dynamics include *p*, *mf*, *p*, and *f*. The instruction *pizz.* is present above the staff.

23

Musical notation for measures 23-28. Dynamics include *p*, *pp*, *f*, *p*, *pp*, *mp*, and *f*. The instruction *birdlike arco* is written above the staff.

28 *pizz.*

>mp=pp *p* *f* *mp* *f* *mp>p* *p<*

33 *arco*

mf *p* *pp* *mf* *p* *pp*

poco accel.

37 *pizz.*

p *mf* *f* *p*

A Tempo ♩ = 100

40 *arco*

mf *p* *mp* *mf* *p*

45 *sul tasto poco vib.*

f *sub. pp* *p* *mf* *sub. p* *ppp*

50 *pizz.* *arco birdlike*

p *mf* *p* *mf* *p*

55 *pizz.*

pp *mf* *ff* *sfz* *p*

61

mf sfz f p pp p

arco

65

mf f > p mp f p > pp

sul tasto

72

ord. *birdlike*

ff p pp mp p pp ppp

sul tasto

77

Adagio ♩ = 60

p ppp mp p pp ppp

rit. pizz.

A Tempo ♩ = 100

arco *birdlike* rit. **Adagio** ♩ = 60 pizz. *ghostly*

mf pp p > pp f pp

arco sul pont. *ghostly* pizz.

90

A Tempo ♩ = 100

mp f mp pp p

accel. cresc.

97

A Tempo ♩ = 100

f > p pp < p mf f

103 *pizz.*

>mp \rightrightarrows pp *ff* *mp*

109

pp *ppp* *p* \rightrightarrows *mf* *mp*

115 *arco*

p \rightrightarrows *pp* *ppp* \rightrightarrows *mp* \rightrightarrows *p* \rightrightarrows *f* *sub. p* \rightrightarrows *pp*

122 *pizz.* *arco birdlike*

mp \rightrightarrows *pp* *f* *p* *pp*

rit. **Adagio** ♩ = 60
sul pont.

127

pp \rightrightarrows *mp* \rightrightarrows *pp* *ppp*

132 *pizz.* *arco*

mp *pp* *ppp* *pp*

135

mp *sfz* *pp* *ppp*

VIII. Portrait

(2015)

for Solo Violin

Portrait

for Violin

Moderato ♩ = 100

David E. Gordon

Musical notation for measures 1-3. The first measure is in 2/4 time, followed by a change to 4/4. The notation includes dynamic markings: *fff sfz*, *f*, *p*, *f ff sfz*, *pp*, and *fp*.

rit. Adagio ♩ = 60

Musical notation for measures 4-7. Measure 4 starts with *> pp*. Measures 5-7 feature triplets and dynamic markings: *f*, *p*, *pp*, and *ppp*. The instruction *pizz.* is present above the staff.

A Tempo ♩ = 100

Musical notation for measures 8-11. Measures 8-9 are marked *arco*. Dynamic markings include *f sfz*, *p*, *f ff sfz sfz*, and *p fp*.

Musical notation for measures 12-15. Measure 12 starts with *> pp*. Measures 13-15 feature triplets and dynamic markings: *f*, *p*, and *ppp*. The instruction *pizz.* is present above the staff.

Musical notation for measures 16-19. Measure 16 starts with *ord.* and *f sfz*. Measure 17 is marked *sul pont. arco* with *p*. Measure 18 is marked *pizz.* with *pp*. Measure 19 is marked *arco* with *ff sfz*.

21

p *f* *ff* *sfz*

23

p *f* *sfz* *p* *pp* *mp*

pizz.

27

p *pp* *ppp* *mp* *f* *fp* *ppp*

arco sul pont.

32

ff *p* *pp* *ppp*

arco pizz.

36

p *f* *sfz* *fff* *sfz* *mp* *pp* *p* *mf*

arco pizz.

40

ppp *f* *sfz* *ff* *sfz sub. p*

arco

44

f sfz *ff* *f* *mp* *f*

47 pizz. arco

ff sfz mp p f sfz ff

50 pizz.

f fp fff sfz mp

53 arco arco

p pp mf

56 ord. pizz.

f fff sfz pp

A Tempo ♩ = 100

58 arco pizz.

f p mf pp p mp

64 arco sul pont. pizz.

pp mp pp f ff sfz p

70 arco

pp ppp f ff sfz > p

106 - - - - - **Grave** ♩ = 30

ff *dim.* *pp* *ppp*

**XI. Six Mondrian
Paintings
(2015)**

for Four Percussionists

Six Mondrian Paintings

for Four Percussionists

I. Composition with Yellow, 1937

Allegro ♩ = 120

Timp.

