UNIVERSITY OF CALIFORNIA
IRVINE

Towards a Cross-Domain Notation

DISSERTATION

submitted in partial satisfaction of the requirements
for the degree of

DOCTOR OF PHILOSOPHY

in Integrated Composition, Improvisation, and Technology

by

Garrett Blake Harrison-Lane

Dissertation Committee
Professor Christopher Dobrian, Chair
Professor Michael Dessen
Professor Kojiro Umezaki
Professor Simon Penny
Professor Cristina Videira Lopes

2022

Dedication

To

my wife and family

for the years of support

and belief.

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Acknowledgements

My deepest thanks go to my advisor Christopher Dobrian. His insight and delving questions led me to places I could not have gone alone. I would also like to thank my committee—Michael Dessen, Kojiro Umezaki, Simon Penny, and Crista Lopes—for each contributing their own unique insights and the rest of the UCI faculty for fostering a supportive and diverse learning environment.

My journey could not have begun without my undergraduate composition teacher Scott Eggert, who inspired in me an interest in music theory and composition. The encouragement and guidance of Lewis Nielson to continue my education directed me to study under Baljinder Sekhon and Paul Reller, who worked tirelessly to prepare me for the challenges ahead.

My lifelong gratitude goes to my mother, Barbara, for her unyielding support of my following the path of musicianship, and my father, Alan, for helping to guide the way for me to become the man I am today. My thanks also go to the Boyd family—Stowe, Sarah, Keenan and Conrad—for their endless care and love over the years.

Last, but definitely not least, none of this would be possible without the patience and dedication of my wife Sohyun. I couldn't ask for a better partner to accompany me on the long, winding path that we walked to get here.

Vita

2012 B.M in Music Recording Technology, Lebanon Valley College

2012 B.A. in Music Composition, Lebanon Valley College

2018 M.M. in Music Composition, University of South Florida

2022 Ph.D. in Integrated Composition, Improvisation and Technology, University of California, Irvine

Abstract

The musical score is an inherently ambiguous object that contains symbols that imply and refer to something other than themselves. The score acts as an imperfect form of communication between the composer and musician and relies upon a shared domain of knowledge to ensure that communication occurs at all. In this dissertation, the author explores the implementation of a notational system that requires musicians to interact with the conceptual metaphors that give meaning to the symbols in the musical score. I call this system cross-domain notation. Chapter 1 explains the conceptual framework that underlies cross-domain notation. Chapter 2 describes the four primary elements of cross-domain notation: presence, absence, and the established and discovered meaning and how these interact and support one another. Chapter 3 shows different implementations of cross-domain notation and how those are augmented through the use of digital scoring. Chapter 4 reflects on the process of working with musicians using this notation and on the next steps in developing cross-domain notation in other areas of the scoring process.

Introduction

As a composer, I have always been interested in how musicians relate to their instruments and the performance practices that go along with the process of learning those instruments. In the Western art music tradition, the reading of the musical score plays a critical role in musicianship and the content of those scores underly what musical information a composer is able to communicate. The content of the score enframes the features of the music that will result through the musician's interaction with the score. Many composers in the 20th century—including but not limited to Cage, Crumb, Feldman, and Brown—began to investigate different ways of using notation. The changes in how these composers used notation went hand-in-hand with their ability to achieve their creative goals. This dissertation is by no means an attempt to survey the history of experimental music notation practices but will instead focus on my new system.

In this dissertation, I will explore different uses of what I am calling cross-domain notation. The purpose of cross-domain notation is to take a process that has become solidified and automatic in reading modern-staff notation—understanding the meaning of the symbols presented in a musical score—to encourage musicians to question their relationship with notation. Working in this manner is meant to provide musicians greater awareness of their own practice. In this spirit, the compositions presented as part of the *Specific Ambiguities* (SA) concert are intended to function like a set of etudes. They focus on the development of a skill or technique over the production of the piece for an audience. The traditional focus of a musical etude is to develop the ability of a musician to play their instrument. The focus of cross-domain notation is on the ability for a musician to remap the meaning of the symbols in a musical score to other source domains.

In chapter 1, Conceptual Framework and Background, I provide a base of knowledge that is helpful for understanding the concepts underlying the cross-domain notation system. Ideas from

postcogntivism and the history of Western music provide a starting point from which to explain the theory which informs the creation of the pieces presented in this text.

In chapter 2, The Compositional Framework, I present the concepts of presence, absence, and the established and discovered mapping and how they are represented as symbols within the score. The phrase and grid score layouts are explained and the process of playing a cross-domain notation score is looked at in more depth.

In chapter 3, Extending the Compositional Framework, I examine compositions involving extensions of the cross-domain notation system into other elements of notation, the scoring modality through the use of digital scores, and the use of other forms of technology such as the Yamaha Disklavier to play cross-domain works.

In chapter 4, Feedback, Reflections, and Next Steps, I look back at the process of developing cross-domain notation, working with musicians, and what the next steps are for the system.

Chapter 1: Conceptual Framework and Background

"The first line on paper is already a measure of what cannot be fully expressed.

Nature, physical nature, is measurable. Feeling and dream have no measure, have no language, and everyone's dream is singular. A man is always greater than his works because he can never fully express his aspirations.

Structure is the giver of light. When I choose an order of structure that calls for column alongside of column, it presents a rhythm of no light, light, no light, light, no light, light.

I said that all material in nature, the mountains and the streams and the air and we, are made of light which has been spent, and this crumpled mass called material casts a shadow, and the shadow belongs to light."

- Louis Kahn

The work that forms this dissertation comes from a wide variety of topics and sources including music, embodiment, linguistics, and logic. This chapter will cover relevant topics in these fields to provide a tapestry against which the core elements of my compositional framework and the notation that accompanies it can be presented. It begins with an attempt to clarify the goal of the project through a look at ambiguity, in "On Ambiguity in Art and Music," and provide some general statements regarding the elements of the music creation process and the roles that different individuals fill within it in "On Performing and Practicing Music." The proceeding sections will discuss relevant historical topics and how they relate to music notation to further seat this project within a world of ideas. These include "On the study or etude," "On metaphor and music notation," "On physical and conceptual mobility in music," and "On musical notation and embodied cognition."

On Ambiguity in Art and Music

Music notation is an inherently ambiguous form of communication. The lack of clarity that it provides is part of what allows for the wealth of expression and interpretation that makes up the

production of music. However, since the word ambiguity is itself ambiguous, it may be helpful to define what type of ambiguity is being referred to when it is used in this document. In the fourth of his six lectures at Harvard in 1973 entitled "The Delights and Dangers of Ambiguity," the composer Leonard Bernstein points to the fact that "ambiguity" has multiple meanings and is, therefore, ambiguous in and of itself. This multiplicity of meaning arises from the prefix ambi- which can

> "signify 'bothness'—that is being on two sides at once—and also signify 'aroundness'—or being on all sides at once. The first connotation, 'bothness,' yields such words as ambidextrous, ambivalent, and so on, which imply duality, whereas the second connotation, 'aroundness,' conditions such words as ambience, ambit, and so on, which all relate to the general surround, thus implying vagueness. Webster gives these two definitions of ambiguous. 1) doubtful or uncertain and 2) capable of being understood in two or more possible senses." (Bernstein 2002b, 193)[1]

Bernstein walks through a short history of ambiguity in music regarding three types of ambiguity: phonological, syntactical, and semantic. He starts with the music of Bach as having an ambiguity of interpretation between chromaticism and diatonicism. Bach's music can be listened to by hearing the chromaticism that the diatonic frame contains or through the containing diatonicism. He then points to the ambiguity in the underlying syntax of Mozart that is converted into ambiguous structures on the surface. Next, Bernstein turns to the adagietto from Mahler's 5th symphony and the opening that arpeggiates a rootless F triad, placing the listener in an ambiguous state as those two notes, A and C, could just as easily be part of an A minor or F major triad until the third note of the chord is heard. The point being that these ambiguities, phonological and syntactic, lead towards another type of ambiguity—a semantic ambiguity regarding the meaning of what is experienced which, beginning with Beethoven, grew more and more throughout the Romantic and Modern Era. It is from these two definitions of ambiguity, "bothness" and "aroundness" as Bernstein put it,

[1] See also (Bernstein 2018) and (Bernstein 2002a)

combined with the semantics of music notation that the two primary categories of my conceptual framework can be understood: *appearance* and *mapping*.

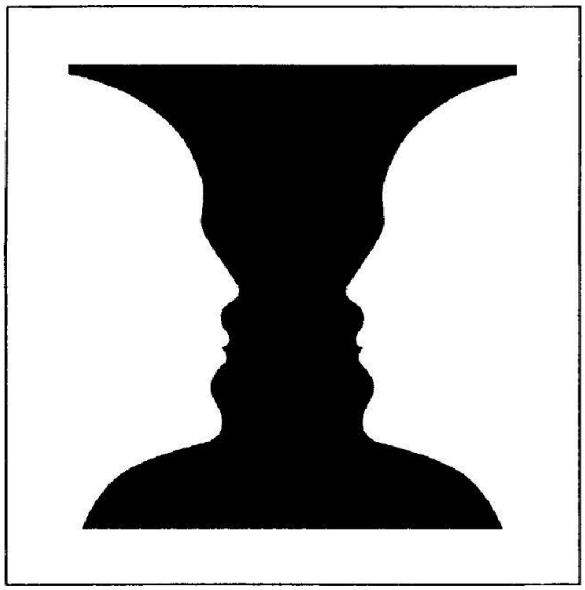


Figure 1 - Rubin's Vase (Ittelson 1960)

The first element of the conceptual framework is the ambiguity between positive and negative, presence and absence, or to put it another way, between figure (foreground) and ground. In the early 1900s, the psychologist Edgar Rubin created a series of bi-stable images for his dissertation that could be interpreted as one of two shapes but not initially held as both at the same time. *Figure 1* shows "Rubin's Vase," also known as the "Rubin Face" or "Figure-Ground Vase." In the image, the viewer can perceive either a black vase or two white faces looking at each other depending on which color they perceive as the background and which they perceive as the figure. While Rubin did not use the term phenomenological in his dissertation, much of the work described the shift in the "visual experience" of the subject which turns the figure into background and vice versa. (Pind 2014, 94) The ambiguity contained in viewing bi-stable images such as Rubin's vase is a "bothness" and an "aroundness". On the one hand, there are two different interpretations that can be made and both of them are equally present in the image but not present in our experience. As a

result of this "bothness," there is an uncertainty regarding the "truth" of the image since no matter what an observer sees, they are dealing with the same "objective item." According to Rubin, "one must as far as possible discard from consciousness one's knowledge about the objective item." (Rubin 1915, 32) However, even if something that was once experienced as a figure shifts to become ground, the experience of it as figure still enframes the way that it is understood. The original experience of the stimuli shapes further interaction. The way that the distinction between figure and ground play a fundamental role in my framework will be discussed further in Chapter 2.

On Performing and Practicing Music

"The problem of music, of course, is that it is, by its very nature, a public art. That is, it must be played before we can hear it…One can't just imagine sound as an abstraction, as not being related to someone pounding the piano or beating a drum. To play is the thing. This is the reality of music." —Morton Feldman (Feldman and Friedman 2000, 24)

The relationship between composer, performer, and audience in the "high art" of western music is a complicated one. As Christopher Small points out in his book *Music of the Common Tongue*, the denial of universal musicality built in to the education system of the West creates a hierarchy of ability in which composers sit at the top and the greater mass of humanity lies at the bottom.

> At the top of the pyramid, tiny in number and exceptional in the nature and extent of their gifts, are those who are capable of a genuine creative act: the composers...Below them, more numerous, are the performers, also a gifted and admired group, if a little lower in social esteem than the first...Below this layer of the pyramid are those whose lot it is simply to contemplate and 'appreciate' the music objects created by composers and presented by performers, that large group who call themselves 'listeners' or 'music lovers'...Below this again are the remainder of the population. (Small 1998, 54)

To negate this world view, Small puts forward the concept of "musicking," as being the verb meaning "to music." He writes that "in most of the human race's musicking the acts of composition and performance are simultaneous while there may not necessarily be an audience at all apart from the performers." (Small 1987, 52) The most important part of music is then the performing of it and the object item—the composition if there is one at all—becomes a subordinate part of it. This

relationship between composer and performer is one of two hierarchies that this document will examine, the other one being the relationship between the performance of music and the practice of music in this age of consumer capitalism.[2]

I will argue that the performance of music is privileged over the praxis of music within the culture of the West. Practice is largely used as a preparation for performance rather than as a means in and of itself. The performer is "a privileged kind of audience— their encounters with musical works are visual, aural, and embodied, they engage with pieces multiple times, they are participants in as well as consumers of the music." (Long 2020, 20) The audience for the works being discussed as part of this dissertation is not the concert-going public but the musician who is working-through the piece. In particular, the spirit in which these works have been created is for them to serve a *practical* purpose foremost and secondarily, if the musician so chooses, a *productive* purpose. [3] Music created in this manner is not a product that is consumed but a recursive practice that is undergone to delve deeper into the nature of the process of acting. The difference between *practical* practice and *productive* practice is not in *what* one does while practicing but in *how* one does it.

In his 1971 book *The Nature and Art of Workmanship*, the designer David Pye puts forth the ideas of the *workmanship of risk* and the *workmanship of certainty*. Put simply, if the quality of the result is not determined prior to setting out and depends on the ability[4] of the craftsman during the process of making, then this is a *workmanship of risk*. On the other hand, if the quality of the result is determined prior to setting out and the process of making is not directly controlled by the

[2] This is referring to late-stage capitalism as described by Jameson and Arrighi refer to as late capitalism where "the goal of production no longer lies in any specific market, any specific set of consumers or social and individual needs, but rather in its transformation into that element which by definition has no context or territory, and indeed no use value as such, namely, money" (Jameson 1997, 260)

[3] Practical coming from the Greek *praktikos* meaning 'concerned with action.' The word practice comes from *praktikē*, the female form of the same root. This is in opposition to productive in the manner that David Pye uses the word to mean the creation of something for sale. (Pye 1971, 22) The focus of the practitioner of music is not on selling the product of their work in the concert hall but purely on the action of creating music.

[4] I am using the word ability here in place of "judgment, dexterity, and care" which is the phrase that Pye uses.

craftsman, then this is a *workmanship of certainty*. The fundamental difference between them is that in the workmanship of risk, the "risk is real." (Pye 1971, 9) The example that Pye provides is the difference between writing with a pen and using a printer. The printer requires more ability prior to the act of making but once put together requires no direct input from a craftsman. The distinction between the two workmanships is a continuum with intermediary activities in-between such as the use of a typewriter. In the physical arts, the quality of the result is determined by every motion since each action of the craftsman changes the material being worked with in a way that cannot be undone. Tim Ingold outlines this process beautifully in his article *Walking the Plank* which investigates the process that a craftsman that undergoes in the process of sawing a plank. Ingold separates the tool-use into four stages: getting ready, setting out, carrying on, and finishing off. Getting ready involves creating an "umbrella plan" for how to act. Gathering the materials that are needed, making marks for future action. An umbrella plan can extend outside of the mind of the craftsman. Setting out is the phase of making the first unalterable action. This is "the moment where rehearsal ends and performance begins" (Ingold 2006, 68) such as putting the first cut into the wood. Setting out involves a narrowing of perspective from the overall activity to the particular immediate act. Carrying on is the point at which the craftsman begins to work in tandem with their material rather than trying to force their will upon it. The craftsman's focus widens out to a larger view of the materials they are dealing with. Finally, the phase of finishing off is reached when the state of the material matches the craftsman original intention. The craftsman then moves back to the getting ready stage through whatever means their work entails.

While this is just as true in the process of playing music, the difference in medium between an art like woodworking and music causes the quality of the result of a musician effort to be much less tangible and the continuum between risk and certainty becomes blurred depending on the medium by which the music is observed. The practice room, the recording studio, and the concert

hall are all different venues in which music can be played. In each, the musician undergoes the same process of risk in playing their instrument but the conditions they are working in change the relationship between their actions and their environment. The workmanship that occurs in each of these locations results in the same outcome—sound—but what is important about the result and the intention with which it is approached change. In comparison with Ingold's phases of tool use, the practice room functions similar to the stage of setting out, focusing in on the task at hand until the musician and the music start to function together as one in the stage of carrying on and finally finishing off in their performance in the concert hall. On the other hand, the recording studio encompasses all of the stages with the final product being created as a result of the repetitive process of recording take after take that can then be mixed down into a final product. Even the act of recording changes the feeling of playing. The important part is that the environment in which the act of workmanship takes place in contributes to what is important about the result and, therefore, how a practitioner goes about determining its quality.

Distinctions such as the one between performance and practice are of great importance. As will be shown, the same outcome approached from two different paths is actually two different outcomes when understood from the perspective of the person on the path. It is this point of view—the experience of the musician—and how that view is shifted and altered through repetition and juxtaposition against other musicians that I am concerned with. The sound that occurs is not as important as the reasons for it coming into being. Echoing Feldman's assertion that both Duchamp and Boulez believed that "what you see or hear is not as important as the historical stance that brought it about," (Feldman and Friedman 2000, 22) what I am concerned with is how the act of making sound comes into being. What elements are involved and how do they inform one another? How does the way that options are presented in the form of musical notation affect their meaning?

Historical Background

With a general background for the reasons for undertaking the project in place, this document will now turn to providing some historical background of areas that inform the creative work. "On Music Notation" will situate the This section will begin with "On the study or etude" which will look at how the musical etude shifted in purpose over its history from being a technical skill builder for musicians to works created by composers to investigate new mediums or compositional techniques. The next section, "On Metaphor and Music Notation," will look at how conceptual metaphor and cross-domain mapping inform the sense making process which underlies music notation which uses common notation. The section "On physical and conceptual mobility in music," will look at the work of Earle Brown and others in considering how musical meaning is created in relationship with the score. The last section "On musical notation and embodied cognition" will look at elements of music notation and how they related to the embodied act of creating and working-through musical scores.

On the development of music notation in the 20th century

An in-depth look at the different forms that music notation has taken over its history is a very broad topic and one that this document does not have the room to discuss. However, some background of the history of notation—and developments related to staff notation in particular—is important to give context to and situate the ideas presented here. I will focus on three different composers' scores which I believe show three different approaches to expanding upon staff notation: John Cage, George Crumb, and Anthony Braxton.

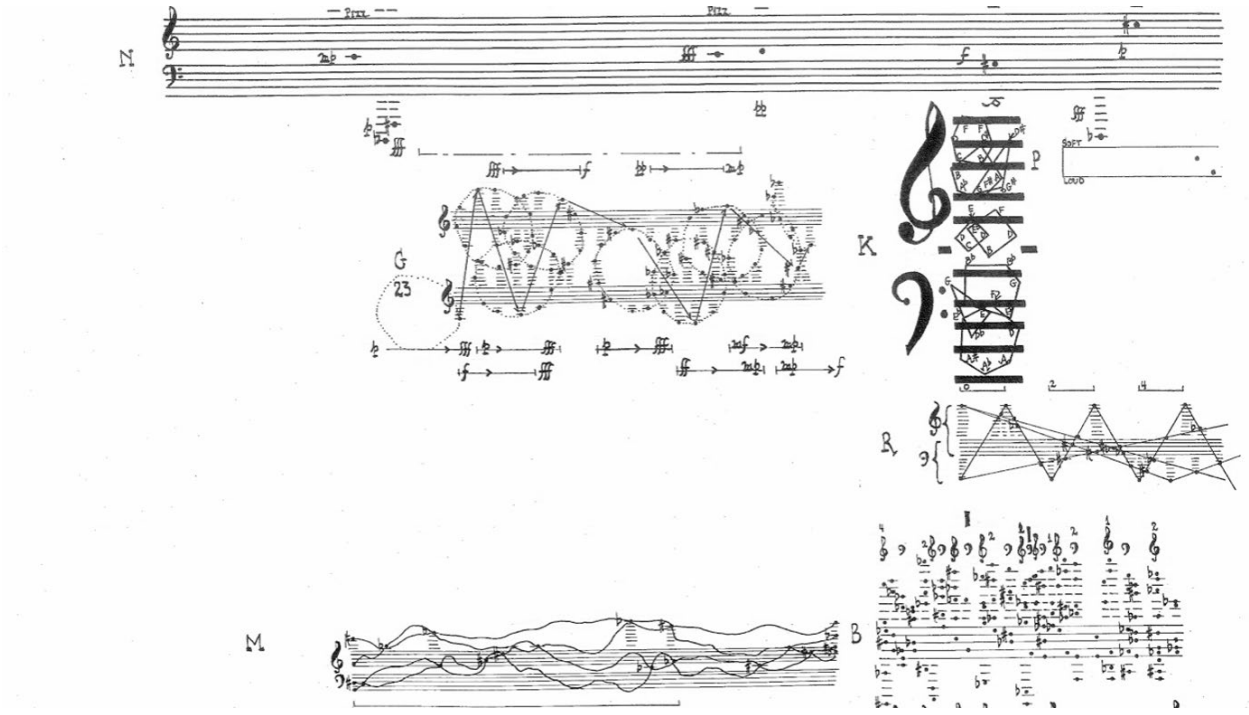


Figure 2 - Example page from John Cage's score of *Concerto for Piano and Orchestra* (Cage 1958)

John Cage wrote a prolific amount of music, much of it involving notation that used symbolic language from staff notation but in new ways. In a piece such as *Concerto for Piano and Orchestra* (1958), the musicians have a lot of musical freedom in what choices to make—how gestures should sound, which ones should be played, and in what order. The freedom that the performers has to express themselves and the means by which that expression should occur lie strictly within how Cage wants performers to play them. The letters next to each corresponds to an instruction of how the music should be played. The instructions for M, for example, ask the musician to "Begin at left, end at right, changing direction at intersections if desired, may be expressed as on voice, a 'counter-point' or, as 3 or 4 voices, pedals only in areas indicated, not obligatory." and continues on to describe the different types of pedal markings. While the material shown in Figure 2 can be played many ways, the meaning of the symbols and the context in which those symbols can be played is quite restricted.

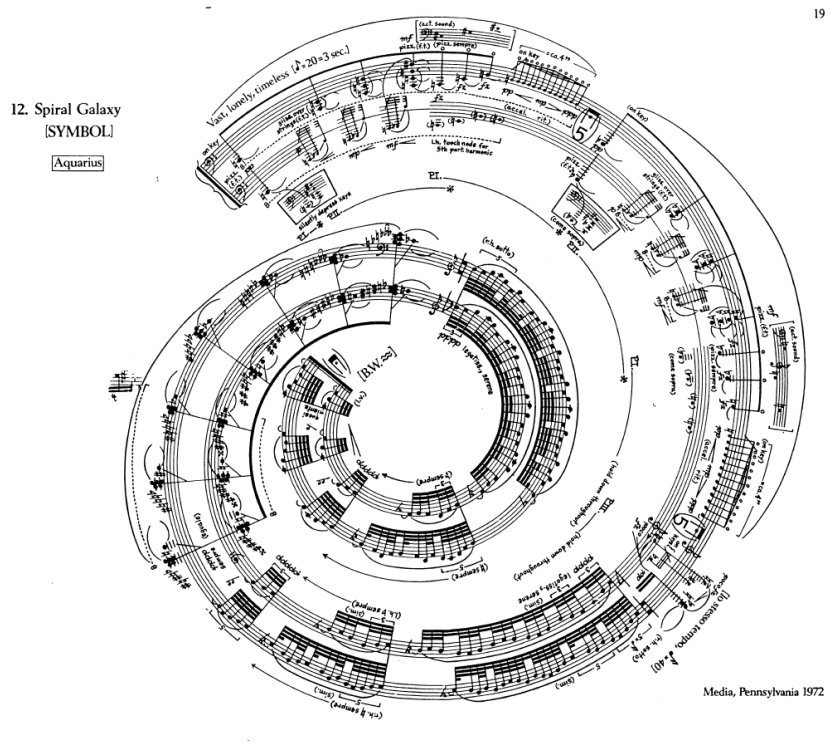


Figure 3 – George Crumb's *Spiral Galaxy* from *Makrokosmos I* (Crumb 1972)

George Crumb's *Spiral Galaxy* from *Makrokosmos I* (1972) provides an example of one of many of his scores that feature the use of staff notation with a change in layout which places the staff into a circular form instead of the standard horizontal layout. This accomplishes two things: first, it relates the layout of the notation to the concept of the work and, second, relating to cross-domain notation, it provides a challenge for the musician in their ability to play from the score. Although the challenge of reading the notation in a position other than horizontal is not of a huge difficulty to surmount, it is an added difficulty that the musician will need to overcome initially to perform the score. The layout of the notation brings the concept of the piece to mind. While the music could be written out with the horizontal and vertical domains maintained, something important would be lost through this reimagining. While these and similar pieces by Crumb can be

in a sense considered graphic scores—insofar as layout of the score affects the way that it is played—they are not graphic scores in the same way as Cage or Braxton.