Percussion 1
(Timpani, Tambourine, Tam-tam, Xylophone)

Percussion 2
(Snare Drum, Bongos, Bass Drum, Glockenspiel)

Percussion 3
(Temple Blocks, Triangle, Vibraphone, Claves)

Percussion 4
(Tom-toms, Chimes, Grotales, Sus. Cymbal)

8

Timp. *mp* *p* *f* *sfz*

S. D. *p* *mp* *mf* *f*

T. Bl. *f* *sfz*

Tom-t. *mf* *f* *sfz*

Detailed description: This musical score is for four percussion instruments: Timp., S. D., T. Bl., and Tom-t. The score is written in a single system with four staves. The Timp. staff begins with a measure containing a triplet of eighth notes, marked *mp*. The S. D. staff begins with a measure containing a triplet of eighth notes, marked *p*. The T. Bl. staff begins with a measure containing a triplet of eighth notes, marked *f*. The Tom-t. staff begins with a measure containing a triplet of eighth notes, marked *mf*. The score continues with four measures. In the first measure, the Timp. staff has a triplet of eighth notes marked *p*, the S. D. staff has a triplet of eighth notes marked *mp*, the T. Bl. staff has a triplet of eighth notes marked *f*, and the Tom-t. staff has a triplet of eighth notes marked *mf*. In the second measure, the Timp. staff has a triplet of eighth notes marked *f*, the S. D. staff has a triplet of eighth notes marked *mp*, the T. Bl. staff has a triplet of eighth notes marked *f*, and the Tom-t. staff has a triplet of eighth notes marked *mf*. In the third measure, the Timp. staff has a triplet of eighth notes marked *sfz*, the S. D. staff has a triplet of eighth notes marked *mf*, the T. Bl. staff has a triplet of eighth notes marked *sfz*, and the Tom-t. staff has a triplet of eighth notes marked *f*. In the fourth measure, the Timp. staff has a triplet of eighth notes marked *sfz*, the S. D. staff has a triplet of eighth notes marked *f*, the T. Bl. staff has a triplet of eighth notes marked *sfz*, and the Tom-t. staff has a triplet of eighth notes marked *sfz*. The score is written in a single system with four staves. The Timp. staff begins with a measure containing a triplet of eighth notes, marked *mp*. The S. D. staff begins with a measure containing a triplet of eighth notes, marked *p*. The T. Bl. staff begins with a measure containing a triplet of eighth notes, marked *f*. The Tom-t. staff begins with a measure containing a triplet of eighth notes, marked *mf*. The score continues with four measures. In the first measure, the Timp. staff has a triplet of eighth notes marked *p*, the S. D. staff has a triplet of eighth notes marked *mp*, the T. Bl. staff has a triplet of eighth notes marked *f*, and the Tom-t. staff has a triplet of eighth notes marked *mf*. In the second measure, the Timp. staff has a triplet of eighth notes marked *f*, the S. D. staff has a triplet of eighth notes marked *mp*, the T. Bl. staff has a triplet of eighth notes marked *f*, and the Tom-t. staff has a triplet of eighth notes marked *mf*. In the third measure, the Timp. staff has a triplet of eighth notes marked *sfz*, the S. D. staff has a triplet of eighth notes marked *mf*, the T. Bl. staff has a triplet of eighth notes marked *sfz*, and the Tom-t. staff has a triplet of eighth notes marked *f*. In the fourth measure, the Timp. staff has a triplet of eighth notes marked *sfz*, the S. D. staff has a triplet of eighth notes marked *f*, the T. Bl. staff has a triplet of eighth notes marked *sfz*, and the Tom-t. staff has a triplet of eighth notes marked *sfz*.

14

Timp. *p* *mf* *p* To Tamb.

S. D. *p* *f* *p* To B. D.

T. Bl. *mp* *f* *ff* *sfz* *sfz* *sfz* To Tri.

Tom-t. *f* *mp* *f* *mf* *ff* *sub. p*

Bongos

29

Tamb. *p* \leq *f* *sfz* *p* \leq *mp* \leq *p* \leq *mf*

To Xyl.

Xylophone

B. D. *p* cresc. *f* *sfz* *mp* \gt *p*

To Glock.

Vib. *mf* *f* *sfz*

T. Bl. *mf* *f* *sfz*

Tom-t. *mp* \leq *p* \leq *mf* \leq *f* \leq *ff sfz*

on rim

ord.

37

Xyl. *f* *sfz* *p* *mf*

B. D. Glock. *p* *mp* *mp* *p*

Vib. *sfz* *p* *mf*

Tom-t. *f* *p* *mf* *p*

on rim

41

Xyl. *fp* *mf* *sfz* To Timp.

Glock. *mf* *mf* To S.D.

Vib. *mf* *f* To T. Bl.

Tom-t. *mf* *f* *sfz sub. p* *ppp*

Detailed description of the musical score: The score consists of four staves for percussion instruments. The Xyl. staff begins with a treble clef and a key signature of one flat. It features a series of notes with a forte piano (fp) dynamic, followed by a mezzo-forte (mf) dynamic, and a sforzando (sfz) dynamic. The Glock. staff also has a treble clef and one flat key signature, with a mezzo-forte (mf) dynamic. The Vib. staff has a treble clef and one flat key signature, with a mezzo-forte (mf) dynamic followed by a forte (f) dynamic. The Tom-t. staff uses a double bar line and has a mezzo-forte (mf) dynamic, followed by a forte (f) dynamic, a sforzando (sfz) dynamic with a subito piano (sub. p) marking, and finally a pianissimo (ppp) dynamic. Various articulations like accents and slurs are present throughout the score.

45

Xyl. Timpani

fp *f sfz mp*

S.D.

Glock. *mf* *f*

Vib. *mp* *f* *mp* *f sfz*

Tom-t. *sfz* *f* *mp* *ff sfz*

T. Bl. *p* *f* *mp* *f*

50

The musical score consists of four staves, each representing a different percussion instrument. The first staff is for Timp. (Tympani), the second for S. D. (Snare Drum), the third for T. Bl. (Tom Bell), and the fourth for Tom-t. (Tom-tom). The score is written in a key with one sharp (F#) and uses a common time signature. The music features a mix of eighth and sixteenth notes, often grouped in triplets. Dynamic markings range from *mp* (mezzo-piano) to *fff* (fortississimo). There are also articulation marks like accents and slurs. The score is divided into measures by vertical bar lines, with some measures containing rests or specific articulations like 'i.v.' (in vivo) and 'To Xyl.' (To Xylophone).

Timp. To T.-t. Tam-tam i.v. *f* To Xyl.

S. D. To Glock.

T. Bl. To Vib.

Tom-t. To Chim. *mp* *mf* *f* *ff* *fff* *sfz*

II. Composition with Red, Blue, Yellow and White: Nom II, 1939

Moderato ♩ = 92

Musical score for four instruments: Xyl. (Xylophone), Glock. (Glockenspiel), T. Bl. (Trumpet), and Chim. (Chime). The score is in 3/4 time and marked Moderato. The Xyl. part begins at measure 56 and features a series of sixteenth notes with triplets and dynamic markings ranging from *p* to *sfz*. The Glock. part consists of single notes with dynamic markings *mp* and *f*. The T. Bl. part features a melodic line with triplets and dynamic markings *p*, *mp*, and *mf*. The Chim. part provides harmonic support with triplets and dynamic markings *mp* and *f*. The score includes first and second endings (1.v.) for the Glock. and T. Bl. parts.

64

Xyl.
f
f
sub. p = f sfz
To Timp.

Glock.
mf
p
mp
f
To Bongos

Vib.
f sub. p
f
sub. p
f
To T. Bl.

Chim.
To Tom-t.
Tom-t.
ff

72

Timp. *p* *f* *mf* *ff* *fp*

Bongos *f*

To Congas

T. Bl. *mf* *p* *f* *mp* *f* *mp*

Tom-t. *p* *mf* *f*

78

Detailed description of the musical score: The score is for percussion instruments. It is divided into two systems, 72 and 78. System 72 features a Timp. part with a melodic line in the bass clef. The dynamics are *p*, *f*, *mf*, *ff*, and *fp*. System 78 features four parts: Bongos (melodic line in bass clef, dynamic *f*), T. Bl. (melodic line in bass clef, dynamics *mf*, *p*, *f*, *mp*, *f*, *mp*), and Tom-t. (melodic line in bass clef, dynamics *p*, *mf*, *f*). There are also some rests and specific markings like 'To Congas' and '3' (triplets) in the T. Bl. and Tom-t. parts.

78

Timp. *f* *mp* *ff* *f*

Congas *f* *fp* *f* *f*

Bongos *mf* *mf* *p* *mf*

T. Bl. *f* *ff* *f* *mf*

Tom-t. *fp* *f* *sfz* *f* *mp*

Detailed description of the musical score: The score is written for five percussion instruments across two measures, 78 and 79. Measure 78 (top system) includes Timp., Congas, Bongos, T. Bl., and Tom-t. Measure 79 (bottom system) includes Congas, Bongos, T. Bl., and Tom-t. The Timp. part starts with a bass clef and a key signature of one sharp (F#). Dynamics range from *f* (forte) to *mp* (mezzo-piano) and *ff* (fortissimo). The Congas part features a mix of *f*, *fp*, and *f*. Bongos play a steady pattern with dynamics *mf* and *p*. T. Bl. uses *f*, *ff*, and *f*. Tom-t. includes triplets and dynamics *fp*, *f*, *sfz*, and *f*. The score concludes with a *mp* dynamic in the Tom-t. part of measure 79.