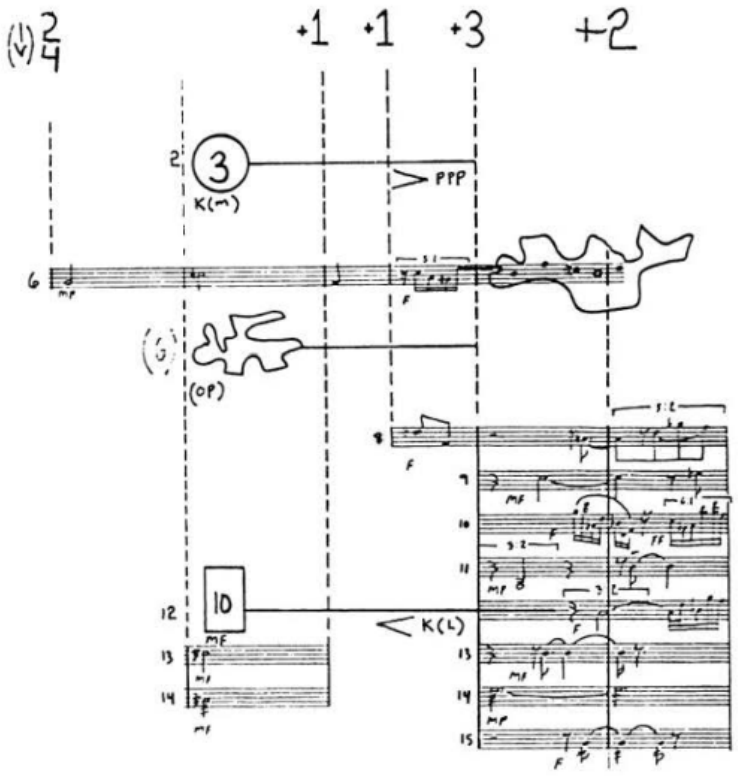


Figure 4 - Example from Anthony Braxton's score of *Composition 100* (Lock 1988, 247)

Similar to Cage, the scores of Anthony Braxton use many different forms of notation, some of which include elements found in staff notation. However, the spirit with which a score by Braxton should be approached is far different from Cage. In his *Tri-Axium Writings*, Braxton points to the different utility that notation has in African-American creative music and Western art music. In creative music, the material serves as a material that is sculpted and used as a foundation for expression, whereas in Western art music the notation serves as something to execute.

> Notation as practiced in black improvised creativity is not viewed as a factor that only involves the duplication of a given piece of music [. . .] Rather this consideration [i.e. notation] has been used as both a recall factor as well as a generating factor to establish improvisational co-ordinates [. . .] Notation in this context invariably becomes a stabilizing

> factor that functions with the total scheme of the music rather than a dominant factor at the expense of the music. (Braxton 1985, 35–36)

The expression of the individual by means of the score is thus a highly important feature of musical performance for Braxton and the graphical nature of his scores helps to further this goal. The meanings that the symbols have relate to a deep reservoir of both Braxton's notational language and the individual performer.

The primary difference between the scores of Braxton and the cross-domain notation scores that have been produced thus far comes with the specificity of the meaning of the symbolic language. Cross-domain notation sits in a somewhat frustrated point between the self-expression and score execution. Cross-domain notation does not relate directly to action but rather to the context in which an action takes place. It achieves this by operating a step away from the surface-level meanings of the symbols which complicates the ability for a musician to both express themselves and execute the notation. The act of playing cross-domain notation is in itself a frustration of habitual self-expression and of execution. As the different symbol types are explained in Chapter 2 and pieces discussed in Chapter 3, the liminal nature of cross-domain notation will be explained further.

Another difference between the work mentioned above and my work presented here is the nature of what the alteration of the notation is aimed at achieving. The difficulty that arises in reading *Spiral Galaxy* or in interpreting a graphic score of Cage or Braxton is a necessary means to an end to accomplish the goal of the performance of the piece. These pieces are meant to be performed. In the case of Cross-domain notation, the difficulties the arise in the practicing of the score are the point of the notation with the musical outcome being secondary. Cross-domain notation is not a notation system that is intended for performance. While it does not preclude the

possibility of performance, the experience of the musician working through a piece is the goal in and of itself, not the preparation of the material for a public showcase.

On the study or etude

The history of the modern concept of the etude dates back to the early 1800s and the invention of the piano. The popularization of the piano brought along with it a need for pedagogical material for the student. Many of these works were written to focus more on the attainment of technical expertise over the creation of a work of artistic value. Prior to this time, the studies were not differentiated from other concert works and were not written to serve a particular pedagogical use for the improvement of particular techniques. The transformation of the study from pedagogical tool to concert work was accomplished mainly by composers such as Frédéric Chopin, Franz Liszt, and Claude Debussy. The first among these to be regularly performed in concert are Chopin's 12 *Grandes études* op.10 (published in 1833) and *12 Etudes*, op.25 (published in 1837). While Chopin's etudes were still focused on particular skills at the piano, Liszt's *Etudes d'exécution transcendante* (1852) were less focused on teaching particular techniques and more focused on being a display of skill. (Ferguson and Hamilton 2001)

In the 20th century, the concept of the study would turn away from the skill of the performer and towards the skill of the composer. The study became a way for composers to show their prowess by investigating a particular element of composition or as a means of investigating the philosophical implications of a composition. Messiaen's *Quatre Études de rythme* (1950), Stravinsky's *Quatre études pour orchestre* (1928–9), and Ligeti's *Etudes* for piano (1985–95) are all examples of etudes that are made to show off the composer's skill in investigating using specific elements of music over improving the technique of the performer or displaying their virtuosity. Other composers like John Cage used etudes to continue the tradition of difficulty—but not merely for displaying virtuosity or

showing-off—through the creation of his *Etudes Australes* (1975), *Etudes Boreales* (1978), and *Freeman Etudes* (1981). The *Freeman Etudes* in particular were written to be as "intentionally difficult" as Cage was able to write them. The violinist "is a model for society by showing that no project is too difficult to pursue, provided that one is committed to the hard work necessary for its completion." (Pritchett 1994)

Etudes also became a way for composers to investigate the possibilities of new musical mediums. *Studies for Player* Piano is a set of pieces written by Conlon Nancarrow for the player piano. In these pieces, Nancarrow uses the player piano to produce music that is extremely rhythmically complex and involves intricate polyrhythms and multiple tempi. *Cinq études de bruits (Five Studies of Noise)* are a set of etudes composed by Pierre Schaffer in 1948 of which *Étude aux chemins de fer (Railroad Study)* is the best known. They are the first example of *musique concrete* (concrete music) which is a composition style that uses recorded sound as the medium of composition rather than the abstract medium of music notation. In them, Schaffer attempted to create a "symphony of noises" by taking recordings, called "sound-objects," and juxtaposing them alongside one another to create a music that is dependent, "no longer on preconceived sound abstractions, but on sound fragments that exist in reality, and that are considered as discrete and complete sound objects, even if and above all when they do not fit in with the elementary definitions of music theory." (Schaeffer 2012, 14) (Kane 2014) Karlheinz Stockhausen's *Etude* (1952), *Studie I* (1953), and *Studie II* (1954) were all written as ways of applying serialism to music created through the electronic medium. The electronic medium also allowed for composers to investigate possibilities that are only possible using recording technology. The composer Easley Blackwood Jr. released *Twelve Microtonal Etudes for Electronic Music Media* as an album in 1980. (Duffie 1993) In the etudes, Blackwood explored the possibilities of equal divisions of the octave other than the standard twelve divisions found in Western music to find idiomatic sounds for those divisions. While his experiments led him to believe that twelve

division equal temperament has the most expressive compositional possibilities, other tunings contain chromatic sets and organizational possibilities that are not found in 12 EDO. (Keislar et al. 1991, 180) The recording studio provided him a space to experiment and sound out his ideas before presenting them to the public already fully formed.

On metaphor and music notation

Metaphor allows us to understand "one kind of thing in terms of another." (Lakoff and Johnson 2003, 5) As stated previously, conceptual metaphor is the mapping of one domain onto another allowing for it to take on properties of the first domain and form concepts and conclusions that would not otherwise be available. Conceptual metaphor is one of the fundamental ways that human beings can think about themselves, the world, and abstract concepts.

> From a conceptual point of view, primary metaphors are cross-domain mappings, from a source domain (the sensorimotor domain) to a target domain (the domain of subjective experience), preserving inference and sometimes preserving lexical representation. Indeed, the preservation of inference is the most salient property of conceptual metaphors. (Lakoff and Johnson 1999, 60)

One example of a conceptual metaphor is TIME IS MONEY. By equating TIME (the target domain) with MONEY (the source domain), TIME is framed as a limited resource that can be commodified and spent. This allows for statements such as "You're *wasting* my time" or "You don't *use* your time *profitably"* to be made. (Lakoff and Johnson 2003, 7) TIME IS MONEY is a linguistic metaphor but the same structure can be used in other forms of expression as well.

In common notation, the notation serves the function of mapping concepts onto the image schema of VERTICALITY and HORIZONTALITY. According to Johnson, an *image schema* is "a recurring, dynamic pattern of our perceptual interactions and motor programs that gives coherence and structure to our experience. The VERTICALITY schema, for instance, emerges from our tendency to employ an UP-DOWN orientation in picking out meaningful structures of our

experience." (Johnson 1987, xiv) Image schema are not concepts. They are the underlying framework that concepts are built upon that arise from repetition in the embodied experience. The VERTICALITY schema appears not only as a part of common notation but around us constantly in anything that is looked at as employing the UP-DOWN orientation including trees, buildings, or the orientation that we take while standing. In common notation, the VERTICALITY schema has the terms "high" and "low" mapped on to it in reference to musical pitch. The "high" and "low" representation in vertical space is the common conceptual metaphor to be found in common notation alongside TEMPORAL RELATIONSHIPS ARE RELATIONSHIPS IN HORIZONTAL SPACE.

> A conceptual metaphor is a cognitive mapping between two different domains...With respect to music, the "high" and "low" used to describe pitches reflect the conceptual metaphor PITCH RELATIONSHIPS ARE RELATIONSHIPS IN VERTICAL SPACE. This metaphor maps spatial orientations such as up–down onto the pitch continuum. The mapping yields a system of metaphors replete with possibilities for describing musical pitch. (Zbikowski 2002, 66)

However, this spatial mapping to pitch is not a universal mapping. The metaphors a culture uses to make sense of abstract ideas structures the way those ideas are expressed and, as a result, structures how music is conceived of and experienced. In his work on the Kaluli people of Papua New Guinea, Steven Feld looks at how the relationship between water and sound structures their theory surrounding vocal music. In the music of the Kaluli people, the term "waterfall" forms multiple metaphorical relationships to the form of music. In Kaluli terminology, motion around the tonal center is directly related to terminology describing the motion of water. In this case, the primary metaphor linked to pitch would be PITCH RELATIONSHIPS ARE WATERFALL CHARACTERISTICS.

> *Sa-gu* is the onomatopoeic and generic term for "waterfall sound"; in musical terminology it means descent to the tonal center. When the tonal center is held for a long duration in a song, it is called *sa-gulu*. *Gulu* is onomatopoeic for continual waterfall flow. As a verb, *sa-gu-lab* means to sing a line that moves to and ends on the tonal center. *Sa-gu-lab* is also the name for the middle section of gisalo songs, where the tonality recenters by descent to the duration tone. (Feld 1981, 31)

The cultures of Bali and Java conceives of pitch as being "small" and "large" denoting a relationship between pitch and physical size rather than of position in space. The Suyá of the Amazon basin describe pitch as being "young" or "old," relating pitch to age rather than space. Taking Feld's article on the Kaluli as an example, these different domain mappings are often then converted into the horizontal and vertical domain mappings of modern staff notation in an attempt to explain them to an audience that are familiar with that form of notation and those mappings. This is a potentially problematic mode of explanation because of the relationship between the image schemata of the two domains being mapped together. The image schemata of VERTICALITY and HORIZONTALITY lend themselves to certain mappings over others. This is important because it implies that the use of modern staff notation enframes what we place into the category of "music" and what we do not.

On physical and conceptual mobility in music

Folio and Four Systems (referred henceforth as *Folio*) is a work in which Earle Brown was attempting to deal with time as an unmeasured experience rather than approximate it through a system of meter or notation through the creation of "an ambiguous but implicitly inclusive graphic 'notation.'" (Brown 1953) The scores found in *Folio* can be seen as one approach to the creation of a "mobile" score with more than one form or realization. The first approach to the creation of a mobile score is a score that is physically alterable and is therefore able to be arranged in different formations to create different outcomes. The second approach Brown outlines is a "conceptually mobile approach to basically fixed graphic elements" which is how the pieces within *Folio* present themselves. *December 1952* leaves the direction of performance, the time it takes, and the directional placement of the score up to the performer.

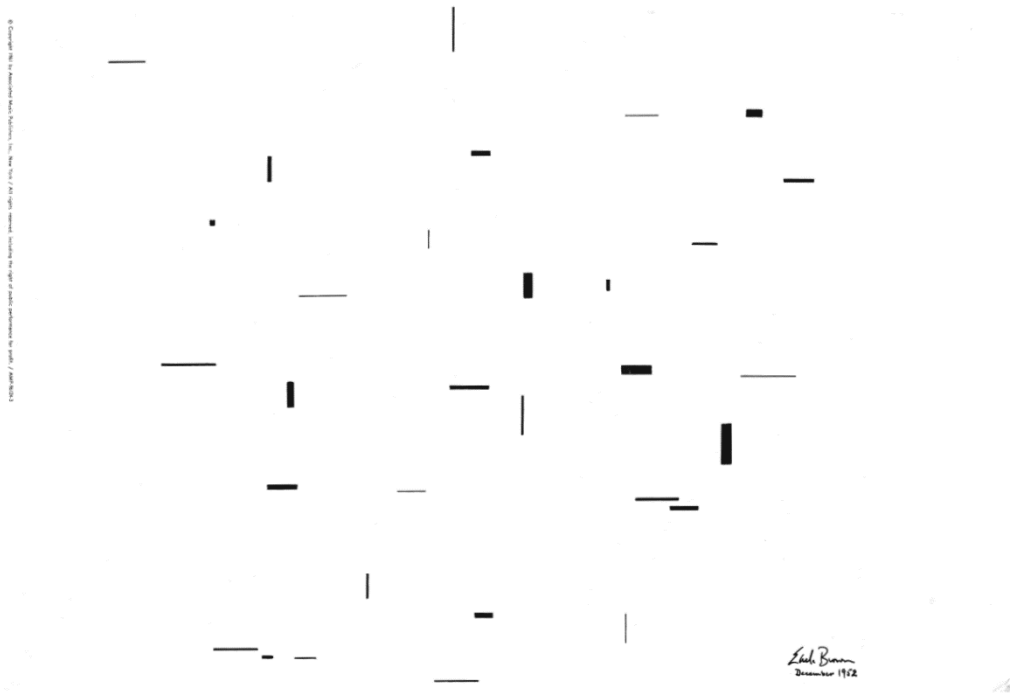


Figure 5 - Score to December 1952 (Brown 1952)

The sketches preceding the publication of *Folio* contain ideas for mobile machines inspired by the work of Alexander Calder and Buckmister Fuller. The score for *December 1952* is supposed to represent a photograph of one of these machines. As Brown describes it,

> In my notebooks at this time I have a sketch for a physical object, a three-dimensional box in which there would be motorized elements - horizontal and vertical, as the elements in December are on the paper. But the original conception was that it would be a box which would sit on top of the piano and these things would be motorized, in different gearings and different speeds, and so forth, so that the vertical and horizontal elements would actually physically be moving in front of the pianist. The pianist was to look wherever he chose and to see these elements as they approached each other, crossed in front of and behind each other, and obscured each other. I had a real idea that there would be a possibility of the performer playing very spontaneously, but still very closely connected to the physical movement of these objects in this three-dimensional motorized box. (Brown 2008, 3)

While Brown never realized this idea, an image of this became the "conceptual mobile" seen in the score for *December 1952*. The positioning of the elements and their size were determined by a

program that Brown created using sampling tables where width of each line was linked by Brown to the loudness of the sound.

Brown's *Calder Piece* achieves a synthesis of the physical and conceptual mobile by using Calder's "Chef D' Orchestre" as a component of the method for reading the score for the work, tying together the physical mobile and score with the conceptual mobility of reading the score. Stemming from his background as a jazz trumpeter, Brown was different to the other members of the New York School by being a performer-focused composer. He wrote, "I am not so much interested in the piece ultimately being a monument as I am in the piece existing as a kind of field of the activity of music-making which can exist between sympathetic and reasonable kinds of people." (Brown 2008, 6) Brown used a logical framework for many of his works in the 1950s, making heavy use of random sampling tables and the Schillinger system[5] for many compositional parameters. (Cady 2017, 12) However, the result of these systematic processes were scores that presented content while leaving form open.

On musical notation and embodied cognition

Modern Western music notation is a graphical, spatial representation of an embodied act. In the Western tradition, prior to the 11th century and the invention of the musical staff, commonly credited to Guido of Arezzo, all music was passed on via forms of cheironomy and "oral notation" made up of formal classifications of physical signals and methods of memorization and teaching using speech. Guido is also credited with the proliferation of solmization and its physical embodiment, the Guidonian hand. (Hughes and Gerson-Kiwi 2001) The Guidonian hand was a pedagogical tool for learning solfege by mapping of the syllables of a hexachord onto the hand. The

[5] The Schillinger System of composition is an attempt to create a holistic theory of music and number. It applies mathematical principals to all aspects of music to give students access to the underlying principles which inform those functions. It is a descriptive musical grammar that offers possibilities of action rather than limitations. See (Schillinger 2015)

practice of using the hand as a pedagogical tool within music extends to other cultures as well. For example, in the Hindustani tradition, counting bols, the mnemonic syllables used to represent each element of the rhythmic cycle (tala), is taught by placing each bol at a different point on the fingers and using the thumb to count them. This physical manipulation of the hand, and later the manipulation of graphical symbols representing the same concepts, are integral in the formation of the concepts themselves. (Malafouris 2007)

One of the main reasons written notation is useful is because it can act as a memory aid. As an externalization of the elements of a work of music into a fixed form, a score allows a composer to conceive of works of much higher complexity and duration than memory alone and provides musicians with the ability to form a repertoire much larger than they could otherwise. In *The Extended Mind*, Andy Clark and David Chalmers conduct a thought experiment where they conceive of two characters: Inga and Otto. [6] Inga decides to go see an art exhibit at the Museum of Modern Art (MoMA), recalls it is on 53rd street, and proceeds to walk there and go to the art exhibit. Inga is compared with Otto who is beset by Alzheimer's disease and relies on a notebook he carries to keep track of information. Otto also hears about the art exhibit, consults his notebook which tells him it is on 53rd street, and goes to the art exhibit as well. Clark and Chalmers claim is that "the notebook plays for Otto the same role that memory plays for Inga. The information in the notebook functions just like the information constituting an ordinary non-occurrent belief; it just happens that this information lies beyond the skin." (Clark and Chalmers 2010, 11) In the case of a score, the performer's belief they can play a given piece of music without having every note memorized falls along the same lines as Otto believing he knows where the museum is without remembering every step to get there. In this way, the written score acts as a "scaffold," or allows for

[6] In the case of Otto's notebook, Clark and Chalmers theory of Otto's notebook requires it to be a personal item. Otto's notebook functions as it does because it is personal to Otto, not a public artifact such as a map. Scores

a "'piggybacking' on reliable environmental properties" (Clark 1997, 45) which allows the composer to maintain a coherent process of discovery in notating the score and allows the performer to have something to hold onto as they attempt to perform the piece. Clark writes that, "Language and culture, in particular, emerge as advanced species of external scaffolding 'designed' to squeeze maximum coherence and utility from fundamentally short-sighted, special-purpose, internally fragmented minds." (Clark 1997, 33) While musicians do not commonly find themselves in the position of relying completely on a score to find their way through a piece, the score serves an important function in acting as a scaffold for the composer and the musician to discover the piece that will become an embodied part of their memory.

The distributed cognition of Edwin Hutchins touches similar conclusions. For Hutchins, cognition is still computational but does not occur entirely within the brain. "Interactions between the body and cultural artifacts constitute an important form of thinking. These interactions are not taken as 'indications' of invisible mental processes; rather they are taken as the thinking processes themselves." (Hutchins 2006) Thinking, therefore, is an embodied act that is distributed between human and environment. Cognition is distributed among people in a group and between humans and tools which together can achieve results that cannot be achieved alone. The examples of tools he provides are computational—a navigator's compass for example—and perform computation that the human would have to do otherwise or relies upon the tool to achieve. The musical score functions as a tool in the framework of distributed cognition in a number of ways.

The external scaffold of the musical score as an object exists within the *representational idiom*. Andy Pickering defines the representational idiom as one that "takes it for granted that the world gets into knowledge only through the medium of inert statements of matters of fact…Whichever way one develops the representational idiom, the material world remains without agency." (Pickering 1994, 413) The defining characteristic of the musical score using modern staff notation is as a

representation of action—or maybe it is better to say as a representation of outcome—and the study of a score is the study of music-as-knowledge. This is specifically an abstract symbolic knowledge that is not an instruction of how to play the piece on its own but one that relies on the embodied knowledge of musicianship. The agency that exists in this idiom is the agency of the composer while the agency of the material they work with and the role of the human being in co-creating plays a less important role.

The *performative idiom* by contrast sees the material world as having agency and acting alongside human beings. From this perspective, the creations of human beings—the musical score being one of them—should be understood in relationship with the materiality of their production, of what they become, and how they are used. The performative idiom is not contrary to the representational idiom but rather subsumes it, acknowledging that representations are a part of the creative process alongside the temporally emergent, socially-engaged elements of practice. As a musician interacts with a score, they undergo what Pickering calls the *mangle of practice*. The mangle is a "dance of agency" between the human and the material, between resistance and accommodation in a similar way to the way that Ingold's forceful process of setting out turns into a cooperative endeavor in the carrying on phase. The performative idiom acknowledges that representation is one element in the intimate[7] relationship between human agency, human perception, and the material world.

[7] This refers to the concept of intimacy as put forth by John Haugeland in his article *Mind embodied and embedded*. He writes: "The term 'intimacy' is meant to suggest more than just necessary interrelation or interdependence but a kind of commingling or integralness of mind, body, and world—that is, to undermine their very distinctness." (Haugeland 1998, 208) Haugeland's point is that the perceived separations between mind—or the feeling of self—and the body and the world actually point to instances of not merely relationship but to overlap and codependence between the three.

Conclusion

Chapter 1 has looked at the ambiguity present in music notation and how the act of playing from that notation is commonly used as a means to perform and not as the focus of a practice in Western Art Music. The chapter then covered the histories of the etude, the presence of conceptual metaphor as a structural element in the function of the score, examples of conceptual and physical mobility in the language of the score and the embodied roots and uses of notation. These topics serve as a foundation for Chapter 2 which presents the basic elements of my compositional framework. The concepts of presence, absence, and the established and discovered cross-domain mappings will be presented as four symbol types—the *presence of the established meaning (PEM), the absence of the established meaning (AEM), the presence of the discovered meaning (PDM), and the absence of the discovered meaning (ADM)*. These symbol types will be used in different layouts and scoring modalities which highlight the relationship between the agency of the musician and the notation.

Chapter 2: The Compositional Framework

Chapter 2 will delve into the implementation of the conceptual framework as a compositional framework which informs the decisions made by the composer in creating the musical score and how that score will be interacted with by musicians. The first section, On Using Common Notation, will expand upon the type of notation being used in this project and the reasons for doing so. The next section, The Four Symbol Types, goes into each of the four symbol types in depth and compares the similarities and differences between them. The chapter then concludes by looking at the different score layouts that are used as part of the project in Score Layouts in the Framework Etudes and expands upon the practice of working-through the cross-domain notation in Bringing-Forth and Working-Through.

On Using Modern Staff Notation

I came to this project from the perspective of a composer who, by necessity, must function primarily in a representation medium. Unless I am also the musician who is playing the music I notate or am composing for a computer-musician that I set the parameters for, I do not have direct interaction with the sonic component of the music creation process. The dance of agency that I undergo is between myself and a score. The score functions as a type of machine that attempts to elicit from musicians a desired result. In the case of this project, that result will often not be a specific symbol-content paring where a symbol represents a specific outcome as is normally the case in modern staff notation. As a result of applying this conceptual framework to notation, the scores will allow for situations where a symbol may represent a number of different outcomes that are unknowable to the composer prior to a musician playing the score and return to being unknowable after.

This project exclusively uses modern staff notation for a number of reasons. First of all, it is a form of notation that is widely understood and, more importantly for this project, has a symbol set that has a codified meaning. The fact that I can depend on the notation to have a shared meaning between different sets of performers means that I can focus exclusively on explaining and implementing the compositional framework. The composition framework is abstract and complicated enough that creating a new form of notation to use alongside it is an inefficient process for a musician unfamiliar with it.