84

Timp.
 Musical notation for Timp. with dynamics: *mf*, *ff*, *p*, *f*, *mf*, *fp*.

Bongos
 Musical notation for Bongos with dynamics: *f*, *fp*.

To Congas
 Musical notation for Congas with dynamics: *f*, *mf*, *mp*, *f*, *sfz*, *mp*, *f*.

T. Bl.
 Musical notation for T. Bl. with dynamics: *f*, *mf*, *f*, *mp*, *f*, *sfz*, *mp*, *f*.

Tom-t.
 Musical notation for Tom-t. with dynamics: *sfz*, *mf*, *f*, *fp*, *f*.

90

To Xyl.

Timp. *mf* *f* *ff*

Congas *sfz* *fp* *ff* *mf* *p*

To Vib.

T. Bl. *sfz* *ff* *f* *ff*

Tom-t. *f sfz sub. p* *f sfz sub. p*

96 *attaca*

Timp. Xyl. *f sub. p* *p* *f sfz*

Congas *f* *ff* *f* *sub. p* *f* *f* *f* *f*

T. Bl. Vib. *f* *mf* *f* *f* *f* *f* *f* *f*

Tom-t. *fp* *ff* *f* *f* *f* *f* *f* *f*

To Glock. Glock. *f* *sub. p* *f* *f* *f* *f* *f* *f*

To Chim. *f* *f* *f* *f* *f* *f* *f* *f*

To Crot. *f* *f* *f* *f* *f* *f* *f* *f*

ord. *mf*

3

1.v.

1.v.

1.v.

1.v.

III. Composition with Yellow, Blue, and Red, 1937-42

102 **Andante** $\text{♩} = 76$

Xyl. *f sfz mf* \triangleleft *f sfz p* \triangleleft *mf* \triangleleft *f sfz mf* \triangleleft *mp* \triangleleft *f sfz*

Glock. *f* *mp* *mf* *mp*

Vib. *f* *mp* *f sfz* *mp*

Crot. *mf* *p* *mf* *p mp*

l.v.

108

Xyl. *fp* *ff* *mp* *f* *sfz* *To Timp.* *mf* *p* *mp* *To T.-t.*

Glock. *f* *mp* *f* *sfz* *To S. D.* *f* *mp* *f* *mp* *Tri.* *f* *mp* *p*

Vib. *f* *mp* *f* *sfz* *To Tri.* *f* *mp* *p* *Sus. Cym.*

Crot. *To Sus. Cym.* *fp* *f* *mp* *p* *pp*

snare off

3 *3* *3*

114

Timp.
 T.t. *mp* *fp* *mf* *p* *cresc.*
 To Timp.
 Timp.

S. D.
f *sfz* *p* *f* *cresc.*

Tri.
mf *mp* *mf*

Sus. Cym.
f *pp* *mf* *pp* *p*

123

Timp. To Xyl. Xyl. *mf* < *f* *fp* < *f* *p* *mp* < *f*

S. D. Glock. *f* *sub. p* *f* *mf* *p* *mf* *ff* *mf*

Cliv. To Vib. Vib. *f* *f* *p* *mf* *f*

Sus. Cym. To Crot. arco Crot. arco *f* *p* *mf* *mp*

129

mf < ff *fp* *f* *p* *mf* *pp* *mp* *pp* attaca
To Tamb.

p *mf* *f* *p* *mf* *pp* *p* *ppp* To T. Bl.

mp *mf* *p* *ppp* To T. Bl.

I.v. *ord.* *p* *pp* *ppp* To W.B.

Moderato ♩ = 92 IV. Composition No. 10, 1942

Tamb.

135

Musical notation for Tambourine (Tamb.) starting at measure 135. The staff is in treble clef with a key signature of one sharp (F#). The music consists of eighth-note triplets with a dynamic of *p*. The first triplet is marked with an accent (>). The second triplet is marked with *sfz*. The third triplet is marked with *mf*. The fourth triplet is marked with *p*.

Glock.

Musical notation for Glockenspiel (Glock.) starting at measure 135. The staff is in treble clef with a key signature of one sharp (F#). The music consists of eighth-note triplets with a dynamic of *pp*. The first triplet is marked with *mf*. The second triplet is marked with *p*. The third triplet is marked with *mf*. The fourth triplet is marked with *p*. A first-violin (1.v.) line is written above the staff, consisting of a single note with a fermata.

T. Bl.

Musical notation for Trombone (T. Bl.) starting at measure 135. The staff is in treble clef with a key signature of one sharp (F#). The music consists of eighth-note triplets with a dynamic of *f*. The first triplet is marked with *mp*. The second triplet is marked with *p*. The third triplet is marked with *mf*. The fourth triplet is marked with *f*.

W.B.

Musical notation for Wood Bass (W.B.) starting at measure 135. The staff is in treble clef with a key signature of one sharp (F#). The music consists of eighth-note triplets with a dynamic of *f*. The first triplet is marked with *mp*. The second triplet is marked with *sfz*. The third triplet is marked with *f*. The fourth triplet is marked with *p*.

142

Tamb. *f sfz* *p* *mf* *To Xyl.*

Glock. *mf* *p* *mp* *mf* *mp*

T. Bl. *mp* *ff* *mp > p* *pp* *mf* *p*

W.B. *sfz* *mf* *p*

The score consists of four staves. The first staff (Tamb.) has a treble clef and a key signature of one sharp (F#). It begins with a double bar line and a half rest, followed by a series of eighth notes with accents and dynamic markings. The second staff (Glock.) has a treble clef and a key signature of one sharp. It features a first-violin-like part with a slur and a triplet of eighth notes. The third staff (T. Bl.) has a treble clef and a key signature of one sharp, with a 7-measure rest at the beginning. It contains several triplet markings and dynamic markings. The fourth staff (W.B.) has a treble clef and a key signature of one sharp, with a 7-measure rest at the beginning. It includes triplet markings and dynamic markings. The score concludes with a double bar line.

149

Musical score for measures 149-152, featuring the following instruments and dynamics:

- Tamb.:** Measure 149 has a single note. Measure 150 has a triplet of eighth notes. Measure 151 has a single note. Measure 152 has a single note.
- Xyl.:** Measure 149 has a single note. Measure 150 has a single note. Measure 151 has a single note. Measure 152 has a single note.
- Glock.:** Measure 149 has a triplet of eighth notes (*mf*). Measure 150 has a single note (*f*). Measure 151 has a single note (*ff*). Measure 152 has a triplet of eighth notes (*f*).
- Bongos:** Measure 149 has a single note (*p*). Measure 150 has a single note (*p*). Measure 151 has a single note (*p*). Measure 152 has a single note (*p*).
- T. Bl.:** Measure 149 has a single note (*mf*). Measure 150 has a single note (*mf*). Measure 151 has a single note (*mf*). Measure 152 has a single note (*mf*).
- Vib.:** Measure 149 has a single note (*fp*). Measure 150 has a single note (*fp*). Measure 151 has a single note (*fp*). Measure 152 has a single note (*fp*).
- W.B.:** Measure 149 has a single note (*p*). Measure 150 has a single note (*p*). Measure 151 has a single note (*p*). Measure 152 has a single note (*p*).

155

Xyl. *fp* *f* *sub.p* *f* To Timp.

Bongos *f* *f* *f* *p* To T. Bl.

Vib. *f* *ord.* *l.v.* *l.v.*

W.B. *mp* *f* *mf* *fp* *f* *sfz* To Chim.

161

Xyl. *mf* *p*

Timp. *f*

Bongos *ff* *sub. p* *f*

T. Bl. *mp* *f* *sfz* *f*

Chim. *f* *p* *mf* *f* *p* *cresc.*

169

The musical score consists of four staves: Timp., Bongos, T. Bl., and Chim. The key signature is one sharp (F#) and the time signature is 4/4. The score is divided into four measures.

- Measure 169:**
 - Timp.:** Bass clef, F#4 quarter note, F#4 quarter note, F#4 quarter note, F#4 quarter note. Dynamics: *mp*, *mf*, *fp*, *f*.
 - Bongos:** Treble clef, F#4 quarter note, F#4 quarter note, F#4 quarter note, F#4 quarter note. Dynamics: *mp*, *f*, *p*.
 - T. Bl.:** Treble clef, F#4 quarter note, F#4 quarter note, F#4 quarter note, F#4 quarter note. Dynamics: *f*, *fp*.
 - Chim.:** Treble clef, F#4 quarter note, F#4 quarter note, F#4 quarter note, F#4 quarter note. Dynamics: *f*, *p*.
- Measure 170:**
 - Timp.:** Bass clef, F#4 quarter note, F#4 quarter note, F#4 quarter note, F#4 quarter note. Dynamics: *mp*, *mf*, *fp*, *f*.
 - Bongos:** Treble clef, F#4 quarter note, F#4 quarter note, F#4 quarter note, F#4 quarter note. Dynamics: *mp*, *f*, *p*.
 - T. Bl.:** Treble clef, F#4 quarter note, F#4 quarter note, F#4 quarter note, F#4 quarter note. Dynamics: *f*, *fp*.
 - Chim.:** Treble clef, F#4 quarter note, F#4 quarter note, F#4 quarter note, F#4 quarter note. Dynamics: *f*, *p*.
- Measure 171:**
 - Timp.:** Bass clef, F#4 quarter note, F#4 quarter note, F#4 quarter note, F#4 quarter note. Dynamics: *mp*, *mf*, *fp*, *f*.
 - Bongos:** Treble clef, F#4 quarter note, F#4 quarter note, F#4 quarter note, F#4 quarter note. Dynamics: *mp*, *f*, *p*.
 - T. Bl.:** Treble clef, F#4 quarter note, F#4 quarter note, F#4 quarter note, F#4 quarter note. Dynamics: *f*, *fp*.
 - Chim.:** Treble clef, F#4 quarter note, F#4 quarter note, F#4 quarter note, F#4 quarter note. Dynamics: *f*, *p*.
- Measure 172:**
 - Timp.:** Bass clef, F#4 quarter note, F#4 quarter note, F#4 quarter note, F#4 quarter note. Dynamics: *mp*, *mf*, *fp*, *f*.
 - Bongos:** Treble clef, F#4 quarter note, F#4 quarter note, F#4 quarter note, F#4 quarter note. Dynamics: *mp*, *f*, *p*.
 - T. Bl.:** Treble clef, F#4 quarter note, F#4 quarter note, F#4 quarter note, F#4 quarter note. Dynamics: *f*, *fp*.
 - Chim.:** Treble clef, F#4 quarter note, F#4 quarter note, F#4 quarter note, F#4 quarter note. Dynamics: *f*, *p*.