Another reason that modern staff notation is helpful for this project is that it is a prescriptive form of notation. The symbols in the scores relate directly to a sonic outcome. Modern staff notation excels at specifying that a sound should occur at a certain pitch for a specific duration at a given point in time. The ability to fix the meaning of a symbol such as the notehead through superordinate symbols such as clef allows for the concepts of absence and the cross-domain mapping to function efficiently.

Presence, Absence, and Mapping

In Chapter 1, I introduced Rubin's Vase and how it plays with visual difference between what appears as the primary figure in a drawing and what appears as the background. The corollary in the work accompanying this dissertation is not a visual shift of focus but a conceptual one. Commonly, symbols within the musical score represent what I am calling the *positive appearance of presence* (referred to henceforth as presence). The nature of marking the page with a symbol limits the possibility of what can be expressed. Additionally, since the marking is commonly understood to be the figure and not the ground, the marking refers positively to its referent. In the musical scores that accompany this document, *presence* will be represented by a black symbol on a white background as is the standard in common notation. (See Table 1 for these concepts represented in notehead form)

Extending the idea behind Rubin's vase, if we treat the mark not as the figure but as the ground, we find what I am calling the *positive appearance of absence*. When this symbol appears, it calls forth all things that are the "ground" of what the symbol represents as an appearance of presence. However, this does not mean that it represents anything. What it represents are those other things that exist within the symbol's domain of meaning which, by not being present, give the symbol its meaning. For example, the verticality of the musical staff commonly represents pitch. The symbol that represents the positive appearance of presence stands for the presence of that pitch as a sound. The symbol that represents the positive appearance of absence stands for the presence of that non-pitch as a sound.[8] The positive appearance of absence of a pitched sound would be any sound that is not that pitched sound but is still identifiable as a pitched sound. The positive appearances of presence and absence exist within the same domain of meaning. *Absence* is represented by a white symbol on a black background. (See *Table 1*)

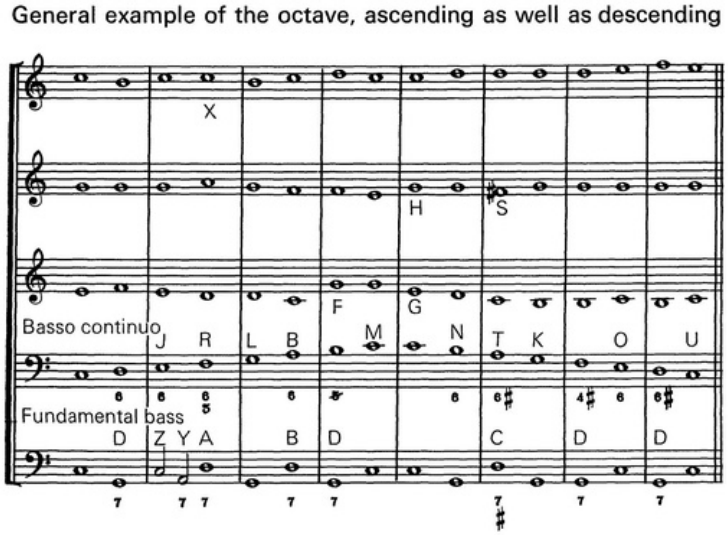


Figure 6 - Fundamental Bass (Rameau 1971)

[8] This is subtly different from the presence of a different pitch. The outcome of the positive appearance of absence is inherently something other than the fundamental meaning. However, the experience of getting to that outcome and the way that outcome is represented are entirely different. This distinction between the phenomenological experience of creating and the observation of that creation is important to this project.

It is important to note here that while different symbols may appear to represent each of these concepts, they are not fundamentally different symbols but akin to the idea of inversional equivalence as it pertains to the idea of the "basse fundamentale" (fundamental bass) of Jean-Philippe Rameau. Rameau's concept of fundamental bass posits the existence of an imaginary bass which is created by the roots of a succession of chords. This imaginary bass differs from the sounding bass when under inversion since the imaginary bass consists of the root of each chord and, for Rameau, was the basis for harmony. (*Fundamental Bass* 2001)

> The notes of this fundamental bass will bear only perfect chords and seventh chords, while the notes of the ordinary bass, which we shall call the continuo, will bear chords of all types. All these parts together will form a perfect harmony. This fundamental bass will thus serve as a proof for all our compositions, and we shall see that all the different chords used there are derived from a progression which differs from the progression of this fundamental bass only in the sense we have just explained. (Rameau 1971, 206)

The positive appearance of presence functions in a similar way to the fundamental bass. All of the other symbols take their identity from and refer to this *fundamental symbol.* As will be discussed later, many of the pieces that are part of the creative work are pieces that exist as an invisible piece—unheard but structuring the sounds that are heard—in the same way that the fundamental bass does. Even if they are not heard, they are what underlies the compositional decisions that are made. In this project, the *fundamental composition* is the basis for form.

	Established Mapping	Discovered Mapping
Presence		

Absence		

Table 1 - The Four Note Types

The second element of the conceptual framework is the ambiguity between what I am calling the *established mapping* and the *discovered mapping*. Mapping refers to the work on conceptual metaphor by George Lakoff and Mark Johnson in *Metaphors We Live By* and its extension by Lawrence Zbikowski in *Conceptualizing Music*. Conceptual metaphor is the mapping of one domain onto another allowing for it to take on properties of the first domain and form concepts and conclusions that would not otherwise be available. The ideas of conceptual metaphor and cross-domain mapping will be further investigated in the "On metaphor and music notation" section.

As was pointed to previously, in common notation the verticality of the musical staff represents pitch.[9] The higher a note is placed in relation to the staff, the "higher" a sound should be made. The description of a sound as high or low is a mapping of the idea of verticality onto sound which does not have a vertical property. The physically accurate way to describe sound would be to say that a sound oscillates faster or slower than another sound. However, showing the rate of vibration of a periodic sound as a point in vertical space provides representational advantages over representing the speed of sound directly when using a fixed medium such as paper and ink. Another example of cross-domain mappings is found in how the spectrum of sound is described. A low

[9] The verticality of the staff can represent other things as well when being used to notate music for instruments of indefinite pitch such as percussion instruments. In this case, the verticality of the score will often relate to the physical location of instruments in the space. Even so, the frequency spectrum that an instrument takes up will often still be arranged low to high. For example, in drum set notation, the drums are ordered kick drum, floor tom, snare, medium tom, high tom, ride cymbal, high-hat, and crash which follows along generally with the area in the frequency spectrum that these instruments take up. Additional situations in which pitch is not a concern, such as the rest or writing for solo percussion, are discussed later in this document.

sound may be "muddy," "fat," or "dark." A high sound may be "airy" or "bright." The mapping of concepts of weight or luminosity to characters of different areas of the frequency spectrum is another way in which other domains are used to describe music.

These common mappings are what I am calling the *established mapping*. The established mapping is the way that a symbol is commonly interpreted based on the shared knowledge of a group of practitioners. If two people who have knowledge within a domain are able to look at the same symbol and understand it to mean the same thing, this is an example of the established meaning. The *discovered meaning* is similar to the positive appearance of absence in that it is a removal of what one knows about the object item—in this case removing the domain that a symbol functions under—and a recontextualization of that symbol into a new coactive domain. The *established mapping* is represented by not altering the standard notehead of common notation. The *discovered mapping* is represented by a slash or X marking through the standard notehead. (See *Table 1*)

This project extends the semantic ambiguity contained in common notation through two conceptual categories: 1) the positive appearances of presence and absence and 2) the established and discovered mappings between the symbols found in the score and the domain of meaning. The overlapping of these two categories leads to the four different symbol types that are seen in *Table 1*: the *presence of the established meaning (PEM), the absence of the established meaning (AEM), the presence of the discovered meaning (PDM), and the absence of the discovered meaning (ADM).*

The Four Symbol Types

As was introduced in Chapter 1, the conceptual framework integrates the positive appearances of presence and absence together with the established and discovered mappings between the source domain and the target domain. This results in four symbol types that appear in the score. These symbol types may appear as noteheads, as was shown in *Table 1*, but will also take

the form of chords and rhythmic feels throughout compositions shows in this document. The next sections will look at each of the symbol types.

The Presence of the Established Meaning (PEM)

Figure 7 - The Presence of the Established Meaning (PEM) - Notehead

The *Presence of the Established Meaning*, referred to henceforth as PEM, consists of symbols that stand for the presence of what they represent and map to the established meaning of the symbol. In the case of a note head, the symbol functions within the VERTICALITY of the score and has the cross-domain mapping of PITCH RELATIONSHIPS ARE RELATIONSHIPS IN VERTICAL SPACE. As was noted in Chapter 1, even though the PEM is a symbol with shared meaning, that meaning is inherently ambiguous because of the symbol's reliance upon (1) modifiers and (2) superordinate conceptual domains. These principles that are long understood and embodied by musicians familiar with modern staff notation take on new importance when the PEM becomes one of multiple representations of cross-domain mappings and categories of action. The way that the PEM is understood has ramifications that span across the other symbol types.

Modifiers and Superordinate Conceptual Domains

The VERTICALITY of the PEM is complicated by presence of the accidental. The accidental acts as a way of modifying the position of a note in pitch space without changing its orientation in vertical space. While this is an efficient use of space on the page, depending on the superordinate

domains of meaning and how those domains are enframed through analysis, the pairs of notes and accidentals that result in the same outcome have meaning outside of their referent. In the frame of tonality, the difference between a C♯ and a D♭ is non-trivial because the accidental alters not only the pitch of the note it applies to but also to the tendency of how that note proceeds to the next. If the same note is analyzed through the lens of set theory, both a C♯ and a D♭ are given the pitch class numerical label of "1" and are not differentiated from each other. In this case, the difference between a C♯ and a D♭ is trivial with regards to the representational idiom but may still be non-trivial within the performative idiom depending on the notes surrounding it or the superordinate domains it exists within.

Bertrand Russell argues that "definite descriptions do have and contribute meanings that go beyond their referents alone." (Lycan 2018, 12) A *definite description* takes the form of "The X" where X is a noun or noun phrase. One example of the problems surrounding the referential theory of linguistic meaning is brought forth by the same entity or event having more than one designation. The German philosopher Gottlob Frege puts forth that a statement such as "Lady Gaga is Stefani Joanne Angelina Germanotta" is a non-trivial statement because it informs the reader of something they may have not already known and that it could have been otherwise. This statement then gives a reader information that is outside of what it refers to.

Turning back to the relationship between C♯ and D♭, the superordinate domain of temperament also affects whether the difference between the two is non-trivial in terms of the performative idiom. In the context of equal temperament, this statement presents two different notes that have the same identity. This informs the reader that the author believes these notes to be the same and that both of the notes refer to the same outcome. Whether a C♯ and a D♭ are the same thing or can be different is contingent upon superordinate factors such as the instrument one plays

or the tuning system one uses. The fact that there are two names for the same outcome means that the statement "A C♯ is the same as a D♭" is a non-trivial statement and not the same as saying that "A C♯ is the same as a C♯."

The effect that accidentals, temperament, and compositional style have is an engrained and embodied part of how musicians are trained to create meaning in relationship to modern staff notation. The transformation of the standard notehead into the PEM forces the musician to reexamine these relationships by making the PEM the *fundamental symbol* which is the referent of the other symbols found in the score.

The PEM as Fundamental Symbol

The PEM is the *fundamental symbol* that the other symbol types refer to in the process of meaning creation. In a similar way to Rameau's *fundamental bass*, the PEM underlies the compositional decisions that are made when composing a piece using cross-domain notation. While the PEM may not always be heard, it is the principle which orders the decisions made in the composition process. This is reflected in what has become the standard rehearsal process. A rehearsal will start by playing every note as the PEM and then add in the other symbol types over time. In this way, a score that uses cross-domain notation functions in the same way as any other piece made using that notation with the added layers of conceptual shifting.

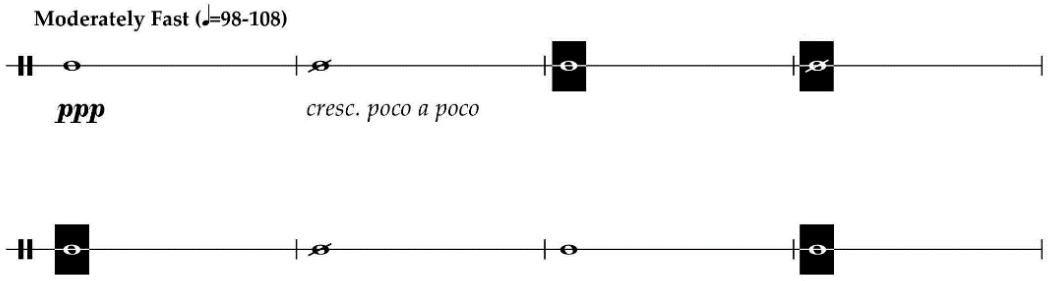


Figure 8 - First Two Systems of *Framework Etudes: No 1. (Phrase)*

The piece played with only the PEM represents what I am calling the *fundamental composition*—the composition that structures the work but is not necessarily heard. For example, take the first two systems of *Framework Etudes: No. 1 (Phrase)*. (See Figure 5) In this piece, the staff consists of only one line, the pitch of which is predefined by the musician. A rehearsal of this work would begin by playing every symbol as the PEM and would result in the repetition of the same pitch in each bar. As time went on, the other symbols would be added in.

This points to another important characteristic of the PEM: consistency. Since the PEM symbol represents the presence of its referent, the appearance of the PEM at the same vertical position throughout a piece should result in the same outcome. This is not true of absence which may be consistent or inconsistent. The consideration of the superordinate domains in which a symbol exists is of primary importance in determining the meaning of the other three symbol types. Without an understanding of the domains in which the PEM function, the other symbol types cannot be defined. This is why the PEM is the fundamental symbol underlies all other symbols types within a work.

The Absence of the Established Meaning (AEM)

Figure 9 - The Absence of the Established Meaning (PEM) - Notehead

The *Absence of the Established Meaning*, referred to henceforth as the AEM, consists of symbols that represent the absence of what they stand for and map to the established meaning of the symbol. The cross-domain relationship for the AEM is the same as for the PEM. The AEM is enframed by

the PEM. The possibilities of what the AEM can be are determined by the frame in which the PEM sits. The AEM can be thought of as a sonification of the ground upon which the PEM is the figure. It can also be understood as communicating a positive negation of the PEM.

Modern staff notation can be understood as the successful communication of a set of instructions for how to structure sound and time. Communication can be considered to have occurred when a second party understands the *speaker-meaning* of a first party who makes some kind of statement. In the case of referential meaning, this meaning will be in regards to a *speaker-reference*. The established meaning can be seen as linking the *speaker-meaning* and the *speaker-reference*. The meaning of the composer is taken as the referent from which the symbol takes meaning and—assuming the musician comprehends that meaning—will result in what the composer meant to occur. The musician has understood the composer correctly and proper communication has occurred. This is as true of the presence of the established meaning as of the absence of the established meaning. (Lycan 2018, 25)

In the case of AEM, the result will be the absence of the PEM. However, because the AEM relies on its definition through its reference to the PEM, the PEM is present as a referent through its absence. This is important because without the PEM as reference, the AEM can become trivial, as in the case of "do anything." The AEM does not give the musician license to do anything but to fill the time of the AEM with an action that falls in line with the cross-domain mapping of the PEM. The frame in which the PEM exists is of vital importance because it defines what the AEM is and is not. The highest-level distinction between the PEM and AEM is between sound and silence and so that AEM can always be the one that the PEM does not represent. More specifically though, the conceptual distance away from PEM that the AEM sits has a direct impact on the overall structure and feel of the work. Does a note of the same pitch class in a different octave represent a far enough departure from the PEM to be the AEM? If the PEM is part of a scale, if the AEM is part of that

scale versus part of the aggregate, how does that affect the sound of the work? These are the sorts of questions that a musician must confront when playing the AEM.

Referring back to the first eight bars of *Framework Etudes: No. 1 (Phrase)* seen in *Figure 5*, the AEM appears in bar 2 and again in bar 6. The AEM need not be consistent between different appearances. The AEM as it appears in bar 2 need not be the same as it appears in bar 6, other than that neither of those periods of time can be filled by the PEM. Another thing to take into consideration when playing the AEM are the surrounding events and the time in which one has to act. In *Etude No. 1 (Phrase)*, the musician has around a bit over 2 seconds to act and within that time has the freedom to shape the time as they see fit as long as it is not the PEM. In the case of a different work such as *Etude No. 2 (Around)*, where the tempo is quicker, what the AEM can be is restricted. (See *Figure* 7) While in *Etude No. 1 (Phrase)*, the space provided allows for an expression of the AEM that can take a form that departs away from the sound of PEM, in *Etude No. 2 (Around)*, the time constrains that the musician has to abide by to maintain the tempo allow for fewer options. *Etude No. 2 (Around)* also presents the grid layout for the score which will be discussed later in this chapter.

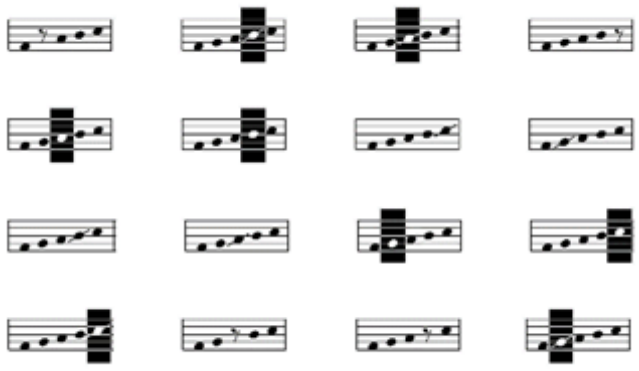


Figure 10 - Excerpt of *Framework Etudes: Etude No. 2 (Around)*

Aside from the practical factors in deciding how to play the AEM, the musician also has a decision in how to react to the way that the AEM is presented. If the AEM is the absence of a step-wise ascending motion versus a step-wise descending motion, the contour of the symbols can be taken into account or ignored. The AEM always relates back to the PEM as fundamental symbol so the notes picked are not arbitrary. The absence can be an absence of the individual elements being represented and/or the way those elements are structured together. In this way, the image schema becomes negotiable in the acting out of the AEM. While the notes of the AEM correlate to the verticality of the score, the actions that result from those symbols may or may not. Figure 8 shows two musical systems. The upper system is the fundamental composition that underlies the cross-domain composition seen on the bottom system. In the first measure, the fundamental motion is an upward stepwise motion from G to D. The cross-domain notation replaces presence of the upward motion within its absence. A musician must move from G to D via some sort of triplet motion but whether or not the character of the fundamental motion is maintained or put aside is in the hands of the musician. The role of the notation in this case is to circumscribe the action a musician should take rather than specify it.

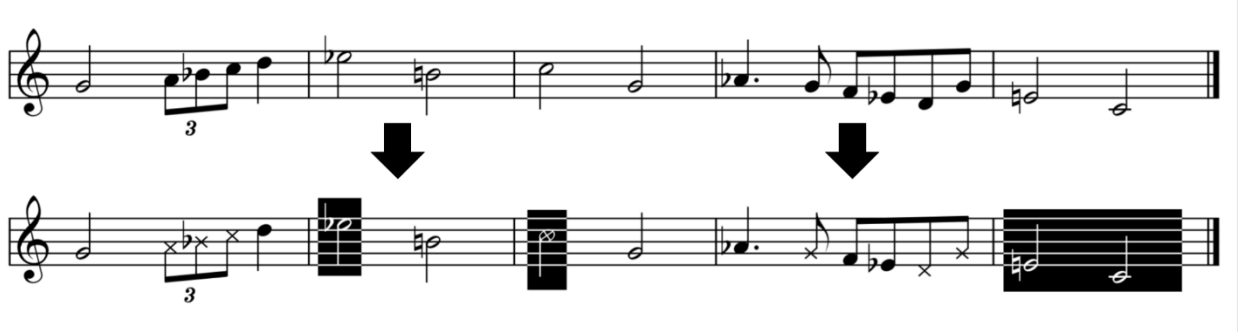


Figure 11 - PEM as fundamental symbol

The Presence of the Discovered Meaning (PDM)

Figure 12 - The Presence of the Discovered Meaning (PDM) - Notehead

The *Presence of the Discovered Meaning*, referred to henceforth as PDM, consists of symbols that represent the presence of what the PEM would represent under a different cross-domain mapping. This can be understood as a break between the *speaker-meaning* and the *speaker-reference*. The musician is taking the symbol as referring to something other than the speaker-reference but keeping the same organizational principles as those that underly the PEM. This remapping can be as simple as the replacement of the note with other pitched material, the remapping of the vertical to another musical parameter such as dynamic or timbre, or the use of action of the sound production such as bodily movement, controlling lights, or painting. Actual approaches to remapping that were taken by musicians will be discussed in Chapter 4.

The Problems of Remapping

Two problems arise in the remapping of the verticality of the score. The first is the problem of *instantiation* which arises in attempting to determine if a proposed mapping does, in practice, map onto the verticality of the score in the same manner as pitch or how the playing of absence is different from expressing something else other than what is absent. The alteration of the source domain presents the musician with a unique opportunity to provide meaning to the familiar symbols of modern staff notation and to investigate the embodied knowledge which informs that meaning. (Keller and Lehman 1991, 276)

According to Heidegger, the world does not present itself as a blank canvas onto which we then place a framework of possibilities. As a result of our situated nature with a particular self-world,

the world shows up in tandem with possibilities for action within it. When we are presented with an object, it exists as a buffet of possibility from which we choose an option. (Grimm 2021) When a musician approaches a musical score, they take it as a buffet of possibility informed by their history. A symbol on the page could represents a specific note, an instrument to be struck, an instruction about a property of a sound. If the musician chooses one of these over the others, they are taking one of the possible meanings and interpreting the score as a result. However, even if the musician approaches a score using notation they are unfamiliar with, there are always possibilities that arise that fit better than others. The second problem that arises when remapping image schema, the *saliency of categorization*, deals with whether the remapping of the verticality of the score or the playing of absence are consequential in a way that they can be mapped into their own categories or, at the very least, into a category other than the PEM.

The problems of instantiation and categorization place the musician into the situation of being taken out of their comfort of expertise to being merely competent in the arena of not only the symbols that are being used but what possibilities those symbols can possibly represent.[10] In his paper *The Current Relevance of Merleau-Ponty's Phenomenology of Embodiment*, the philosopher Hubert Dreyfus describes five stages of skill acquisition: Novice, Advanced Beginner, Competence, Proficient, and Expertise. While the beginner acts according to rules and the advanced beginner can use those rules within an understood context to make decisions, the competent person will take a hierarchical perspective and limit themselves to relevant information which makes decisions easier to make. Competence means that one has the understanding that there are more situations than rules can be made for and must create a plan without knowing whether or not it will be skillful in the situation that arises. The PDM is just this type of situation where the musician must attempt to map

[10] Remember that I am writing specifically in reference to common notation. The situation of being presented with symbols of questionable meaning is common in less established music notation languages.

a new domain onto the verticality of the score and be unsure if that mapping will instantiate or fulfill the category of the PDM properly. Once the PDM has been worked with, the musician becomes proficient in defining the notation and learns to act intuitively but may still not be able to make the ideal decision without deliberation. The expert understands what needs to happen and how that outcome is to be achieved. At this point, a new domain can be mapped and the process of reattaining expertise can be undergone.

Symbol Type	Outcome	Content
PEM	Consistent	Consistent
AEM	Inconsistent	Inconsistent
PDM	Consistent	Inconsistent
ADM	Inconsistent	Inconsistent

Table 2 - Consistency of Symbol Types from the Composer's View

Consistency of Outcome & Consistency of Content

Looking again at the first two systems of *Etude No. 1 (Phrase)* found in Figure 5, we find the PDM present in bars 3, 5, and 8. Similar to the PEM, what occurs in those bars will be consistent but, unlike the PEM, I as the composer am not privy to the content of those bars. Thus, I will say that from the standpoint of the composer, the *outcome* of those bars is certain while the *content* of that outcome is not certain. This is the primary difference between the PEM and PDM from the compositional view. The PEM prescribes both the outcome and the content of what a musician should do within a period of time. On the other hand, the PDM prescribes the outcome but does not prescribe its content, only that it map faithfully to the image schema that the PEM functions on.

The Absence of the Discovered Meaning (PDM)

Figure 13 - The Absence of the Discovered Meaning (ADM) – Notehead

The *Absence of the Discovered Meaning*, referred to henceforth as the ADM, consists of symbols that represent the absence of what they stand for and map to the discovered meaning of the symbol. The ADM has the same mapping as the PDM. From the standpoint of communication, the ADM is the opposite of the PEM. In the case of the discovered meaning, the speaker-meaning is necessarily abstract because the composer cannot know what the musician will choose as a new source domain. A consideration for the ADM is that, depending on the mapping of the PDM, the ADM may overlap with the PEM. The absence of the discovered mapping may result in the same outcome as the established mapping if they exist within similar frameworks.