175

attaca

Timp. *ff* *mp* *p* *pp* *ppp*

Bongos *ff* *mp* *f*

T. Bl. *f* *mp* *mf* *p*

Chim. *f* *mp* *mf* *p*

To Sus. Cym.
l.v.

V. Composition with Blue, 1937

182 Allegro $\text{♩} = 120$

The musical score consists of five staves. The first staff is for Timp. (Tympani) in bass clef, with dynamics *f*, *p*, *mf*, and *f*. The second staff is for Bongos in treble clef, with dynamics *fp* and *f*. The third staff is for T. Bl. (Trumpet) in treble clef, with dynamics *mf*, *p*, *f*, and *mf*. The fourth staff is for Sus. Cym. (Suspended Cymbal) in treble clef, with dynamics *p*, *mf*, *mp*, and *f*. The fifth staff is for another Sus. Cym. in treble clef, with dynamics *mf*, *mf*, and *p*. The score includes various musical notations such as notes, rests, and slurs.

190

Timp.
Musical notation for Timp. (Tympani) in bass clef. Dynamics: *mp* (mezzo-piano), *f* (forte), *p* (piano).

Bongos
Musical notation for Bongos in treble clef. Dynamics: *mp* (mezzo-piano), *fp* (fortissimo), *f* (forte), *p* (piano).

T. Bl.
Musical notation for T. Bl. (Tom-tom) in treble clef. Dynamics: *p* (piano), *mf* (mezzo-forte), *f* (forte), *p* (piano).

Sus. Cym.
Musical notation for Sus. Cym. (Suspension Cymbal) in treble clef. Dynamics: *p* (piano), *mf* (mezzo-forte).

198

Timp.
p *pp* *mf* *p* *mf*

Bongos
To B. D. *p* *mf* *p*

T. Bl.
mf

Sus. Cym.
p *fp* *f sfz* *p*

B.D.

l.v.

206

Timp. T. Bl. To Timp. Timp.

p *mf* *f* *ff* *sfz* *mf*

B. D. *mf* *pp* *cresc.* *mf*

T. Bl. *f* *mp* *f*

Sus. Cym. *mf* *f* *ff* *sfz* *p* *mf* *fp* *mf* *p*

Detailed description of the musical score: The score is for percussion instruments and is written in bass clef. It consists of five staves. The first staff is for Timp. (Timpani), with dynamics *p*, *mf*, *f*, *ff*, and *sfz*. A 'To Timp.' instruction is placed above the staff. The second staff is for T. Bl. (Tom-toms), with dynamics *mf* and *pp*. The third staff is for B. D. (Bass Drum), with dynamics *mf* and *cresc.*. The fourth staff is for T. Bl. (Tom-toms), with dynamics *f* and *mp*. The fifth staff is for Sus. Cym. (Suspended Cymbal), with dynamics *mf*, *f*, *ff*, *sfz*, *p*, *mf*, *fp*, and *p*. The score includes various rhythmic markings such as accents, slurs, and fermatas.

216

Timp. *p* *f* *ppp* *mf* *p* *mf* *f* *sfz*

Xyl. *ppp* *mf* *p* *mf* *f* *sfz*

B. D. *p* *f* *pp* *mf* *f* *mf* *f*

T. Bl. *fp* *f* *mf* *f* *mf* *p* *mf* *mp*

Sus. Cym. *mf* *pp* *mf* *p*

To Glock.

To Vib.

Vib. *mf* *f* *mf* *p* *mf* *mp*

Glock. *pp* *mf* *f* *mf* *mf* *mp*

I.v.

226

To T.-t. T.-t.

Xyl.

To Timp.

I.v.

pp

mp

f

To S.D. S.D.

Glock.

To Glock.

p

mf

p

f

To Vib.

Vib.

p

To Crot.

I.v.

pp

mp

p

mf

mp

f

Sus. Cym.

VI. Composition with Black, White, Yellow and Red, 1939-42

Adagio $\text{♩} = 60$

Timp.

235

The musical score consists of four staves for percussion instruments: Timp., Glock., Vib., and Crot. The Timp. staff (bass clef) features a first ending (l.v.) with a *f* dynamic and a first ending (ord.) with a *fp* dynamic. The Glock. staff (treble clef) includes a first ending (l.v.) with a *mp* dynamic and a triplet with *sfz* dynamic. The Vib. staff (treble clef) includes a first ending (l.v.) with a *p* dynamic and a triplet with *ff* dynamic. The Crot. staff (bass clef) includes a first ending (l.v.) with a *mp* dynamic and a first ending (l.v.) with a *ff* dynamic. The score concludes with the instruction "To Tom-t." and a final *ff* dynamic.

243

Timp. *pp* cresc. *f* > *p*

Glock. i.v. *p* To Congas

Vib. i.v. *p* Tom-t. *p*

Congas *mf*

Tom-t. *p* < *mf* > *pp* To Sus. Cym. *f* > *p*

Detailed description of the musical score: The score is for percussion instruments and is written in 4/4 time. It begins at measure 243. The Timp. part starts with a triplet of eighth notes (G4, A4, B4) marked *pp* and *cresc.*, followed by a triplet of eighth notes (C5, B4, A4) marked *f* and an accent (>), and ends with a triplet of eighth notes (G4, F4, E4) marked *p*. The Glock. part has a first-violin-like (i.v.) triplet of eighth notes (G4, A4, B4) marked *p*, followed by a rest, and then a triplet of eighth notes (C5, B4, A4) marked *p*. The Vib. part has a first-violin-like (i.v.) triplet of eighth notes (G4, A4, B4) marked *p*, followed by a rest, and then a triplet of eighth notes (C5, B4, A4) marked *p*. The Congas part has a triplet of eighth notes (G4, A4, B4) marked *mf*, followed by a rest, and then a triplet of eighth notes (C5, B4, A4) marked *mf*. The Tom-t. part has a triplet of eighth notes (G4, A4, B4) marked *p* and an accent (>), followed by a triplet of eighth notes (C5, B4, A4) marked *mf*, and ends with a triplet of eighth notes (G4, F4, E4) marked *pp*. A 'To Sus. Cym.' instruction is placed above the Tom-t. staff in the final measure.

Allegro ♩ = 120

250

Timp. *mp* *mf* *p* *mp*

Congas *p* *mf* *f* *p* *mf* *mp* *p*

Vib. *p* *mf* *f* *p* *mf* *mp* *p*

Sus. Cym. *p* *pp* *ppp* *mp* *p*

To T. Bl. *mf* *mp* *mf* *mp* *mp* *mp* *p*

T. Bl. *mf* *mp* *mf* *mp* *mp* *mp* *p*

Detailed description of the musical score: The score is for percussion instruments. It starts at measure 250. The tempo is Allegro with a quarter note equal to 120 beats per minute. The instruments are Timp., Congas, Vib., Sus. Cym., and T. Bl. The Timp. part has dynamics *mp*, *mf*, *p*, and *mp*. The Congas part has dynamics *p*, *mf*, *f*, *p*, *mf*, *mp*, and *p*. The Vib. part has dynamics *p*, *mf*, *f*, *p*, *mf*, *mp*, and *p*. The Sus. Cym. part has dynamics *p*, *pp*, *ppp*, *mp*, and *p*. The T. Bl. part has dynamics *mf*, *mp*, *mf*, *mp*, *mp*, *mp*, and *p*. There are also markings for 'To T. Bl.' and 'Sus. Cym.'.

258

Timp.
p
mf
p

Congas
mf
f

T. Bl.
mp
mp
fp
p
 To Crot.

Sus. Cym.
pp

263

The musical score consists of four staves for percussion instruments: Timp., Congas, T. Bl., and Sus. Cym. The notation includes various rhythmic figures, rests, and dynamic markings.