Score Layouts in the *Framework Etudes*

The scores that will be presented as part of this document fall into two layouts: the phrase layout and the grid layout. The *Framework Etudes* show these two forms in a variety of ways. *Etude No. 1 (Phrase)* is an example of the phrase layout of a cross-domain notation score. It is a single-page piece designed to introduce musicians to the notation of the conceptual framework. The layout of the score is the same as one would find in a composition using modern staff notation. In the case of this piece, the staff contains one line which represents a pitch of the musician's choice. This is done so that the musician will focus on implementing the conceptual framework without having to consider how their mapping is relates to the verticality of the score. The addition of tempo and dynamics add to the restrictions of what mappings are available. The musician must take into

account surrounding events when deciding how to enact a symbol other than the presence of the established meaning.

Another level of complexity arises when working-through the etude alongside other musicians. Many questions are raised when working-through the score with others that are not found when working-through it alone. Is the found mapping one we find together or alone? How do my absences and the absences of others combine or collide? Does the process of working-through the score affect my decisions or do I approach with a fully-formed vision?

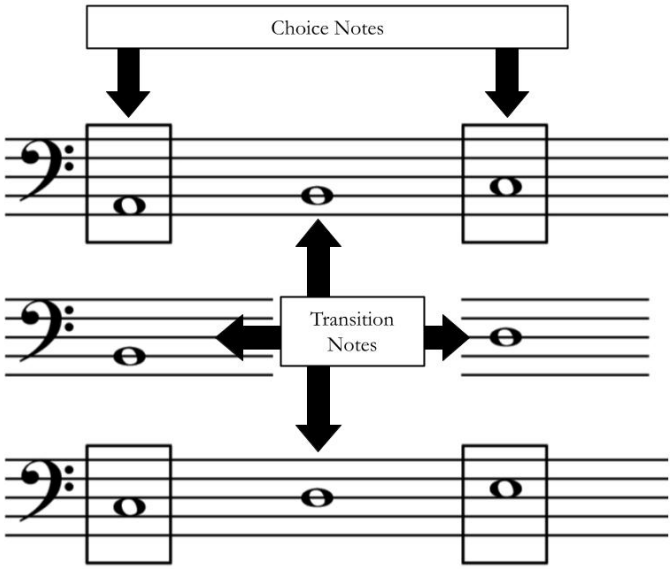


Figure 14 - Grid Layout: Choice and Transition Notes

The *grid layout* can be seen in its most simple form in *Etude No. 3 (Grid)*. While in the phrase layout, the four conceptual elements are displayed using different symbol types, in the grid layout all four interpretations are embedded within the PEM. These notes are the *choice notes* shown in Figure 10. When a musician plays one of these notes, they can choose to play the PEM, AEM, PDM, or ADM. Depending on their choice, they then move up, down, left, or right and play the corresponding *transition note*. The transition notes sonify the choice made on the previous choice

note and clarifies the ambiguity inherent in that choice as a result of the potential overlapping of symbol types.

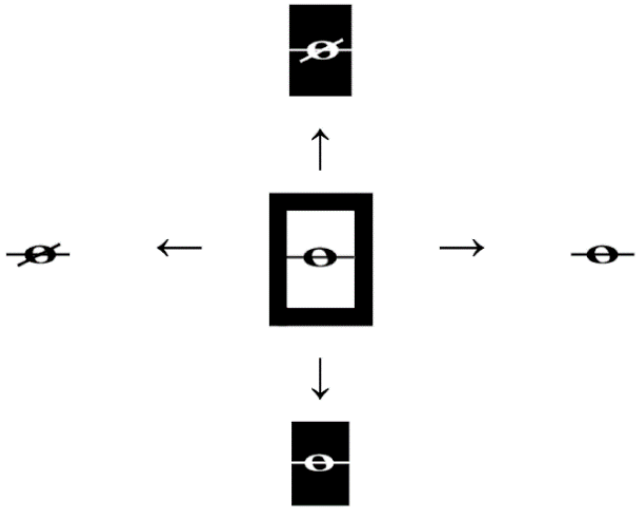


Figure 15 - Moving within the grid

Figure 11 shows how a musician moves through the grid, If the interpretation is of the PEM, the musician moves to the right and plays the note written there. This motion functions the same as a piece written in the phrase layout would and leave room to integrate the phrase and grid layouts together or to take a segment of a phrase and place it on a grid. If the interpretation is of the AEM, the musician moves left and plays the note written there. The left-right motion creates the cross-domain mapping HORIZONTAL MOTION IS MOTION IN THE ESTABLISHED MAPPING where moving right is motion from presence and moving left is motion from absence. If the interpretation is of the PDM, the musician moves down and plays the note written there. If the interpretation is of the ADM, the musician moves up and plays the note written there. The down-up motion creates the cross-domain mapping VERTICAL MOTION IS MOTION IN THE DISCOVERED MAPPING where moving down is motion from presence and moving up is motion from absence. Once the direction has been moved in and the note has been played, the musician continues in the same direction and reaches another choice note as which point the cycle repeats.

While the way a musician moves through the grid layout is radically different from the phrase layout, the grid layout still functions on the foundation of the *fundamental composition*. If every choice note is interpreted as the PEM, the outcome and content of the piece will exist as the composer wrote it. If any other interpretations are used, the linearity of the piece breaks and the content of the choice notes becomes inconsistent. The grid layout also points to the primary difference between modern staff notation and cross-domain notation. The symbols that are used for the choice notes and the transition notes in *Etude No. 3 (Grid)* are the same: the standard whole-note. However, even though they use the same symbol, they are not the same in a similar way as the difference between a C♯ and D♭ as discussed earlier. The choice note is shown as a PEM because it contains within it absence and other domains. The transition note is shown as a standard notehead because it only contains what it is. Even though they look the same, they are not.

Etude No. 2 (Around) works within the grid layout in a different manner than *Etude No. 3 (Grid)*. The piece is focused on the application of the four framework elements in patterns of repeating and expanding rhythms. The first of the two pages of the score lays out all possible patterns that can be played as part of the piece. All patterns consist of the first 5 pitches from the A minor scale arraigned in a pattern combining eight and quarter notes. Each grouping contains all possible permutations of that grouping of quarter and eighth notes.

The second page presents the progression of the piece rhythmically and the grid from which the piece should be performed. The top line shows the progression in rhythmic possibilities that should be performed. The musician starts with the five-note pattern on the left containing all eighth notes. As the piece progresses, the musician moves right until eventually they hit the pattern that is all quarter notes. If the piece continues, the quarter notes become eight notes in a new tempo and the cycle begins anew. Below the top line is the grid. As the piece progresses, the musician will move between different options that each contain either a rest or one of the altered noteheads from the

compositional framework. The piece ends when the musician wants to stop. *Etude No. 4 (Rest)* and *Etude No. 5 (Turn)* will be discussed in Chapter 3.

Bringing-Forth and Working-Through

As was discussed in Chapter 1, the pieces discussed throughout this document were made to be *practical* rather than *productive*. They exist as an attempt to bring the superordinate domains of meaning that notations function within into the process of creating meaning in conjunction with the score. The point is not to prepare the musician to display those actions to an audience but to use the experience to transform their relationship with the embodied knowledge they have about the meaning of the symbols in the score. The act of playing the score is the point in and of itself. Cross-domain notation "brings-forth" a different way of relating to musical notation through its inclusion of domains superordinate to the surface level symbols.[11]

In his article *Before and Beyond Representation*, Lambros Malafouris approaches image and representation in the Upper Paleolithic era by questioning the validity of the representationalist interpretation of those images and whether the people creating them viewed the images as symbolic representations. Malafouris clams that representationalism is inherently misleading because, "1) it implies that in human cognitive evolution the hardware (biology) drives the software (culture); ... 2) it reiterates the myth of the isolated or unaided mind..." (Malafouris 2007, 292) In contrast, Malfouris points to the notion of 'enactive conception' stemming from the work of Maturana and Varela which conceives of mind as "action structurally coupled in a network of ongoing interactions." (Malafouris 2007, 294) As an example of this collaborative simultaneous "bringing forth" of the world, Malfouris uses the example of counting with one's fingers. From a

[11] Here, surface level symbols refer to symbols in a musical score that related directly to action. The notehead relates directly to action by specifying the pitch a musician will play whereas the clef relates indirectly to action as it provides context for which pitch the notehead represents.

representationalist point of view, using fingers to count is an externalization of the inborn human ability to conceptualize numerical values. However, from an enactive perspective, this action is seen as:

> ...more of a dense structural coupling between the supposedly 'internal' and 'external' domains of the human conceptual map...It is the resulting structural coupling or blend that brings about the possibility of the meaningful cognitive operation we know as counting and not some innate biological capacity of the human brain... The fingers do not 'stand-for' numbers, as it may seem, the fingers bring forth the concept of numbers by making visible and tangible the manipulation of their properties. (Malafouris 2007, 294)

The reframing of cognition as resulting from interactions between the body and the environment has large implications for the creation and production of music. By integrating cognitive and physical tasks and the instruments used to accomplish them, the relationship between the concepts used in composing or performing a piece of music and the tools used to instantiate those concepts in written or sonic form becomes much more complex.

Taking Malafouris's perspective, the process of composition using notation falls under a similar structural coupling as the process of counting. In the case of composition, by manipulating notes in modern staff notation on a score, the composer "brings forth" at the very least the concept of dividing time into discrete segments and specifying a discrete pitch which will resonate during that time. In addition, pitch and duration cannot be conceived of apart from elements such as timbre, dynamics, and even acoustic space. The musician undergoes a similar process through the manipulation of their instrument. A musician undergoes a "bringing-forth" of the world by using their instrument to transduce physical energy into sound in the exploration of a potential that the score created by the composer gives rise to.[12] The nature of the notation contained within that score and what the musician believes that notation to mean enframes the possibilities of what action can

[12] The listener also participates in this paradigm albeit in a different way as the listener will generally not have access to the score. It is this active investigation of the world through the implementation of bodily skills that "brings-forth" the world of the music for the listener. By coupling with an event as it plays out in time, the listener uses their body to focus attention on aspects of the event thus garnishing a greater understanding of it.

be taken. The philosopher Alva Noë posits that "The world shows up for us. But it doesn't show up for free...We achieve access to the world around us through skillful engagement; we acquire and deploy the skills needed to bring the world into focus." (Noë 2012, 2) As Malafouris shows, that skillful engagement does not arise from within ourselves but through the structural coupling of the musician and their environment which includes the score. As Noë claims, "what we perceive is determined by what we do," (Noë 2006, 1) and the opposite is just a true. What we do is determined by what we perceive and that perception changes how we perceive the world. Thus, the composer, musician, and listener are all "laying down a path by walking"[13] as they navigate the world which they simultaneously create. Cross-domain notation expands this path to include not only the path itself but the principles by which walking functions. A musician working-through a piece that uses cross-domain notation walks, does not walk, and must find out what walking means to them.

Conclusion

The compositional framework takes the concepts of presence, absence, established mapping, and discovered mapping and applies them to elements of the score. Each of the four symbol types expresses an overlap between these concepts and creates a point of personal exploration into where the meaning of the symbol arises from. These symbol types can be represented in different score layouts allowing for the meaning of symbols to flow in a predefined order and meaning or left open to the musician letting the work become a non-linear experience. By working-through the score, the musician brings-forth a discovered meaning for the symbols that compose it and, as a result, take an active role in the shaping of the superordinate domains of meaning of the score. The primary element that has been discussed so far has been the notehead but other elements of the score can be used in conjunction with the compositional framework. Chapter

[13] A term used by Francisco Varela to describe this lack of separation between understanding and exploration.

3 will examine other ways that the compositional framework can be applied to notation and the technologies used in the process of composition.

Chapter 3: Extending the Compositional Framework

Chapter 3 will look at different ways that the framework presented in Chapter 2 is extending. The compositional framework is extended through three primary methods. The first method is by extending the symbol types to domains of the score other than the verticality of the staff. The section Extending the Notation looks at this method in *Etude No. 4 (Rest)*, *Combo Pieces,* and *Return*. The second method is through the digital and networked score. The section Extending the Scoring Modality uses the seven modalities of the digital score from Craig Vear to examine *Etude No. 5 (Turn)* and *Fragments* as well as analyze *Fever Dream* by Dan Tramte and *On Junitaki Falls* by Craig Vear to show how the work in this project compares to other work in the same sphere. The third method is through algorithmic composition and the computer-musician. The section Extending the Composition looks at a version of *Etude No. 2 (Around)* written for performance by the Yamaha Disklavier.

Extending the Notation

The first extension of the compositional framework that will be discussed is by extending the notation. This extension takes three forms within this project. In *Etude No.4 (Rest)*, the compositional framework is applied to the other symbol type that is found on the staff: the rest. In the *Combo Pieces*, the compositional framework is extended to apply to chord symbols and to the feel of the rhythm of a piece. Finally, in *Return*, a branching staff structure is added in to allow for a consistency in notation to result in inconsistent outcomes by giving musicians multiple realizations to choose from.

Framework Etudes No. 4 (Rest)

As was introduced in Chapter 2, the *Framework Etudes* are set of 5 etudes that were written to investigate the conceptual framework. The complexity of the material contained within each etude is necessarily simple to allow for the complexity of the conceptual framework to be investigated with a low level of complexity in other areas of composition. The etudes can be performed as solo or ensemble works.

Etude No.4 (Rest)[14] extends the notation into an element of the staff that does not interact with its verticality: the rest. The work has a single-page layout similar to *Etude No. 1 (Phrase)*. The impulse for the creation of this work comes from the experience of rehearsing the other etudes and noticing musician's reticence in interpreting the absence of the established or discovered mapping as an absence of making sound. The notehead itself seems to suggest action possibly because it is juxtaposed by a symbol that represents a lack of it. The other scores in the project do not include many rests since playing the absence always includes the absence of not only the *particular* action represented by the symbol but of the *category* of action represented by the symbol. The primary interpretation of playing the absence in the enactments thus far seem to function on a conceptual level of difference between notes rather than the superordinate level of difference between the note and the rest.

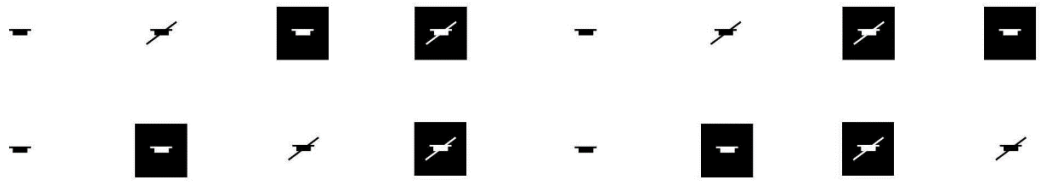


Figure 16 - Excerpt from *Etude No. 4 (Rest)*

[14] See Appendix A: Etude No. 4 (Rest) for the full score.

To force the issue, this study uses only rests to present the opposing opportunity. The rest does not function on the vertical in the same way that the note does. This is because the rest is primarily a function of the horizontal and not the vertical. The movement of the rest up and down in the vertical has no effect on how it is to be interpreted since it represents the absence of sound, the domain that the vertical is mapped to. The elimination of the vertical domain as a factor forces the musician to focus on superordinate concepts to differentiate the between the primary mapping and secondary mapping of the rest that may not need to be as apparent in the primary and secondary mappings of a note. This focus on the superordinate brings the problem of salience of categorization to the fore when making decisions about remapping the rest into a new cross-domain relationship.

Combo Pieces

The *Combo Pieces* (2022)[15] are a set of pieces written for saxophone, piano, bass, and drums that investigate the implications of the conceptual framework as applied to harmony and rhythm. The first of the combo pieces, *From A to B*, is a 16-bar straight-ahead, up-tempo work. In the first half, the fundamental note motion is between A and B and is then modified through the symbol types. The primary extension of the compositional framework in this piece is into the harmony that accompanies the melodic line. These works are written for an ensemble and, as a result, the cross-domain notation destabilizes the relationship between the melody and harmony. The musicians are then thrust into a position where the content of the actions of the other members of the ensemble are not made clear by the score and the conventions of playing together are obfuscated. The absence and remapping put the bass and keys player in a position where they way their roles normally interact is shifted by their own personal interpretations of those concepts.

[15] See Appendix C: Score for Combo Pieces for the full score.

Applying cross-domain notation to harmony brings up new questions and problems that a simpler concept such as the note does not. As a concept that is superordinate to the note, harmony has some of the characteristics of pitch. The primary identifier of a harmony is the note that makes up its root which functions not in the vertical domain of pitch but in the cyclical domain of pitch class. In addition to this identifier, there are other considerations to consider such as the qualities of the triad and the extension. A musician remapping the domain of a harmony has a choice to remap all of these elements, a single one, or somewhere in-between.

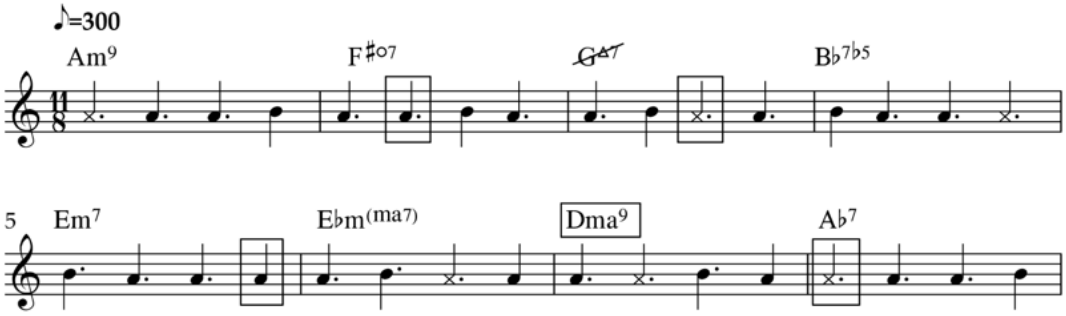


Figure 17 - Excerpt of *From A to B*

As the first piece introduced that was created for an ensemble setting, *From A to B* brings up a yet undiscussed area of cross-domain notation: how personal interpretations of the cross-domain mappings interact in ensemble work. This is where the practical nature of the work comes most in play. Discovering one's own cross-domain mapping turns from the end of a self-contained process into a step in a larger process between multiple musician's readings of the score. A musician's concept of the PEM, its enframing of the AEM, and the mapping chosen for the PDM and ADM now interact with other musician's decisions and the backgrounds that inform their understanding. This experience will be investigated further in Chapter 4.

The second of the combo pieces, *Violet Bright*, is a 40-bar ballad in ABA' form that adds cross-domain notation to the rhythmic feel of the work. The percussionist now has an opportunity

to add to interpreting the cross-domain notation through the feel of the piece. In the case of *Violet Bright*, the feel is swing. The AEM can then be thought of as the absence of swing and the cross-domain mapping a mapping between something and how the rhythm of the piece is played. Similar questions as when dealing with pitch arise: Is the AEM the absence of swing or absence of rhythm altogether? How does a different mapping interact with the melody, rhythm, and form of the piece? Does the cross-domain mapping affect only the rhythm being played or does it have other ramifications on how the musician is playing the instrument? However, the feel of a piece of music does not function with the same linearity or modularity as pitch or harmony do. Feel functions in tandem to the horizontality of the score but as modifying principle in a similar way as timbre relates to pitch. These modifying factors are at the edge of what this project has investigated so far. The remapping of the horizontality of the score is an area of modern staff notation that has much to yield in terms of investigation.

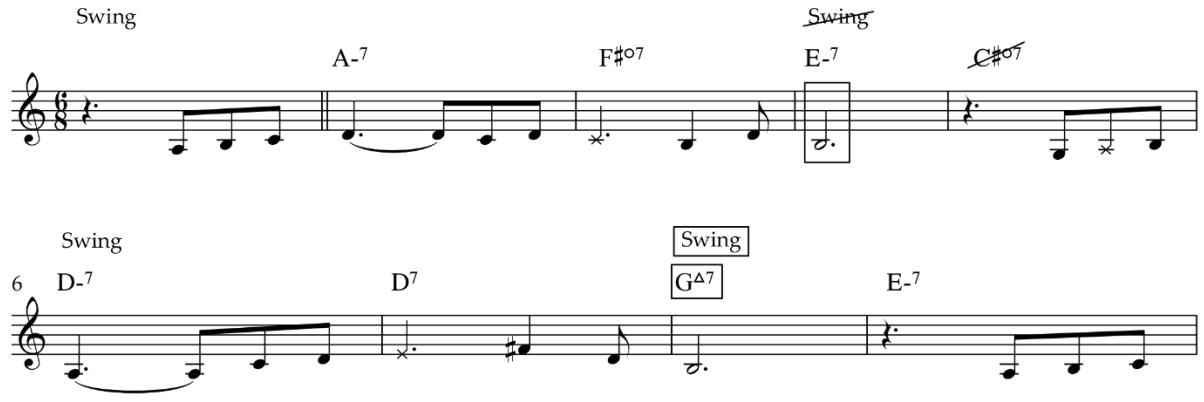


Figure 18 - Excerpt from *Violet Bright*

Return

Return (2022)[16] is a piece for unspecified instrumentation that incorporates the different elements of the compositional framework discussed thus far. The piece is intended to be played as both a solo and group work. The structures built into the piece are designed to be uncovered as the piece is repeated. Repetition is an important part of the work since many of the outcomes of the notation will be inconsistent or will be in a domain other than what is commonly heard as a result of modern staff notation.

The primary addition that this piece brings is a branching staff structure. The pieces shown in the phrase layout thus far have included a single staff that contains all of the notes for a player. In *Return*, new staves are introduced as branches off of the primary composition. The fundamental composition is maintained on the top staff but alternative possibilities are now added concurrently. Whenever a new branch is introduced, a musician can choose to change to any of the available branches. If a musician is playing an instrument capable of playing multiple independent lines, such as a piano, they may play two lines at once. This first section is repeated giving the musician the opportunity to work through the same material while presenting a different result. The second system contains another branching path with overlapping rhythms that ends in a descending figure before moving in to the second section of the piece. This figure returns at a later point in the piece and acts as a touchstone for the identity and the form of the work.

[16] See Appendix D: Score for Return for the full score.

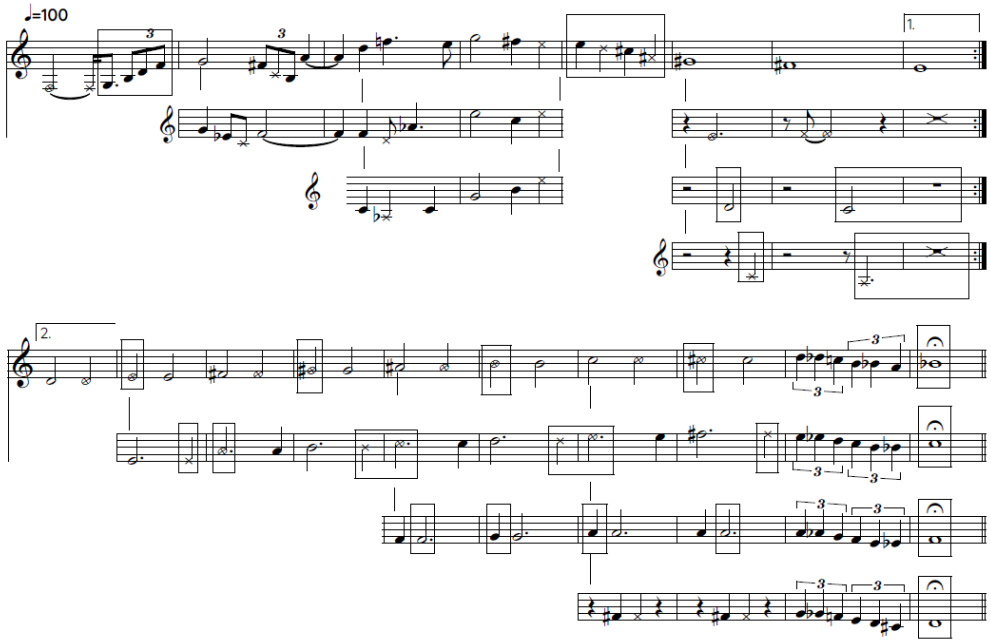


Figure 19 – First two systems from *Return*

The second page of the work involve two major shifts. The first is a change from the phrase layout to the grid layout. The second is an alteration of the discovered meaning. The top half of the page consists of choice nodes that have two note phrases leading to transition nodes the contain a single whole note. On the bottom half of the page the contents of the choice and transition nodes are swapped. The effect this has is that any choice of playing the PEM initially will be heard again assuming that the musician plays some PDM or ADMs within this section. The last page of the score returns to the phrase modality with a repeating figure that allows for multiple musicians to resynchronize after potentially losing a shared musical time in the grid layout. Once the musicians are aligned in time, the descending figure returns and builds a large held note. The last system of the piece contains four contrapuntal branches that slowly slow and fade into nothingness as the tempo and dynamics of the work decrease.

Extending the Scoring Modality

In his book *The Digital Score*, Craig Vear introduces seven modalities of the digital score: interface object, material affect, goal, content, language, feedback, flow. (Vear 2019, 43) The *interface object* is the immediate method through which the score is interacted with and is concerned with the sensory modalities that are involved. The traditional scores involved in the project have an interface object of pieces of paper and have the sensory modality of sight which is the sense through which meaning is formed. The digital scores use solely sight as a sense but use the computer as an interface object. No auditory elements or any other sensory material will be used in conjunction with the digital score. The computer will be interfaced with in two primary ways: through USB MIDI Pedal and via active sensing of MIDI or audio on the part of the computer.

The *material affect* of a score is how the score "shows up" in the world and results in the arising of meaning and connection through its physical construction. A paper score connects with a musician because it is a score representing an understood modality of music-making and displaying the requisite information for taking part in its performance. It is not the paper nature of the score which forms that connection as can be seen by the proliferation of digital tablets that are used to display paper scores in image format. It is the medium of the notation which acts as the content of a paper score which provides this connection. The connection between musician and cultural practice can be maintained or averted in either a paper or digital score.

The *goal* of a score is the end to which a musician works when interpreting the score. All scores that make up the project have the two-part goal of creating a conceptual space within which the notation has meaning and then becoming comfortable with interpreting and altering that framework during the practice of the score. The addition of a digital score allows for the score to take a more participatory role in the creation of meaning and the ability to make the creation of

meaning more immediate to the act of music-making by generating the content of the score in the midst of performance rather than before it.

The *content* of a score refers to the "direct signals that convey meaning" and how those symbols feel over time. The content of the score results in the formation of the *language* of the score. One of goals of cross-domain notation is to make apparent the culturally-conditioned medium of modern staff notation and it's lack of inherent meaning. The content of a score is notation and the alteration of the *material affect* that notation has when moved between *interface objects* can assist in illuminating the "patterns of perception" that are commonly overlooked according to Marshall McLuhan. McLuhan writes,

> For the "content" of a medium is like the juicy piece of meat carried by the burglar to distract the watch dog of the mind....The "content" of writing or print is speech, but the reader is almost entirely unaware either of print or of speech...The effects of technology do not occur at the level of opinions or concepts, but alter sense ratios or patterns of perception steadily and without any resistance. The serious artist is the only person able to encounter technology with impunity, just because he is an expert aware of the changes in sense perception. (McLuhan 1994, 18)

Cross-domain notation requires the musician to differentiate the familiar cross-domain mapping they are accustomed to and subsequently conflate symbols that function along the same image schema with a different conceptual metaphor helps the musician to be aware of and interrogate the medium of notation.

The *language* of a score is the method by which musicians interpret the *content* of a score or apply their own ideas to the *content* of the score. The types of *language* of a digital score can appear in three general forms: *iconic, sensorial indices,* or *arbitrary*. (Vear 2019, 60) An *iconic* symbol is one that directly relates to something understood such as a specific pitch or non-pitched sound marked by a notehead in modern staff notation. A symbol that can be classified as a *sensorial index* calls forth an emotional connection between the symbol and an experience. An image of a fire may suggest responding with sounds related to the experience of being near a fire but the particulars of what

elements of fire are chosen to be sonified are left open to the musician. An *arbitrary* symbol is one that is linked by multiple levels of abstraction. A sound or image made by a computer may evoke a thought or mood that is then translated into action. Instead of the symbol directly leading to action, as in the case of a *sensorial index*, the symbol prompts a reaction which then leads to action.

As an outgrowth of modern staff notation, this project explicitly references the language of Western European Art Music while simultaneously subverting the meaning of the content of that language by demanding a redefinition of the symbols using different conceptual metaphors. The meaning of the symbols that are interpreted via an altered cross-domain mapping effectively have no intended meaning until that meaning is given by a new conceptual metaphor created by the musician. A score that uses the phrase model will contain two *iconic* symbols and two *arbitrary* symbols. The *iconic* symbols are the PEM which corresponds to modern staff notation and PDM which is a cross-domain mapping that is left open to the musician's interpretation. The *arbitrary* symbols are represented by AEM and ADM which reference their *iconic* counterparts in corresponding to an action that can be understood to exist within the conceptual metaphor of that space but is not the *iconic* referent. A score that uses the grid model will contain only *iconic* symbols written in modern staff notation. However, some of those symbols will require interpretation through one of the four elements of the core concept. As a result, the *iconic* is made *arbitrary* but non-trivial.

The modality of *feedback* deals with the way in which the score relates to the musician's engagement with the score through their ability to follow the goal of the score and how involved they are in the playing of the work. In relationship with a paper score, engagement is determined by the musician and how accurately they feel their playing is in relationship with the goal of the composition—in this case likely how close their realization sounds to a more canonical version. In the paper scores that are a part of this project's creative work, a similar situation is the case.

However, as a result of the removal of the established domain from the notation, the musician is in the position of having to make the familiar alien and then familiar again, putting them in the unique position to judge whether they are following the goal of the score and how rewarding the process is. The digital score amplifies this process by making the score dynamic and, as a result, destabilizing the relationship between musician and score.

The last modality of the score is *flow*. *Flow* is a concept coined by Hungarian-American psychologist Mihaly Csikszentmihalyi defined as "the state in which people are so involved in an activity that nothing else seems to matter; the experience itself is so enjoyable that people will do it even at great cost, for the sheer sake of doing it." (Csikszentmihalyi 2009, 9) A partial goal of the project is to interrupt the musician's ability to attain a state of flow—at least until a musician has become comfortable relaxing their grasp on attaining a specific realization of the goal of the project.

A piece of mine that bridges these modalities is *Etude No. 5 (Turn)*. To dig deeper into these ideas, I will look at three versions of that piece and analyze two works by other composers—*Fever Dream* by Dan Tramte and *On Junitaki Falls* (2016-17) by Craig Vear—followed by an analysis of my work *Fragments*, a work for trumpet, flute, and electronics that uses a networked digital score in the grid layout.

Etude No. 5 (Turn) (Paper Score)

Etude No. 5 (Turn)[17] focuses on the nature of how the restriction of information affects the interpretation of the score and how the score is processed. An inspiration for this piece comes from *Rabbit Hole* (2013) by Mark Applebaum. In *Rabbit Hole*, the "page turns come first." (Applebaum 2013) Applebaum's work focuses on the logistical elements of performance as the primary elements of the composition rather than pitch and rhythm. This etude is also about making explicit and

[17] See Appendix A: Etude No. 5 (Turn) for the score.

composing using the auxiliary elements of musical production that are often hidden away as a part of performance. However, as a work not written for performance, the focus is on highlighting the interaction between the musician and score for the musician themselves and not for an observer of the process.

Etude No. 5 (Turn) consists of 96 pages with each page containing a single symbol. This uncommon material affect of having only one action per page presents two difficulties that arise in working-through the score. These difficulties mirror the instantiation and saliency issues that appear as part of the meaning making processes with the symbols therein. Since there is only one symbol per page, the musician cannot easily look ahead to see what the next symbol will be. Additionally, the musician must turn the page to see the next note. This alternation between enacting the symbol from the score and reaching out to the score to gain access to the next symbol integrates the physical act of working through the score with the conceptual working-through of the material of the score.

The musician's interaction with the physical score is of equal importance to their interaction with the conceptual elements of the score. The turning of the page requires that the musician has a hand available to do so. For many instruments, this action means that there will be moments of silence between each symbol with the duration of that silence tied directly to the practice of the instrument the musician plays. The symbolic language of the score is the same as the other etudes but the way that the musician works through the score is altered through the way the score necessitates physical engagement to process. To obtain an engaged experience with the etude, the musician must be able to manage their instrument, the score, and the conceptual framework in equal proportions.

Analysis: Dan Tramte - Fever Dream (2015)

Fever Dream was written for the pianist Keith Kirchoff at IRCAM in 2105 by Dan Tramte, artist and founder of *Score Follower*. The piece was inspired by the generative music of video games such as *Desert Golfing* and *No Man's Sky* and is an example of "single-seed music." Single-seed music uses a single algorithm to generate all the material for a piece. This method gives the composer the ability to create a work of an extremely long duration but still maintain influence in the notes that are being played by choosing which seed to use in a particular instance of the piece.

Fever Dream falls under the *collaborating score* subtype of the *referential screen* paradigm. The referential screen is a group that contains three categories of digital score: *Augmented Page, Technological Conductor* and *Collaborating Score*. (Vear 2019, 75) Scores of this type feel as if they are functioning in the same space as the musician but do not interact in a meaningful way with the actions of the musician. The *augmented page* shows images of paper scores in a way that alters the interaction between the musician and the score. Examples of this type of work include playing from digital copies of handwritten manuscripts or playing from a score follower. The *technological conductor* uses an arrangement of prefabricated elements to guide the musician through a linear process. The *collaborating score* adds real-time processing of audio to a *technological conductor* score to add the illusion of the pre-recorded or processed audio as taking part in the music. Compositions that take this form will feel distanced from the act of music making and will have less of an active role in shaping the music than a score that falls under the *interactive systems* or *co-operative code* score types.

The *interface object* that the composition uses is a computer screen that has a *material affect* that presents itself through displaying a score in modern staff notation and producing audio to accompany the musician using Max MSP and the BACH package created by Andrea Agostini and Daniele Ghisi. The patch uses a *bach.roll* object to display a stream of noteheads on four staves which extend the range of the standard two-staves which the piano is commonly written on for ease of reading notes higher and lower than those staves allow for. (See Figure 12) Performance notes and

controls for the patch including where in the piece the performer wants to begin are located below the set of staves. The *goal* of the work is to place the musician and listener in a relationship with an experience they can never complete and test the musician's endurance against a composition that can outlast them.

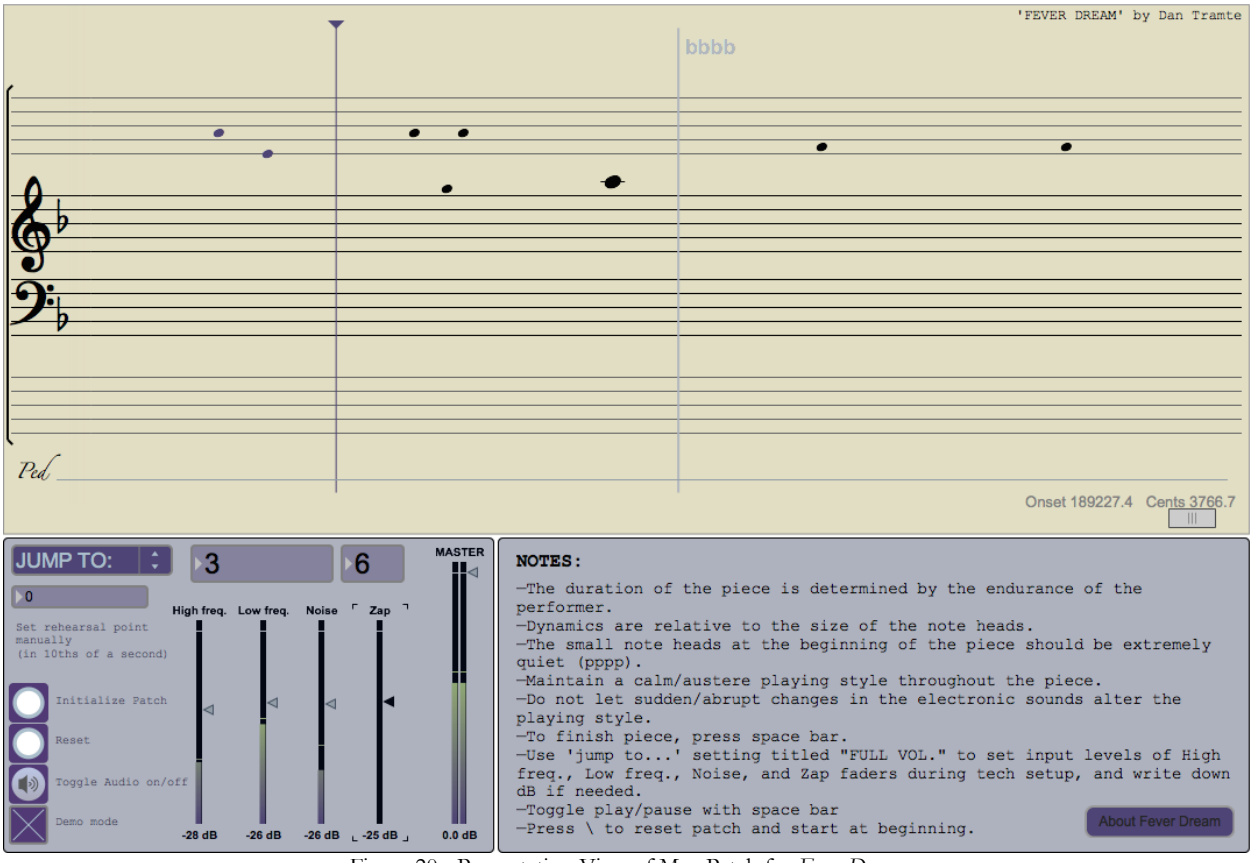


Figure 20 - Presentation View of Max Patch for *Fever Dream*

The *content* of the work contains noteheads without stems, which appear on the right side of the screen and automatically scroll leftward once the piece has begun. The size of the note head depicts how loudly the note should be played. When a note head reaches the vertical line left of center on the screen, the performer should play the note. The *language* of the score is tied to modern staff notation with the removal of note stems that would normally determine the duration of a note. The score instructions show the pedal to be pressed down for the entirety of the piece and the notes move by one at a time for the most part which lends a reading of a monophonic line with notes that

each have a long decay. The two primary alterations to the common modality of notation are the size of the noteheads determining dynamic and the scrolling motion of the notes along the screen. The modality of *feedback* as a measure of engagement with the score is created by the constantly scrolling nature of the score which produces notes from a seemingly inexhaustible supply prompting the musician with each new note to ask if they want to continue the piece. *Flow* can be measured by the musician's willingness to continue to play the piece. Since the duration of the piece is left open and up to the musician, the performer's engagement with the piece and level of involvement with the piece will relate directly to the duration of the piece.

Analysis: Craig Vear - On Junitaki Falls (2016-17)

On Junitaki Falls is a composition for oboe, two AI performers, and computer-controlled score written for oboist Christopher Redgate. The score consists of an image shown on a computer screen which contains a transcription of a solo by Eric Dolphy on "God Bless the Child" by Billie Holiday. As the performer plays the piece, the computer records parts of the performance that will become part of the AI player's performances in the future. The *interface object* for the work is the computer screen which shows the images of the score and the speakers that play the sounds of the AI performers. Since the *interface object* exists as a multi-modal sensory experience, the *material affect* of the digital score is seen, heard, and felt. The modern staff notation of the score is altered by the computer which is then interpreted by the performer. The *goal* of *On Junikaki Falls* is to work together with the score and AI performers in a way that immerses the performer in the world of the piece and into a state of *flow*.

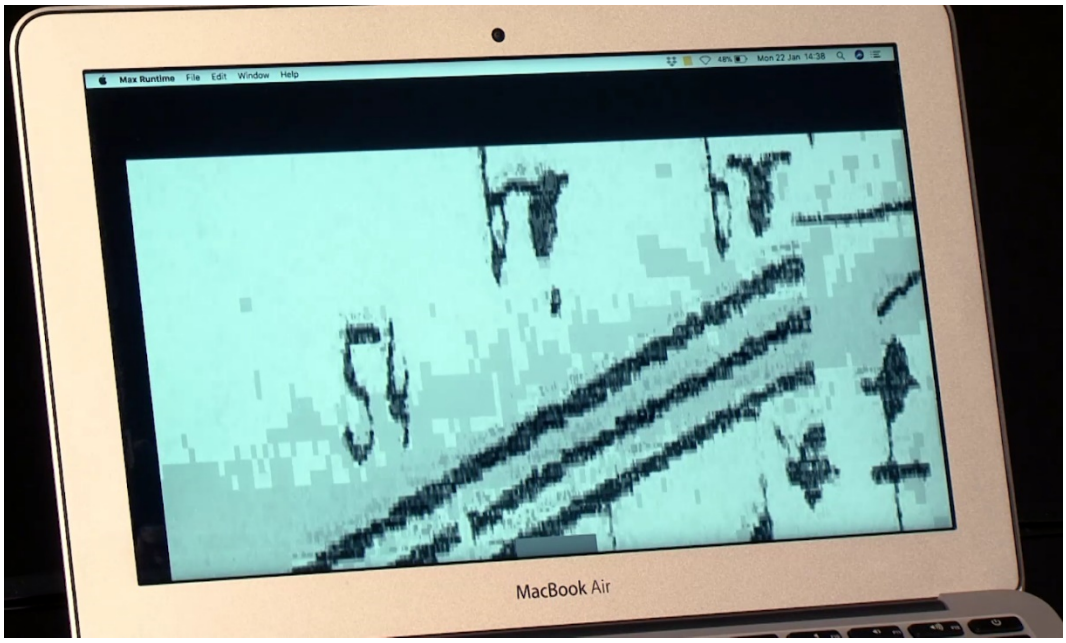


Figure 8 - Image of score from On Junitaka Falls

The *content* of the score is made up of modern staff notation, chord symbols, handwritten notation, graphic notation, and spectral analysis found in various states of juxtaposition and overlap. The content also includes audio elements played by the AI performers who play back recordings of the oboe processed through pitch and time transposition as well as looped. The different forms of notation afford different methods of interpretation which may shift based on the performer's relationship to the *goal* of the work or to being in a state of *flow*. As a result of the *content* of the score containing different sensory modes of expression, the *language* of the score encompasses all varieties of interpretation. Vear has housed these interpretations into three general responses: note, node, or noise. The performer is free to move between any of these forms of response and choose whether to respond to the visual or sonic elements at play. The addition of recordings of the performer from current or past performances being brought into the work, what Vear calls "memories," offer the meaning and response to those sounds to change over time as the interpretation of those sounds shifts between iconic and arbitrary.

The *feedback* in *On Junitaki Falls* is shown by a "breath" bar located at the bottom of the screen. The duration of the bar is set to between 20 and 80 seconds. The out-breath is the time in which an image will be displayed before moving back into the in-breath and the screen will display nothing. The immersive elements of the score are the animated visual elements, the sonic "memories" played back by the AI performers, and the feeling of cooperation that arises from the visual and sonic elements of the score being controlled by the same source. The *flow* of the work is enhanced by the inclusion of both visual and sonic elements and the inclusion of "memories" within the AI performers adds an element of interpretation not commonly available to musicians in being able to use their own prior performance as part of the language of their current one.

The *feedback* modality that Vear uses in *On Junitaki Falls* is very similar to an idea for measuring time that appears the interactive score version of *Etude No.5 (Turn)*. While Vear separates the "breath" into an in-breath and out-breath, my system separates the breath into 4 parts similar to the way the core concept has four types of interpretations. In addition to the in-breath and out-breath, my model includes the after-in-breath/before-out-breath and the after-out-breath/before-in-breath. The breath is not always moving and these moments of respite in between the action of breathing are an important part of my personal meditative and spiritual practice which were part of the key insight that helped to develop the conceptual framework.

Figure 9 - The visual representation of the breath in Max

The visual representation of breath in my work comes in the form of two overlapping circles. The outer circle represents the motion of the breath—filling up the circle representing the in-breath and emptying the circle representing the out-breath—and the inner circle represents the spaces in between breaths—filling up the circle representing the after-in-breath/before-out-breath and emptying the circle representing the after-out-breath/before-in-breath. The cycle of the breath begins on the in-breath and ends on the after-out-breath/before-in-breath. Both the outer and inner circles are *dial* objects set to 360 degrees using the "pie slice" mode. Over the course of a turn, the dial moves from 0 to 127 and once it reaches its target triggers the next dial's motion. Upon ending the cycle, the object sends out a bang to notify any parent patch that one breath cycle has been completed.

Etude No. 5 (Turn) (Augmented Score)

The first digital version of *Etude No.5 (Turn)* is an augmented score. To access the work as an augmented score, a performer will use a PDF of the score rather than with a paper score. The primary difference between the working-through of the paper score version and the digital

augmented score is the means by which the musician changes from one page to another. Instead of having to turn every page by hand, the musician has the option to use a footswitch or automate the turns of the page using a software program. This change in interface object also has ramifications for the feedback and flow modalities. The augmented score lowers the amount of resistance that a performer will experience while playing the piece as it can remove the need for the use of hands in making a page turn. The ability to swipe the screen of a tablet or hit a key on a keyboard is still a less demanding motion than flipping a physical page if a footswitch is not in use.

Figure 21 - Augmented Score for *Etude No. 5 (Turn)*

Etude No. 5 (Turn) (Animated Score)

Interactive systems are a group of scores that contain three subtypes: *Animated Score*, *System-as-Score,* and *Creative System*. (Vear 2019, 94) The main difference between scores that are interactive systems and scores that fall under the referential screen type is that an interactive system actively participates in the creation of the music. Compositions of this sort can only be understood through interaction as some elements will be unique to each time the score is played. *Animated scores* are

digital scores that primarily rely on the computer's ability to change the content of the score for the creation of a dynamic experience of time. One property that separates animated scores from referential screen digital scores is that they can only be understood during performance. In a *System-As-Score* composition, the score consists of hardware and electronics hooked together to create a performative environment. The tactile nature of these hardware systems afford unique modes of interaction as each composition is a system in and of itself. *Creative System* digital scores use a multi-modal collection of real-time processed audio and video controlled by a central computer which regulates the flow of performance.

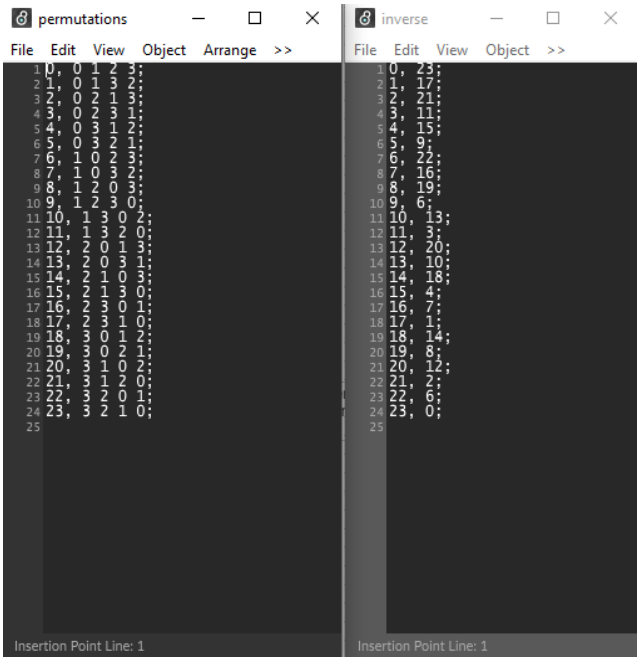


Figure 22 - Permutation and Inverse Collections for *Etude No. 5 (Turn)*

The next version of *Etude No. 5* is made using Max and adds in the use of the breath mechanic as described in the analysis of *On Junitaki Falls*. The material affect of the work is altered by the computer's ability to (1) change the order of the appearance of the symbols, (2) change the symbols without human interference, and (3) changing the size and number of symbols that are

displayed. The creation of the animated score using the original .png files that were used to make the paper and augmented scores allows for the ordering of the symbols to be generated at the beginning of the piece. All 24 different permutations of the ordering of the four symbols are stored in a *coll* object which is embedded into the patch. As one order is chosen by a non-repeating random number generator, the inverse of that possibility is placed in the opposite position in the list maintaining a balance in the order of the score.

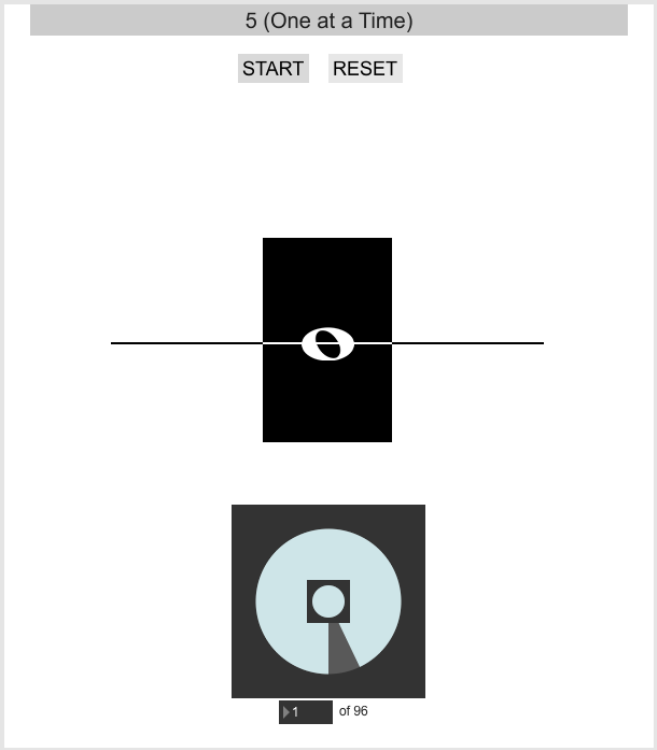


Figure 23 - User Interface for *Etude No. 5 (Turn)*

Another change in modality is caused by the computer controlling the flow of the score. In the paper and augment versions of the piece, the musician(s) had control over the tempo of the work and could either perform it steadily to a pulse, with a cue for each note, or at the speed of their breath. The addition of the computerized breath adds an unstable element to the flow of the piece and imposes a temporal frame upon each note. The performer now has the ability to sync each note

within a given time frame with an element of the breath or to use the overall space as the period in which to play a note without worrying about syncing with other musicians.