- Timp. (Tympani):** Measures 263-264 feature a melodic line starting with a half note G#4, followed by quarter notes A#4, B4, and C5. Measure 265 has a half note G#4. Measure 266 has a half note G#4. Dynamics range from *fp* to *f*.
- Congas:** Measures 263-264 have a rhythmic pattern of quarter notes G2, A2, B2, C3. Measure 265 has a half note G2. Measure 266 has a half note G2. Dynamics range from *fp* to *f*.
- T. Bl. (Tom-tom):** Measures 263-264 have a rhythmic pattern of quarter notes G2, A2, B2, C3. Measure 265 has a half note G2. Measure 266 has a half note G2. Dynamics range from *fp* to *f*.
- Sus. Cym. (Suspended Cymbal):** Measures 263-264 have a rhythmic pattern of quarter notes G2, A2, B2, C3. Measure 265 has a half note G2. Measure 266 has a half note G2. Dynamics range from *mf* to *sfz*.

Additional markings include a *Crot.* (Crotchet) symbol in measure 266 and various dynamic markings (*fp*, *f*, *mf*, *sfz*) throughout the score.

X. Sonata

(2011)

for Viola and Piano

Sonata

for Viola and Piano

Grave ♩ = 40
dark, brooding

David E. Gordon

Viola

Piano

Grave ♩ = 40

p *mp* *mf* *f*

8^{vb} Red.

5

Vla.

Pno.

mp *f* *sfz* *p* *f* *sfz*

p *pp* *f* *sfz* *p* *mf* *ff* *p*

Red. 8^{vb}

9

Vla. *fp* *mf* *sfz* *f* *sfz* *pizz* *arco* *poco accel.* *tr*

Pno. *mf* *pp* *mp* *pp* *mp* *f* *poco accel.* *tr* *tr*

Adagio $\text{♩} = 60$

14 (tr) *f* *mp* *fp* *f* *mp* *ff* *tr*

Pno. *sfz* *sfz* *sfz* *f* *mp* *mp* *tr* *8va*

18 ricochet

Vla. *sfz* *pp* *mf sfz* *f* *mp* 5

Pno. (tr) *p* *pp* *mp* *p* *mf < f* *p* *mp* *sfz*

sfz *sfz*

23

Vla. *f* 6 *mf < fp* *pp* *f* *mp*

Pno. *mf* *mp* *pp* *p* *mp* *mf*

27

Vla. *poco accel.*

sub.
ff p *mf* *f* *f* *sfz* *mf*

tr

Pno. *poco accel.*

sub.
p *mf* *mp* *p*

31

Vla. *Andante* ♩ = 80

f *fp* *ff sfz* *pizz* *p*

Andante ♩ = 80

Pno. *f* *mf* *sfz* *p*

34 *calm, slightly sad*
arco

Vla. *p* *mf* *f*

Pno. *p* *mf* *f*

8^{va}

38 *sul pont.* *poco vib. ord.*

Vla. *ff* *p*

Pno. *ff* *p* *p*

8^{va}

sfz *sfz*

41

Vla. *mf* *f* *ff*

Pno. *mf* *f* *ff*

44

Vla. *mp* *f* *sfz* *sfz* *p*

Pno. *p* *mf* *p*

47

Vla. *pizz* *arco* *molto espressivo*

mf sfz *mf* *ff sfz* *mf*

Pno. *molto espressivo*

p *mf* *p* *mp*

8va *8va*

51

Vla. *pizz* *arco*

ff *sfz* *p* *f* *sfz* *mf* *sfz*

Pno. *f* *ff* *sub. p* *sfz*

(8)

54

Vla.

Pno.

ff *mp* *f* *mp*

mf *ff*

mf *ff*

57

Vla.

Pno.

fp *mf* *fp* *f* *p*

mp *f sfz*

mf *f sfz*

61

Vla.

p ————— *mf* > *p* ————— *mf* *fp* <

Pno.

(8)

mp ————— *pp* ————— *mp* ————— *p*

65

Vla.

mf ————— *p* cresc.

Pno.

(8)

mf ————— *p* ————— cresc.

69

Vla. *mf* *pp* *p* *ppp* *sul pont.*

Pno. *mf* *pp* *mp* *p* *sfz* *8^{va}*

74

Vla. *ord.*

Pno. *p* *mp* *p* *pp* *mp* *pp* *8^{va}*

77

Vla.

f

mp

p

pizz

Pno.

p

mf

pp

ppp

XI. Echo

(2015)

for Fixed Media and Video

Duration: 6 minutes 18 seconds

Format: .MOV

XII. Refracted Light

(2011)

for Fixed Media

Duration: 3 minutes 9 seconds

Format: .AIFF

XIII. Modulations

(2015)

for Fixed Media

Duration: 8 minutes 33 seconds

Format: .AIFF

XIV. Transformation

(2012)

for Fixed Media

Duration: 8 minutes 0 seconds

Format: .AIFF

XV. Parallels

(2015)

for Fixed Media and Video

Duration: 9 minutes 11 seconds

Format: .MOV