Fragments

Fragments (2022) is a piece written for trumpet and flute in conjunction with a digital score. The piece combines the scores for two solo pieces for flute and trumpet as a digital networked score that uses the decisions made by each musician to influence the score of the other musician in addition to triggering electronic sounds. The score presents each performer with an abridged version of the grid layout which shows only the current choice node and the adjoining transition nodes. The content of the piece comes from *Fragments of Density* (2022) for solo flute—which uses fragments of *Density 21.5* by Edgard Varèse as the content of the choice nodes—and *the way Rothko bled his edges* (2022) for solo trumpet.[18] *Fragments of Density* was written for a flute player who has played *Density 21.5* already. The placement of familiar notation as a PEM shifts the relationship between the musician and a piece that they have as an embodied memory. *the way Rothko bled his edges* is a work for solo trumpet which asks the musician to play while spinning in a circle and altering the timbre of the trumpet by changing the position of a plunger mute. This gradual changing movement adds friction to the process of playing the instrument by adding unfamiliar elements

The digital score of this work adds three primary elements to the working-through of the compositions that is not found in their fixed counterparts. First, similar to the way *Etude No. 5 (Turn)* isolates symbols from each other, *Fragments* isolates the choice nodes and their surrounding transition nodes of the grid from each other. The paths can be learned and followed since the fixed score is still what is underneath the modular presentation of the digital score but extra effort is needed to do so since the majority of the score is hidden at any given time. The second, and more

[18] The full scores can be found in Appendix C

impactful change, is the capability for the scores to be networked together and for players' decisions to affect one another. Instead of the musician's interpretation of the choice node affecting the way their own score functions, their choice now moves the score of their partner and vice versa. The third layer is the addition of electronic sounds. (See Extending the composition below) The pitch and spatial positioning of the electronic sounds are determined by the how the choices of the two musicians align or do not align. Compared with the fixed scored, these three factors place more weight upon the individual decisions of the musicians since those choices directly alter the experience of the other musicians and the content of the electronic sounds.

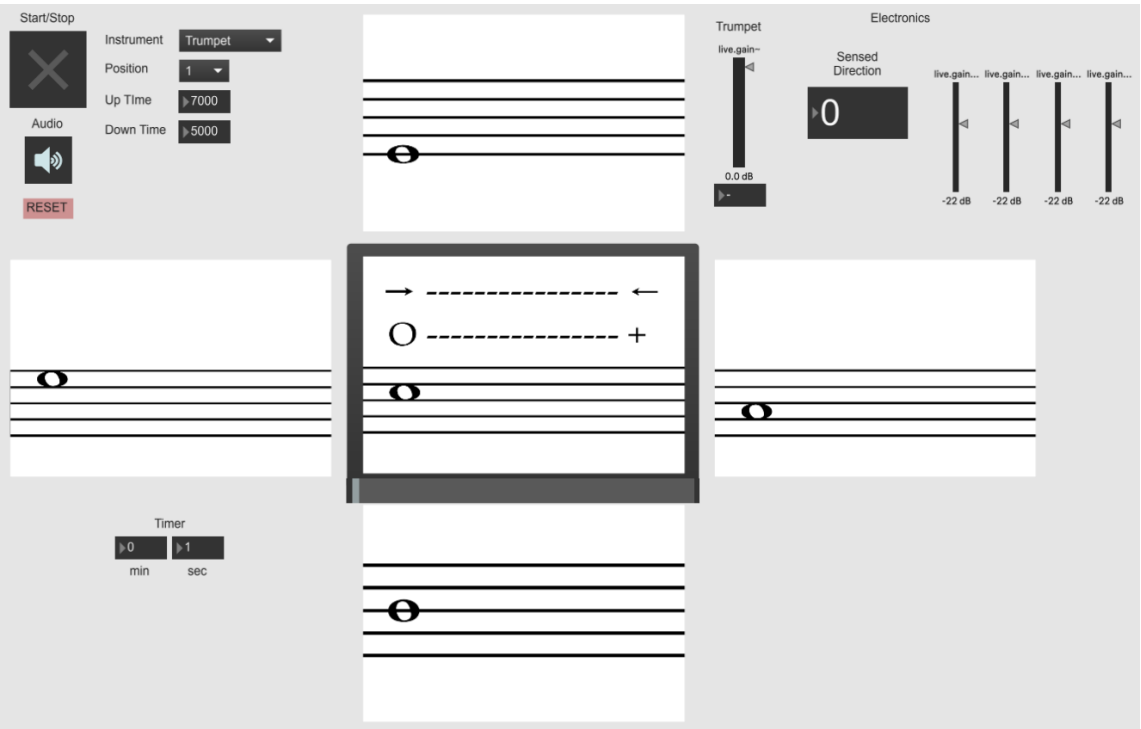


Figure 24 - Presentation View of Max Patch for *Fragments* (Trumpet Version)

Figure 20 shows the initial view that the trumpet player sees at the beginning of the piece. In the digital score, the choice node is found in the center of the screen surrounded on each side by four transition nodes. The choice node for the trumpet player includes two types of symbols other than the notehead. The top line represents the direction that a player should face at the start of

playing the choice node and the direction that a player should face at the end. The second line represents the position of the mute with "O" representing fully open and "+" representing fully closed. The other options are ¼, ½, and ¾ closed. Underneath the choice node is a [slider] object that functions similar to the way the breath functioned in *On Junitaki Falls*. This slider sets time periods within which the choice node and transition note are played. Within the time it takes the slider to move from left to right, the musician should play their interpretation of the choice node as PEM, AEM, PDM, or ADM. Within the time it takes the slider to move from the right to the left, the musician then picks a transition note and plays it.

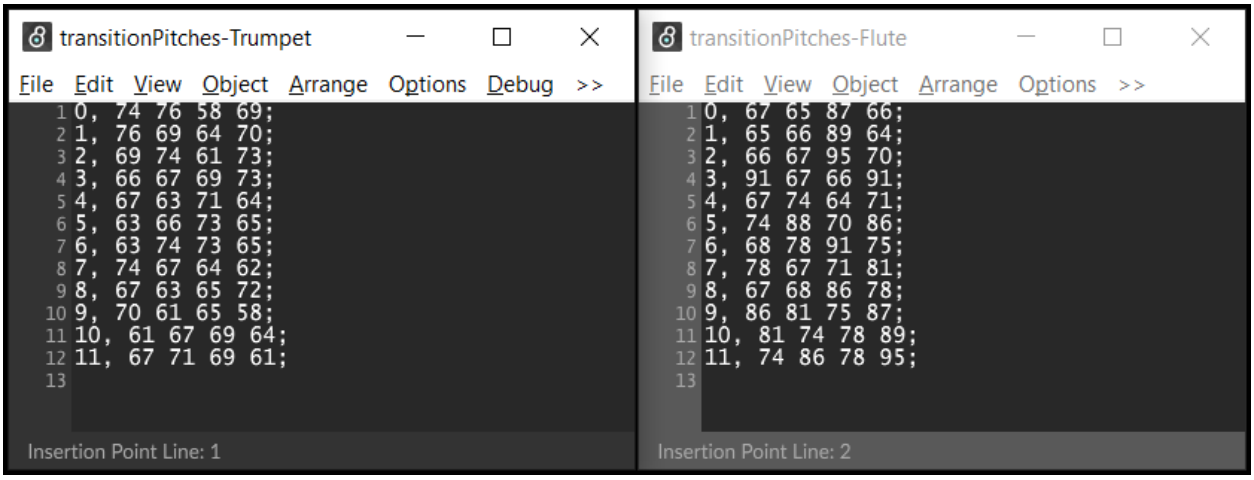


Figure 25 - *Coll* Objects containing the pitches for transition nodes

While the slider is moving from right to left, the Max patch tracks the pitch of each musician using *sigmund~* by taking the value of the pitch as a MIDI number rounded to the nearest integer every 1/10th of a second. These values are stored into a collection. At the end of the down time, the collection is flushed and the most prevalent value is taken to be the pitch that the musician has played. Based on that pitch, the grid is then shifted to show the choice and transition nodes that exist in the new location.

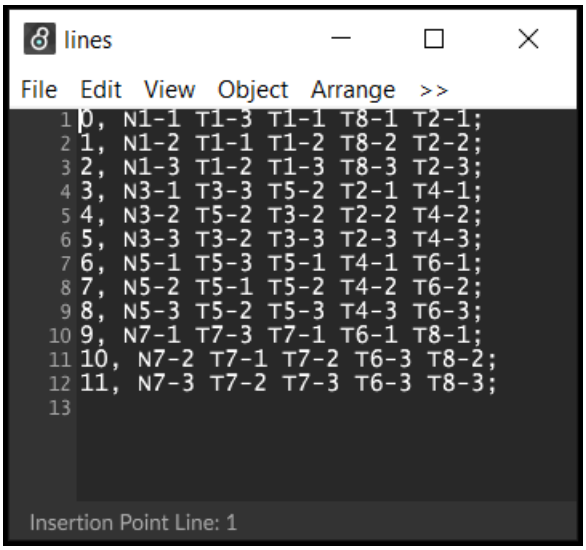


Figure 26 – *Coll* object containing image layout

The images that are being displayed come from the original scores for each work. The list items referenced in the *coll* correspond to the type of node—N standing for choice node and T standing for transition node—and the X-Y position in the grid. The file name is then prepended with an identifier for the trumpet or flute which matches images for choice or transition notes for the correct instrument. The first element is the identifier that refers to which point in the grid a musician is on. The second element is the choice node which will be displayed in the middle followed by the transition to the left, transition to the right, transition to the top, and transition to the bottom.

Extending the Composition

So far we have looked at the extension of the compositional framework through applying the framework to other areas of the notation and through altering the scoring modality. The last way of extending the composition that will be discussed in this document is extending the composition through the use of a computer-musician. The use of a computer-musician creates a situation that differs greatly from the functioning of presence, absence, cross-domain mappings, and the

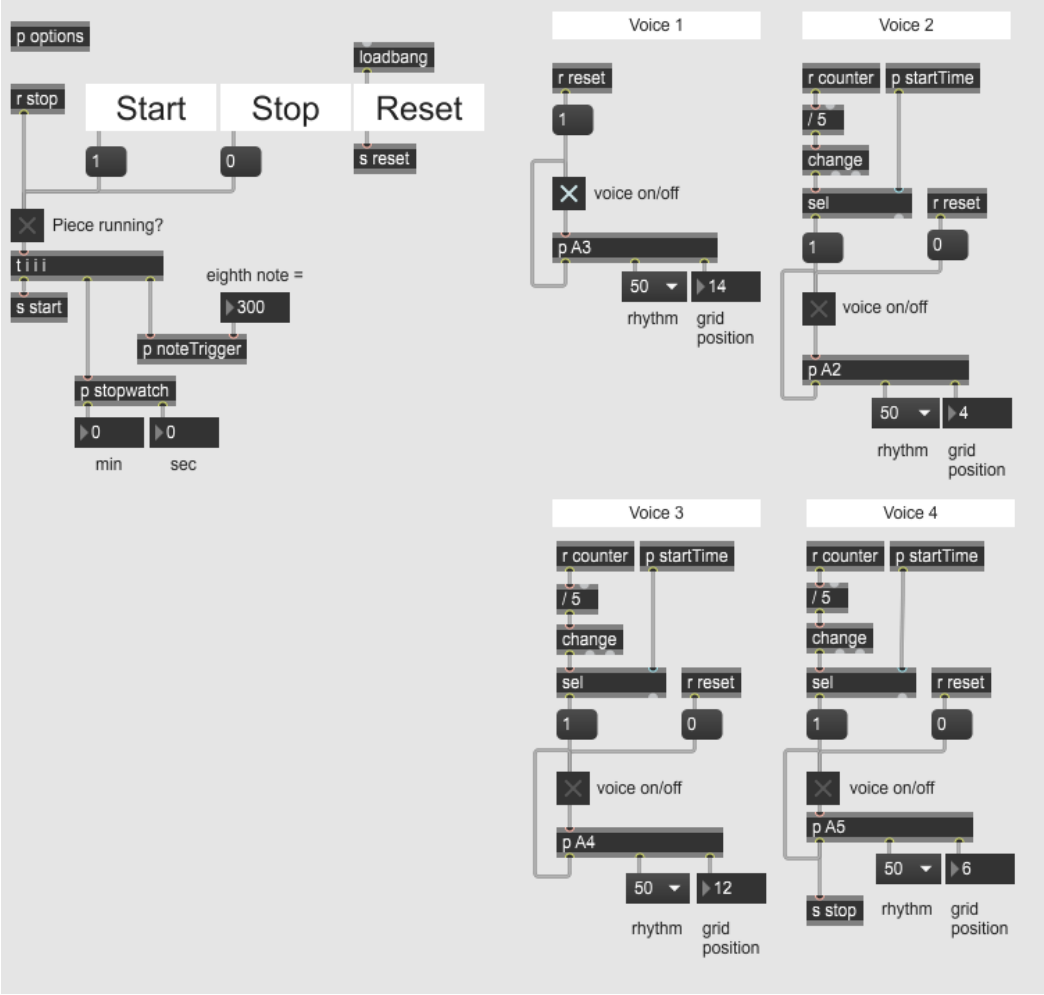
workshops of risk and certainty as they occur when a human musician plays the piece. The workmanship that happens in the practice of this piece is exclusively the workmanship of certainty and can happen almost entirely within the workshop of certainty.[19] The way the program is designed allows for different outcomes to occur but limits what those choices can be and the method by which those outcomes are chosen. This means that the composer must specify the discovered mapping in addition to the established mapping. From the perspective of the composer, in the case of a human musician, the outcome of the PDM was known while the content of the mapping was unknown. In the case of computer-musician, both the outcome and the content of the PDM are known. In addition, because the composer specifies both domains, the outcome of the AEM and ADM also become predetermined.

Framework Etudes: No. 2 (Around) for Disklavier

As was discussed in Chapter 2, *Etude No. 2 (Around)*[20] is a piece in which a musician works through 16 different ascending five note scale patterns that contain one of the four symbol types. As part of the concert where *Specific Ambiguities* was premiered, this piece was played by a Yamaha Disklavier using Max. The Disklavier is a reproducing acoustic grand piano that is capable of recording and playback using electromechanical solenoids to move the keys and pedals. (Yamaha Corporation 2021) The Disklavier can be sent MIDI data which can control the pitch and amplitude of the keys being played as well as the pedals.

[19] This depends on how one interprets Pye's use of the word "result." He writes: "In the workmanship of certainty the result of every operation during production has been predetermined and is outside the control of the operative once production starts." (Pye 1971, 22) If one takes "result" to mean what happens *specifically* (what I am calling the content of the outcome), then an algorithmic composition is inherently a workmanship of risk. On the other hand, if one takes "result" to mean the outcome and not the content of the outcome, then a computer picking an outcome out of a predefined range of outcomes qualifies as a predetermined event. While the content of the event differs, the outcome remains consistent at the fundamental level.

[20] See Appendix A: Etude No. 2 (Around) for the full score



In the case of *Etude No. 2 (Around)*, the computer-performer has a set of four voices. Each voice has control over one octave of the piano, starting on an A and extending up to the next A non-inclusively. Each voice uses nearly the same code to execute playing the Disklavier but has a unique mapping for the discovered meaning.

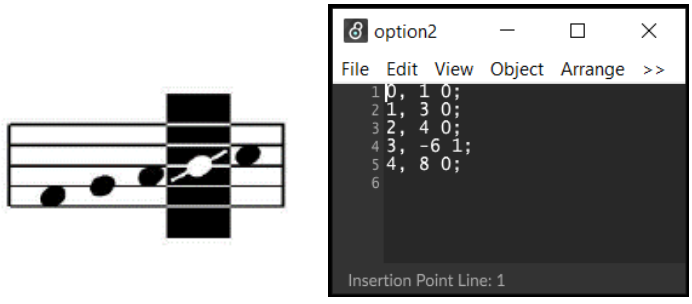


Figure 27 - Grid Row 1, Column 2 Notation and Collection

Figure 23 shows the notation for the second option on the first row of the piece represented in modern staff notation and in a collection in the Max patch. Following the index of the note which corresponds to the beat, the first element of the list represents the pitch. A positive number represents the presence of that pitch and a negative number represents the absence of that pitch. This pitch value is then transposed to start on an A. The second element in the list represents the mapping. A "0" represents the established mapping and a "1" represents the discovered mapping.

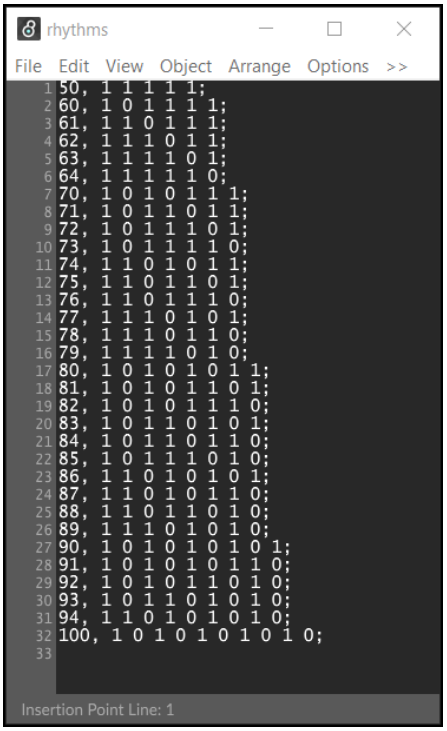


Figure 28 - Collection of Rhythms in *Etude No. 2 (Around)*

The rhythm in the piece is contained within a collection which mirrors the first page of the score. The "1" element represents the triggering of an attack and the "0" element represent not triggering an attack. As the piece progresses, each voice starts on index 50 and moves to index 100, skipping some along the way. Once a voice reaches 100, the tempo for that voice is halved and the voice moves back to index 50. This effectively is a metric modulation of ♩ = ♪. As the piece

progresses, each voice gradually slows down as more and more time is added in between the five attacks that occur as a part of each pattern.

Conclusion

Chapter 3 covered three different ways of extending the composition framework. The first section looked at extending the notation through the application of the symbol types to elements other than the notehead. The second section covered extending the scoring modality through different types of digital score and the new possibilities that arose with each new modality. The third section examined extending the composition through composing for a computer musician and the implications of the composer creating both the compositional framework and making the decisions of how to function within it. Chapter 4 will reflect upon the process of working with cross-domain notation as a composer, observe the feedback received from musician working with the system, and posit the next steps that I will take in further examining the possibilities of cross-domain notation.

Chapter 4: Feedback, Reflections, and Next Steps

The initial impetus for setting out on the development of cross-domain notation was to investigate how the identity of a piece of music may be formed outside of immediately observable elements such as pitch or rhythm. The path that I chose to take was to create a system of notation that allows for the malleability of the meaning of symbols by changing their relationship with the superordinate elements of the score. This allows for a method of composition similar to how I was composing previously with the addition of a second layer of composition by adapting those symbols via the compositional framework. In this way, the logic and creative expression of the initial composition is preserved while allowing an expression of it that is something closer or further away from it depending on the will of the musician. The fundamental composition made of pitches and rhythms is present indirectly as the foundation upon which the cross-domain notation is applied.

From my point of view, the implementation of cross-domain notation has been successful thus far. Working with musicians has allowed me to hone my descriptions of the concepts and how best to communicate those concepts through notation. The notation may not result in a new type of sonic experience for the listener but has seemed to produce a new mode of interaction between the score and the musicians which was the initial desire. One of my interests as a composer is in using a composition as an opportunity for a musician to confront the performance practice of their instrument and tradition. In the past, this has often dealt with how the desires of a composer interact with instrumental techniques. For example, as a violinist, the point at which the bow is placed with regards to the bridge and fingerboard combined with the pressure applied to the bow affects the harmonic content and thus the "richness" of a sound. As the bow moves closer to and over the fingerboard, the upper harmonics are dampened leading to a more muted tone color. This bow position is commonly known as *sul tasto,* and is commonly paired with quieter dynamics as a

result of the tone color and the physical requirements of the position causing high bow pressure to likely cause other adjacent strings to be struck with the bow. In my work *stands among them* (2017) for two violins, I ask the performers to not only apply dynamics that are unusual for the bow position but also to shift the bow between different points on the string in combination with these dynamic changes alongside modulating their vibrato. Musicians I have worked with on this piece have reported that this focus on the position and movement of the bow has affected how they practice other pieces they are working on. As musician, we are encouraged to practice until a technique becomes so natural that it no longer requires conscious attention. Pieces such as *stands among them* reframe instrumental technique in a way to make it necessary for a musician to bring what had become engrained to attention and to work with it in the same way that an etude requires a musician to focus on a particular technique.

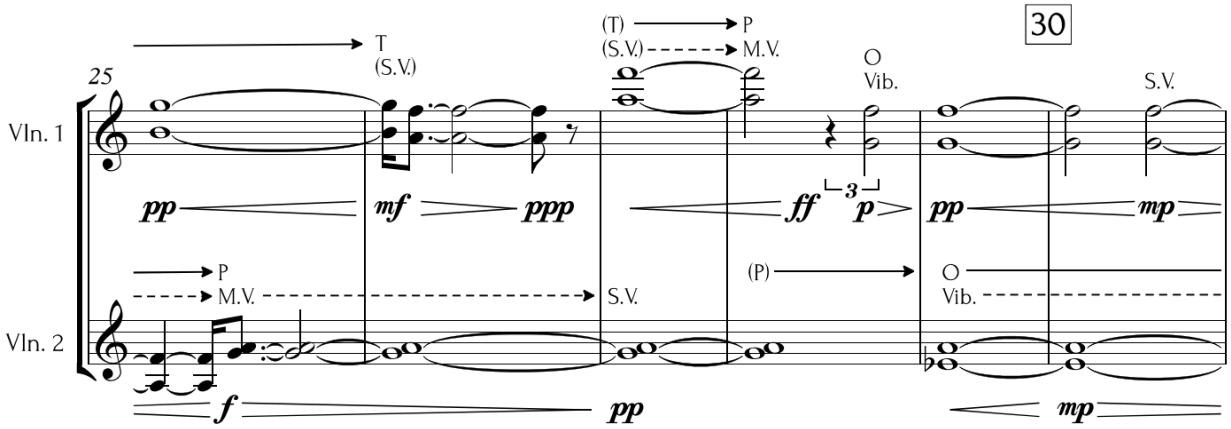


Figure 29 - Excerpt from *stands among them* (2017)

I see cross-domain notation to be an outgrowth of this desire to place musicians in situations that encourage them to examine their performance practice. Cross-domain notation extends this practice of focusing on what has become natural by shifting this style of composition away from the instrument and towards the score. The relationship between musician and score has become one of the most foundational relationships within the Western Art Music context. The ability for a musician

to recognize and almost immediately act in accordance with notation is a necessity to achieve competence. By taking this understood and familiar relationship and adding new layers of complexity, cross-domain notation places the musician in a position to examine how they conceive of the possibilities of their instrument and their musical practice.

The main point where things have not succeeded thus far is in the extent to which the technological elements of the original vision have progressed. The plan for this work was to first extend the score into the digital domain through the creation of a modular scoring program that would learn the behavior of a musician and be able to begin to model their domain mappings and use of absence. The current digital scores and programs that have been completed are merely a first step in this direction. The state of this portion of my work will be expanded upon further in Moving Forward: Technology.

Feedback

The feedback that I received from the musicians I have worked with on scores using cross-domain notation has yielded some common answers. In practice, the implementation of absence, in the case of both the AEM and ADM, proved the most difficult to work with at first. The cognitive dissonance that arises from the swap from "symbol=do this" to "symbol=do not do this" proved to be difficult initially. While it may make sense conceptually, putting this into practice requires a shift away from symbol as presence to symbol as absence which, as discussed in Chapter 2, is not as simple as "do anything except this."

On the other hand, the discovered mapping was the most difficult part of cross-domain notation conceptually. At first, this was likely due to the fact that the explanations of the different symbol types were not as clear as they could have been something I improved over the course of rehearsals. Mainly, the issue goes back to the fact that different image schema align some source

domains and target domains better than others. The mapping of pitch to verticality shapes the structure that informs the way that music created using modern staff notation functions. Simple cross-domain mappings to ideas that can modify pitch such as gesture lend themselves relatively easily.

However, a deeper dive into the concept requires much more time and effort on the part of the musician but has the possibility of yielding a much richer mapping. The bassist and composer James Ilgenfritz describes his discovered mapping as follows:

> The key to finding solutions for me was in connecting the notion of the "absence of the written note" to what Blake described as a 90-degree realignment of processes. So for the four notations, I had chosen four solutions: 1. the note as-written. 2. a transposition of that note (playing that note a perfect fourth down, which is a very natural mental process on my 5-string contrabass). Then for the absence: 3. a remapping of movements TOWARDS the string (over-pressure bowing, col legno battuto, jeté, glissandi towards the standard playing area, a particular arco technique where I repeatedly press and release the finger on the left hand while bowing, creating a constant alternation between stopped pitch and harmonic) 4. a remapping of movements AWAY FROM the string (snap pizzicati, col legno tratto, glissandi towards the scroll, any string techniques that ended with my hands away from the bass, as with certain types of arco gestures).

James chose to have a consistent mapping of absence and to remap the notehead to relate to techniques that effect the direction of the movement of his right hand towards or away from the instrument. The mapping changed from PITCH RELATIONSHIPS ARE RELATIONSHIPS IN VERTICAL SPACE to RIGHT HAND DISTANCE FROM STRING RELATIONSHIPS ARE RELATIONSHIPS IN VERTICAL SPACE.

The complexity of the cross-domain mapping seems to also be related to the size of the ensemble. The freedom of playing alone or with one other musician gave some musicians the opportunity of use the domain of time in their interpretation of the score leading to the duration of notes being elongated or shrunken down. Without the necessity of thinking about how one's own mapping interacts with the mappings of others, new creative ways of dealing with cross-domain notation arise. The other main factor that arose in how musician's came to their discovered meaning

was the type and complexity of the music. The *Combo Pieces* are both more rhythmically complex and rooted in a conventional harmonic and melodic framework than the other cross-domain pieces included in this project. As a result, the cross-domain mappings that the musicians chose tended to be more restricted in time as they needed to fit them into notes of short and long duration and play them within a strict meter.

Different Ways of Working-Through

One difference in approach that surprised me was how each musician worked through the grid layout. In my mind, I had thought of the choice node as being the decision that would motivate a movement to a transition node based on the interpretation that a musician wanted to take. However, in practice, some musicians worked this in reverse. Instead of deciding their interpretation of the choice node and then moving to the corresponding transition node, they chose the transition node they wanted to go to and then played the interpretation of the choice node that would get them there. In hindsight, this approach does make sense since the transition nodes are fixed and therefore are easier to use as a point from which to decide how to act. In the design of the grid layout, I did not take this as a possible approach to moving through the grid so it was a nice surprise to see a method I was not aware of while creating the layout.

Another major difference between the approach of musicians to cross-domain notation was how pre-planned their concept of absence and their mappings were. The discovered mapping necessitates a preconceived approach since the PDM requires a consistency akin to the PEM. The control musicians gave themselves was widely divergent. One musician used transposition as their discovered mapping but used the chance method of dice rolling to alter each appearance of the PEM. On the other hand, absence as a concept has a lot of space for deciding at what point a

musician wants to choose their absence. Some musicians, such as James, chose to have a consistent absence whereas others chose to improvise absence in the movement.

One of the musicians I worked with, the composer and woodwind player Isaac Otto, took this preplanning a step further. Figure 26 shows an excerpt from Isaacs realization of *Return.*[21] Isaac took the opportunity to essentially compose all of the symbol types other than the PEM which was provided to him. This is another situation in which cross-domain notation provides an opportunity to sit in the spectrum between composition and improvisation. While some elements of a cross-domain notation score need to be predetermined, most of the execution of those ideas can be done at any point prior to or during the realization of a piece. This is an element of how the pieces are composed that I would like to investigate going into the future.

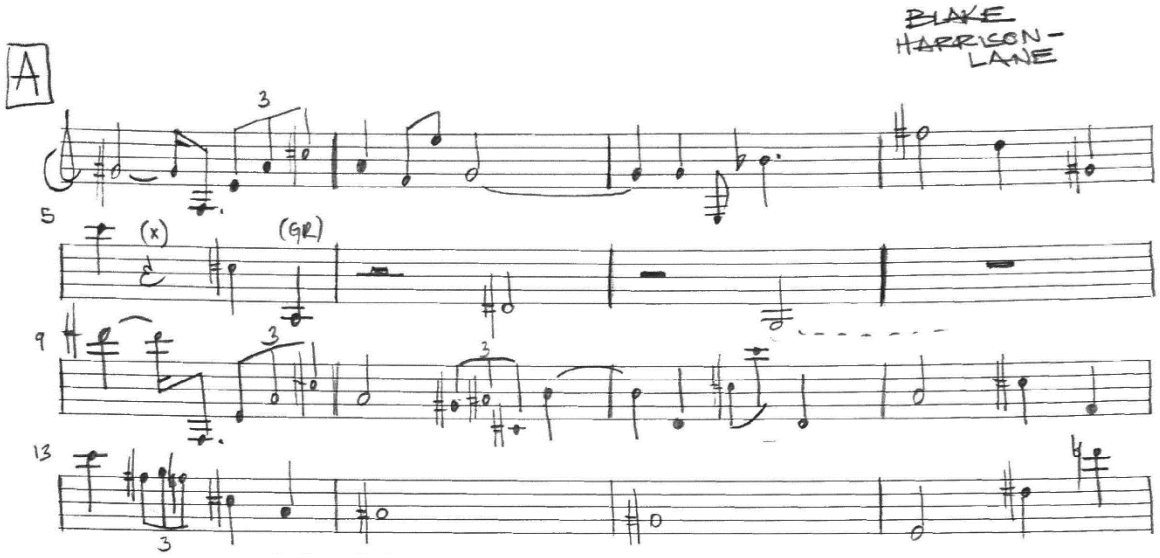


Figure 30 - Excerpt from Isaac Otto's Realization of *Return*

[21] See Appendix E: Realization of Return by Isaac Otto

Wherein Lies the Difficulty and the Value?

A primary point of discussion I had with the musicians who participated in playing the music regarding cross-domain notation was around where the difficulty lay in working with the notation, how that difficulty changed as one became more familiar with it, and what the value of cross-domain notation is versus other forms of notation. The agreement among musicians was that the initial hump of learning what the different symbols meant and how to come up with a new cross-domain mapping was the most difficult challenge to overcome initially. This initial hump required the musician to learn not only what the symbols represent but how they delimit the space of possibilities. The symbol has both a meaning related to direct action and a meaning related to the conceptual space in which that action takes place. Compared with the works discussed earlier, this is a rather unique feature of cross-domain notation.

Once the initial difficulty of understanding the meaning of the symbols and how they fit into context has been overcome, the musicians reported running into a cognitive dissonance that arose from managing the difference in meaning between the pre-existing meaning of the notation and the meaning that is brought to the notation through cross-domain mapping. This is in part an intentional part of the design of the cross-domain notation scores that were played. Cross-domain notation is in essence a meta-notation that can be applied to any type of notation that uses mapping between a source and target domain. The choice to use staff notation as the means by which to employ cross-domain notation inevitably puts the musician in a position where they have to manage multiple meanings applied to the same symbol. The addition of multiple domains and domain swapping being applied to the same symbol creates a cognitive load that the musician must actively manage, which is a different skill set than is commonly asked for when playing from notation. Given enough time, musicians will likely be able to manage cross-domain notation in a manner similar to

other notations that have fixed meanings. At this time, there is not enough data to conclusively make a truth claim about this.

In creating cross-domain notation, I hoped to provide musicians with an experience that was worth the effort. The value of the system seems to lie in the notation allowing a musician to occupy a middle ground between a recitation and an improvisation. The specificity of the notation as it stands lends itself to feel less improvisatory and more like a complex reading when compared to graphic notation. This is likely tied to the friction that arises from the use of a symbol set that has a deeply engrained meaning in the minds of highly-trained musicians, as described earlier.

Return being both a solo and group work brought to the attention of the performers the way in which they were approaching the rehearsal process in addition to their own decisions in practicing and mapping. The specificity required by musicians in coming up with their own mappings reveals the mechanics of how they approach the act of interpreting notation. The movement from solo work to group participation requires a potential shift in how one maps the notation to action. The approach that one takes towards both improvisation—as was mentioned when discussing Braxton's scores—and how one works in a group becomes an active element in the mind of the musician when working with cross-domain notation.

Overall, the difficulty and reward from playing with cross-domain notation seems to come from having to exercise a different type of thought process that sits somewhere in between performing pre-composed music and improvising. Musicians must be actively engaged with the meaning they are giving to the symbols in the process of playing. Pairing this with the pre-existing meaning of the symbols creates an in-the-moment awareness of the domain mapping one is bringing, which is not something that a musician needs to manage with scores in which the meaning of the symbols and not the context in which they function is the primary goal.

Moving Forward

This document outlines the beginning of my work on cross-domain notation. There are many areas of interest that the works referenced in this document did not cover. For example, all of the notation in the project, outside of the percussion in the *Combo Pieces*, were written with instruments that were built to be able to create specific pitched sounds in a reliable manner in mind. This section will cover other areas of notation that are next steps in the expansion of cross-domain notation.

Time

The cross-domain notation that was used as part of this project worked with either the vertical/pitch domain—including chord symbols/harmony—or with elements that modify time—in this case, feel. One of the next steps is to apply cross-domain notation to the horizontal domain of the score and reframe the temporality of the vertical domain. Admittedly, this is a very difficult idea to work with because if pitch is not a function of time then what is it a function of? How does a musician portray the absence of time since music is by its nature temporally emergent? How does a musician move out of and back into the horizontal mapping to temporality? Synchronicity of events is an important part of music made using modern staff notation. The removal of temporality as a parameter of notation removes along with it ideas of beginnings and endings and turns a piece into something else entirely. The cybernetic artist Nicolas Schöffer makes just this point in his essay *Sonic and Visual Structures: Theory and Experiment*. He writes:

> Music without beginning or end is no longer 'music', it is already something else. On the sociocultural level, time limitations lead to limitations on the consuming of music – that is, its availability. On the sociotechnical level, music has been consumed in limited spaces and times. These limitations have censored its creators. Musical composition has been founded on extremely rigid rules, where defined time has been programmed from relationships clearly signifying the linearity and ordered arrangement of its unfolding. Thus, music made linear and enclosed within its temporal prison has been the dominant form up to the present. How

> does one move beyond this? The solution is in my opinion simple: one need only transfer the techniques of visual arts to the techniques of sonic arts and rethink the problems of technical and social diffusion and consumption of music. (Schöffer 1985)

In a way, the grid layout is one step in this direction. The grid still uses a linear succession of elements but allows for more than one axis of movement. The next step would be to separate out movement from the horizontal and vertical and leave a music that unfolds in time in a non-linear, asynchronous form.

Technology

The work on cross-domain notation that I have undergone this far has primarily been focused on the development of the notation system and the concepts supporting it. Extending these concepts through algorithmic composition and networked scoring is one of the areas I am most excited about pursuing. The initial impetus for this project dealt mostly with networked scoring. However, I realized that there was much work to be done on the conceptual underpinning of how those programs were to function before I was able to realize computerized pieces that were anywhere close to the larger scale vision I have.

In one sense, cross-domain notation is quite easy to achieve in the computer. For example, remapping MIDI pitch values as velocity and vice versa requires little to no effort in an environment such as Max—a mere swapping of connections between outlets and inlets. This can be seen in the code for the Disklavier version of *Etude No. 2*. The addition of a modifier allows for a quick shift between domains. However, as long as the composer is the one writing the code, it is not the computer that defines the domains, it is the composer. Digital scores also allow for more exploration in networked scores where the actions of one musician affect the contents of another's score as in *Fragments*.

The difficulty in advancing cross-domain notation in the digital domain currently lies in two major areas: analysis of musician's decisions and how those decisions effect a change in the score. *Fragments* deals with the first issue in a basic way by performer pitch analysis of each musician's playing via FFT and amplitude tracking to determine which direction the trumpet player is facing which is an important part of the piece. This data is used in two ways. The first can be used to determine the movement of the other player's score. The program for *Fragments* is built to allow the user to have their own actions effect as score or to allow for the other musician's action to effect it as well. The second way in which the analysis changes the development of the piece is in the creation of the electronic component. The pitch and movement data of the musicians is used to create long tones with a smooth amplitude curve the move around the audience using a quadraphonic speaker setup. The pitches of these notes and the beginning and end speaker placements are derived from the choices the musicians make.

The next step is to have the program function in a generative manner by producing one or more elements of the score as part of playing the piece rather than using a given data set. In this case, the score that I create for the initial run of the piece will then function as a "proto" score that seeds when the piece will become an individualized version for each musician as they work with it more. The method of analysis and the ability to show different type of action via the notation become the primary limiting factors in the depth of this evolution. For example, FFT pitch analysis struggles when presented with more than one pitch simultaneously. Therefore, other forms of analysis will be needed to expand the range of musical expression that can be represented by cross-domain notation scores using this paradigm. A more advanced way of plotting these values over time is also necessary for a generative cross-domain notation to function well. *Fragments* works within well-defined windows of time where the category of action of a musician is limited so that the current method of analysis can be effective. To allow for more creative freedom, a less prescriptive

format for action will need to be taken which requires the analysis of time to be able to be much looser.

A primary danger in the movement from a pre-composed score towards a "proto" score is for the developments that the computer makes to be arbitrary or unfulfilling. As a composer, it is important to me that the decisions I make have a contributing factor to an integrated whole that I can comprehend. Handing over the reins of composer to the computer is both an exciting and daunting prospect since, as the designer of the program, I am still ultimately responsible for the piece. A generative piece inherently evolves without the composer being able to directly make any decisions about the course that it takes. The path forward in developing a piece that grows with the musician must be a careful process with high levels of trial and error with the assistance of musicians who share my common goals.

Notation

Finally, beginning to work outside of modern staff notation and the domains it exists within is another step I would like to take. Other target domains such as the ones discussed in Chapter 1—large and small, young and old, or waterfall characteristics—have possibilities embedded within them that the horizontality and verticality of modern staff notation does not. Once a musician has been familiarized with the conceptual framework through modern staff notation, the next step is to expand the target domains with which they can work. A new set of *Framework Etudes* in a scoring language that uses a different set of target domains is a good next step. The use of digital scores or scores using a medium other than paper allow for the exploration of more than two domains interacting together or the use of visual modularity to accompany the conceptual modularity that underpins the framework.

Conclusion

In undertaking the development of cross-domain notation, my intention was to oblige musicians to question the way they derive meaning from a musical score. The developments described in this dissertation are the beginning of expanding cross-domain notation as a system and a technology. In this text, I have shown how the four symbol types and their underlying concepts complicate the relationship between symbols and their meaning. This complexity is meant to help musicians examine their personal relationship to staff notation. That in turn may assist musicians in viewing practicing music more as a practice that has value in and of itself rather than a means towards the end of performance. Each of the pieces presented in this dissertation showed a different way in which cross-domain notation can be used. The introduction of technology expands the potential uses of that notation, and introduces the possibility of the score changing in real-time. The dynamic possibilities of the digital score can allow the musician to encounter the unfamiliar in a way that a fixed score is not capable of. It is my hope that this contribution to musical notation can grow and provide interesting experiences for musicians for years to come.

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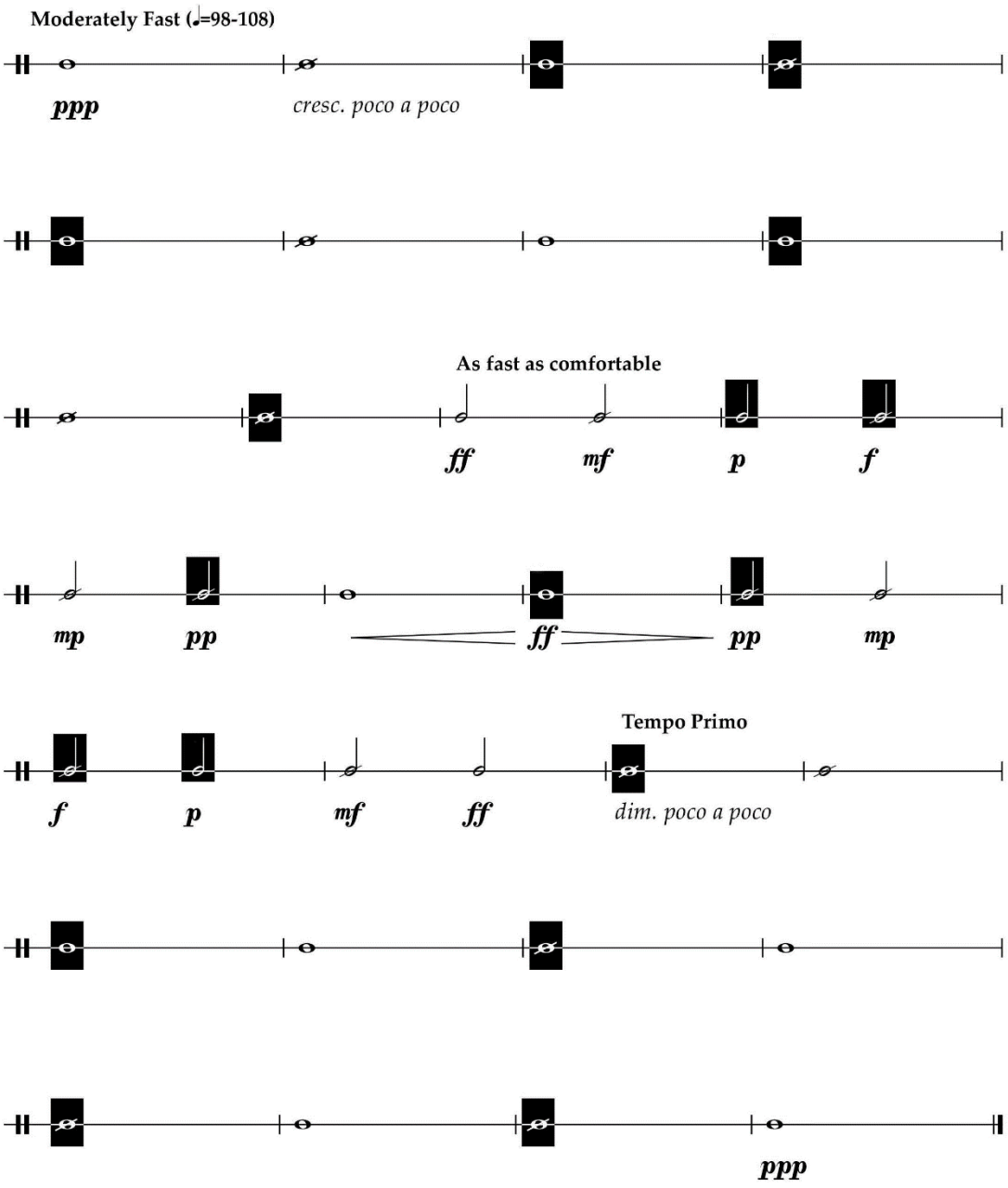
Appendix A: Score for *Framework Etudes (2021)*

Etude No. 1 (Phrase)

1

G. Blake Harrison-Lane

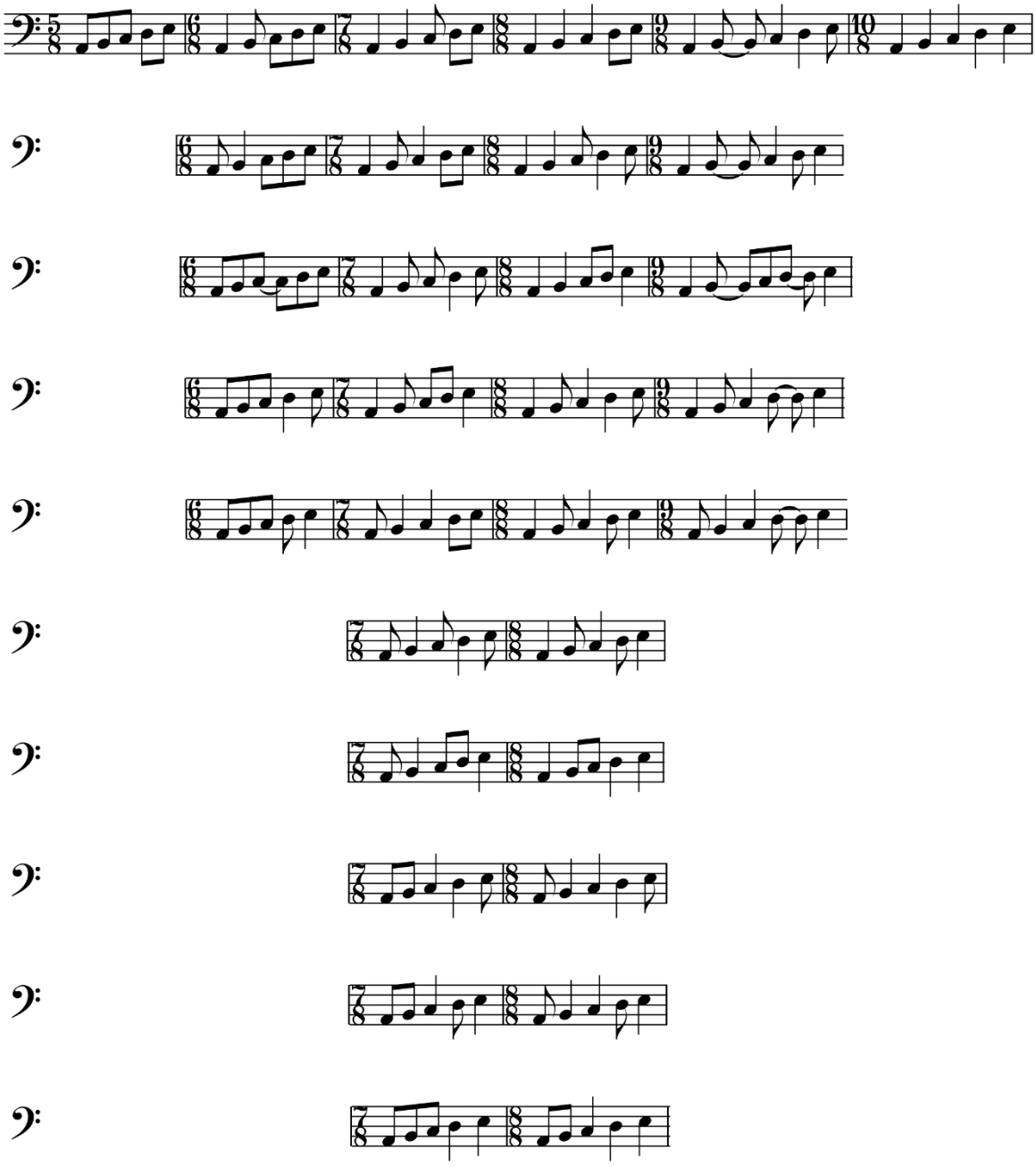


Etude No. 2 (Around)

2

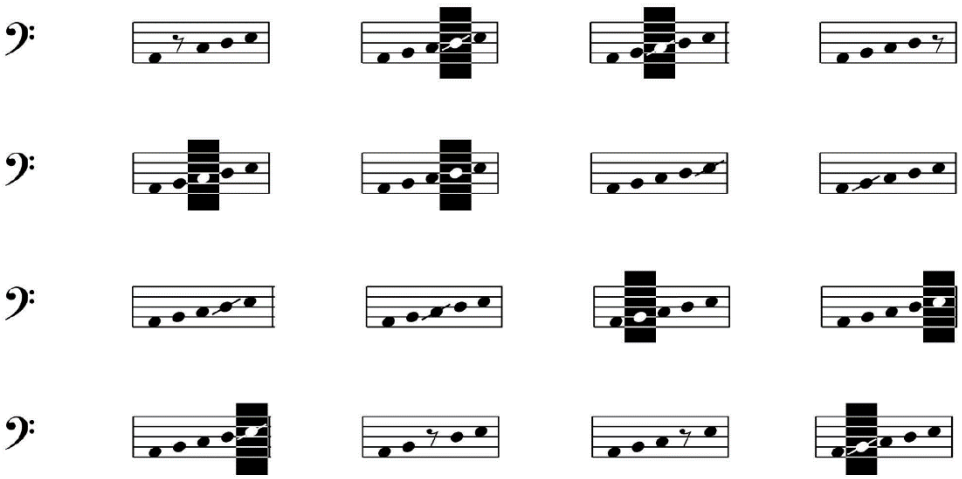
Options

G. Blake Harrison-Lane



2

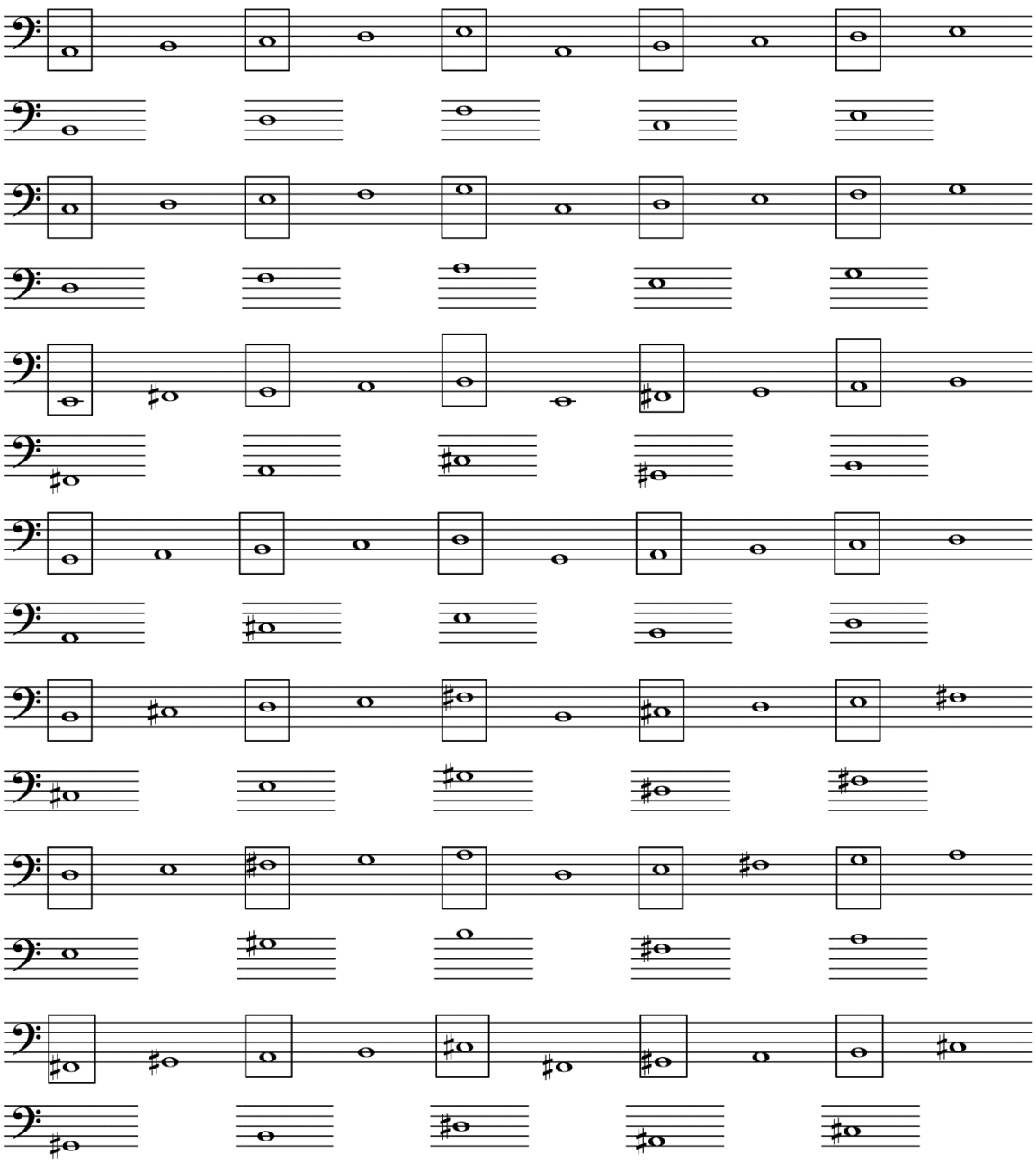
5 . . . . 6 . . . . 7 . . . . 8 . . . . 9 . . . . 10 . . . .



Etude No. 3 (Grid)

3

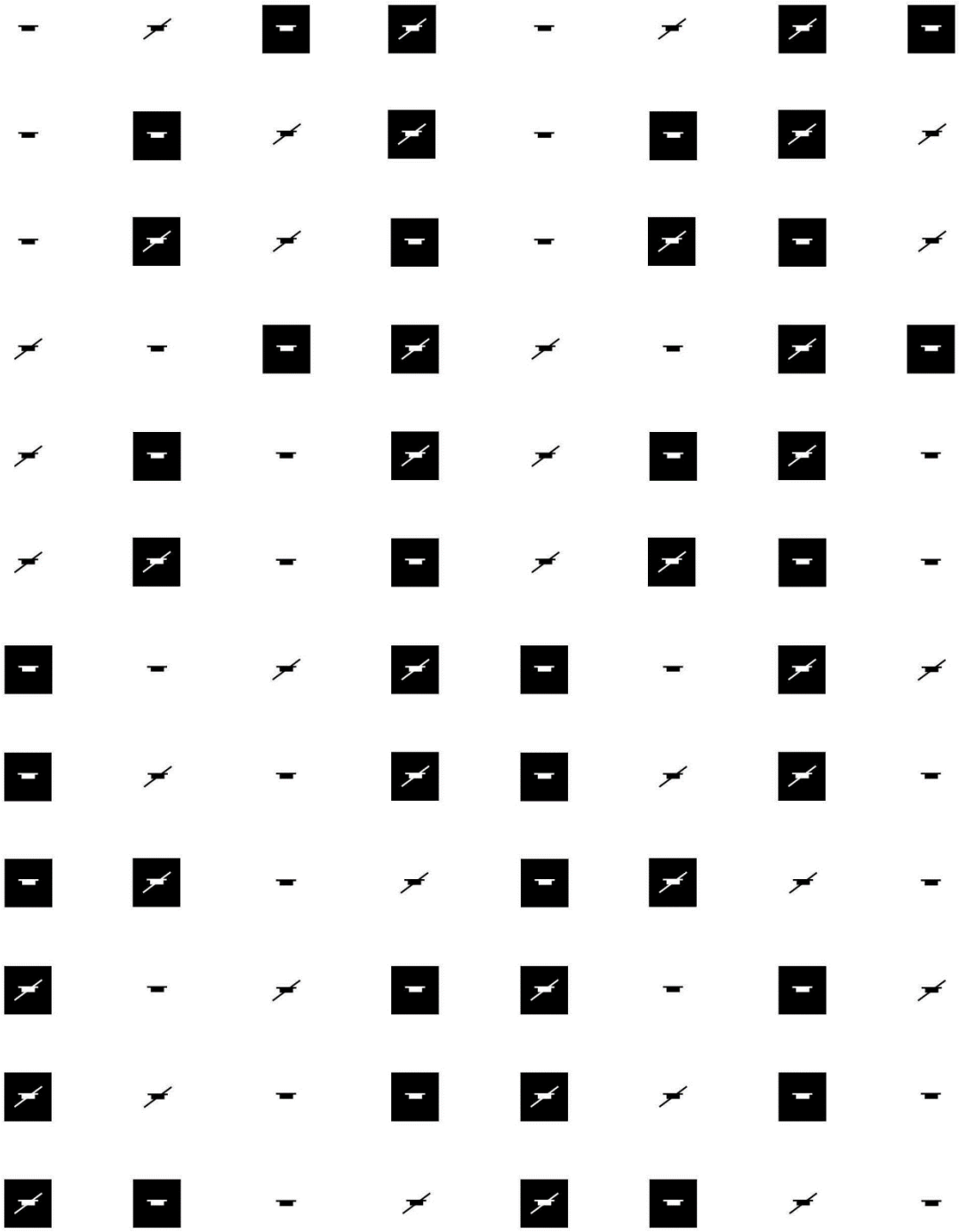
G. Blake Harrison-Lane



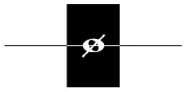
Etude No. 4 (Rest)

4

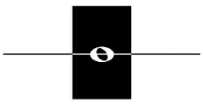
G. Blake Harrison-Lane



Etude No. 5 (Turn) (First Four Pages)[22]

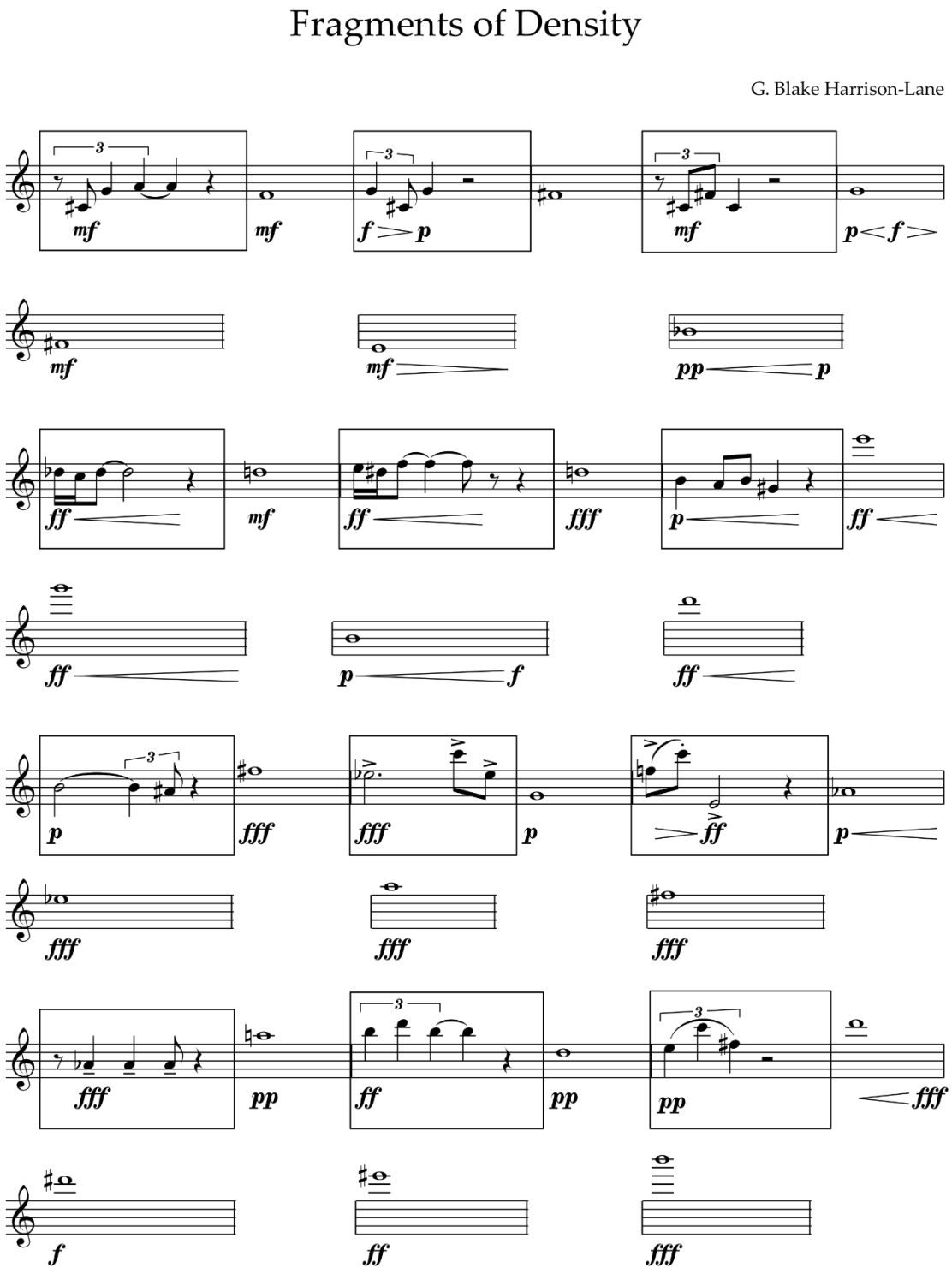


[22] *Etude No. 5 (Turn)* consists of 96 pages in total. For brevity, only the first four pages are shown here.

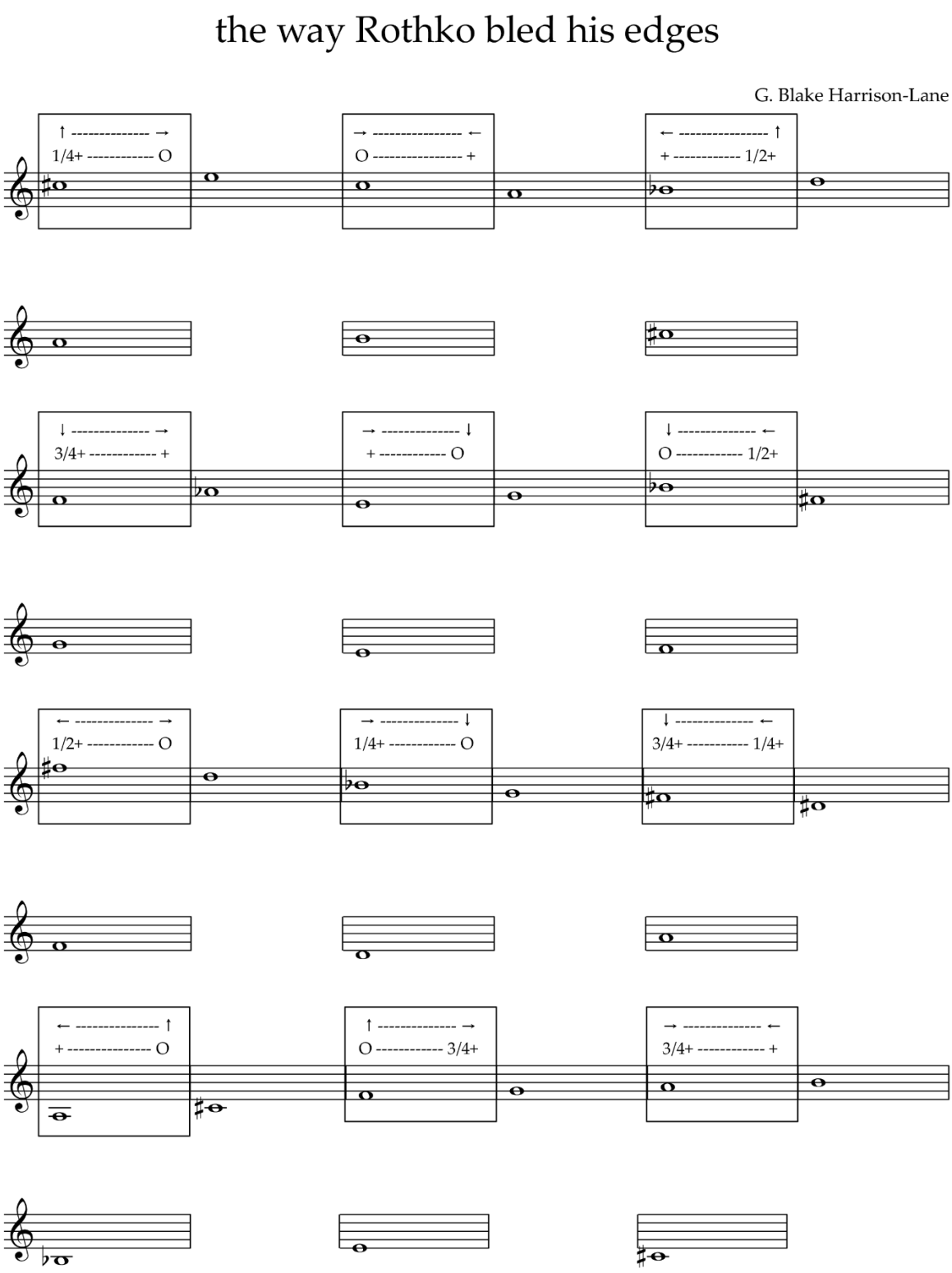


Appendix B: Score for *Fragments (2022)*

Fragments of Density (2022)

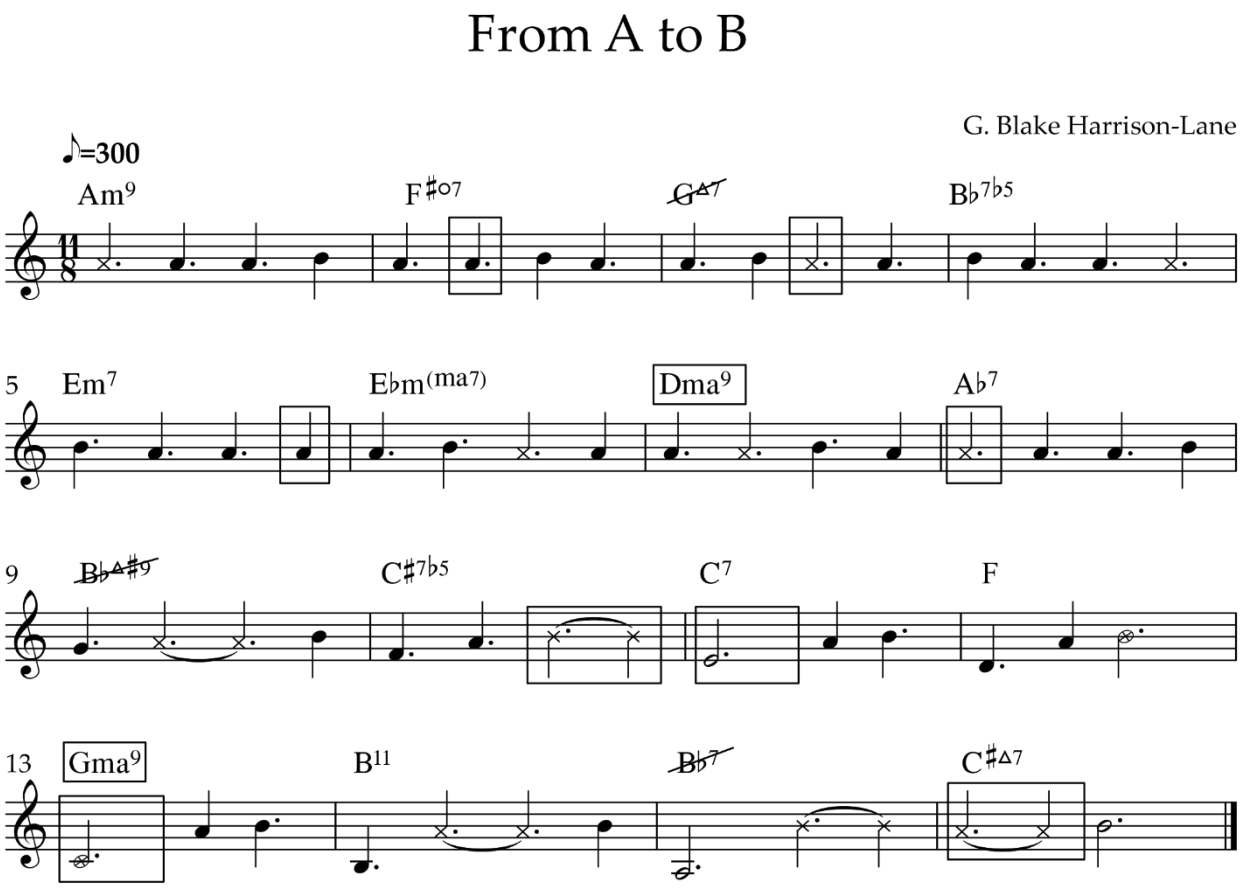


the way Rothko bled his edges (2022)



Appendix C: Score for *Combo Pieces (2022)*

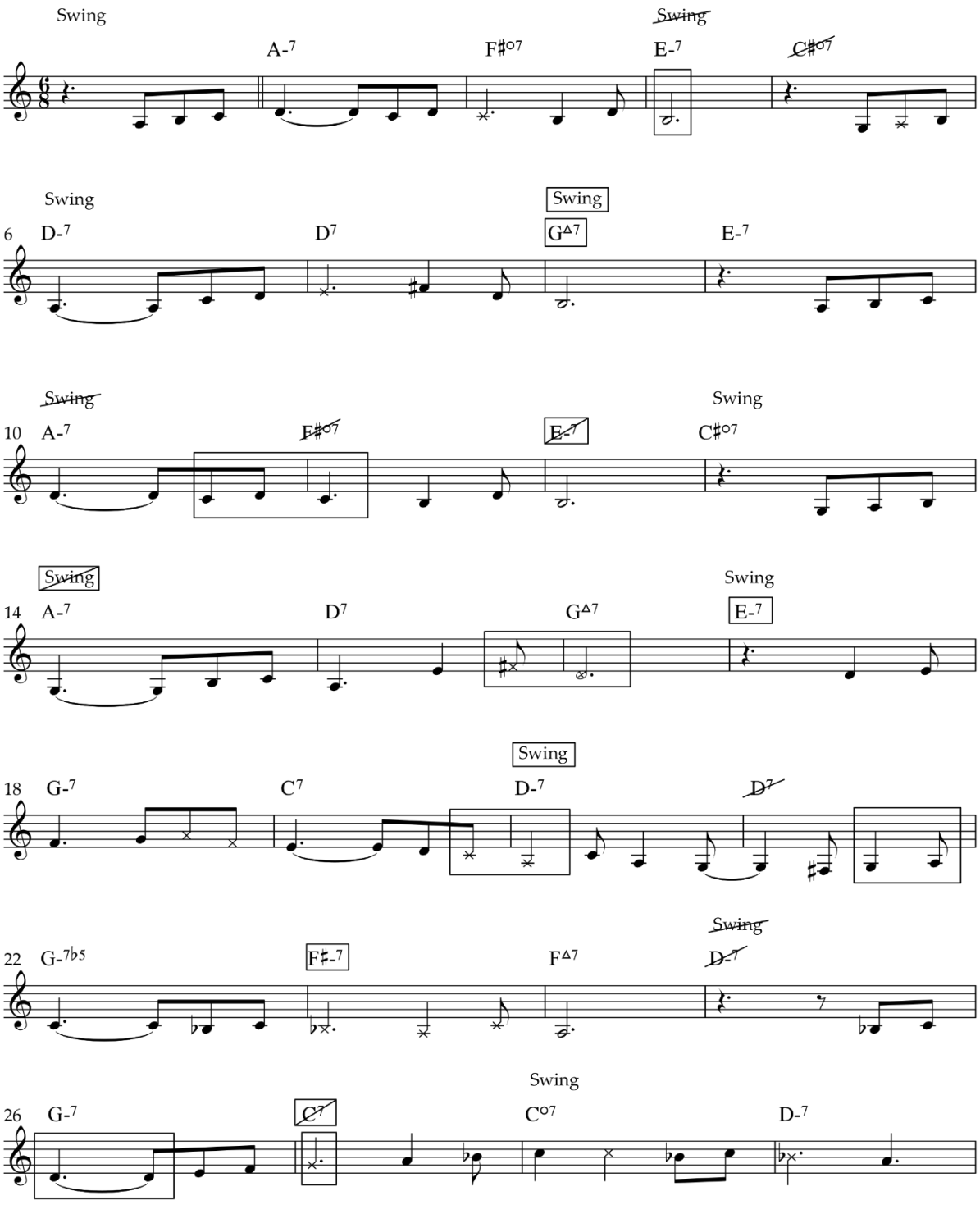
From A to B (2022)



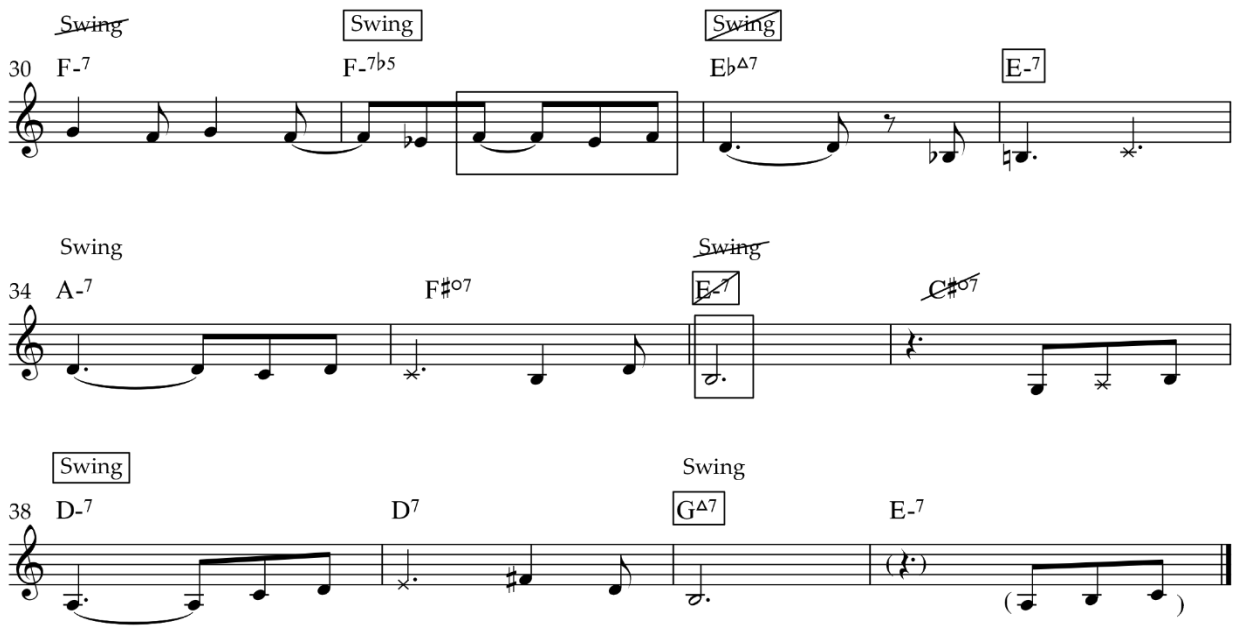
Violet Bright (2022)

Violet Bright

G. Blake Harrison-Lane



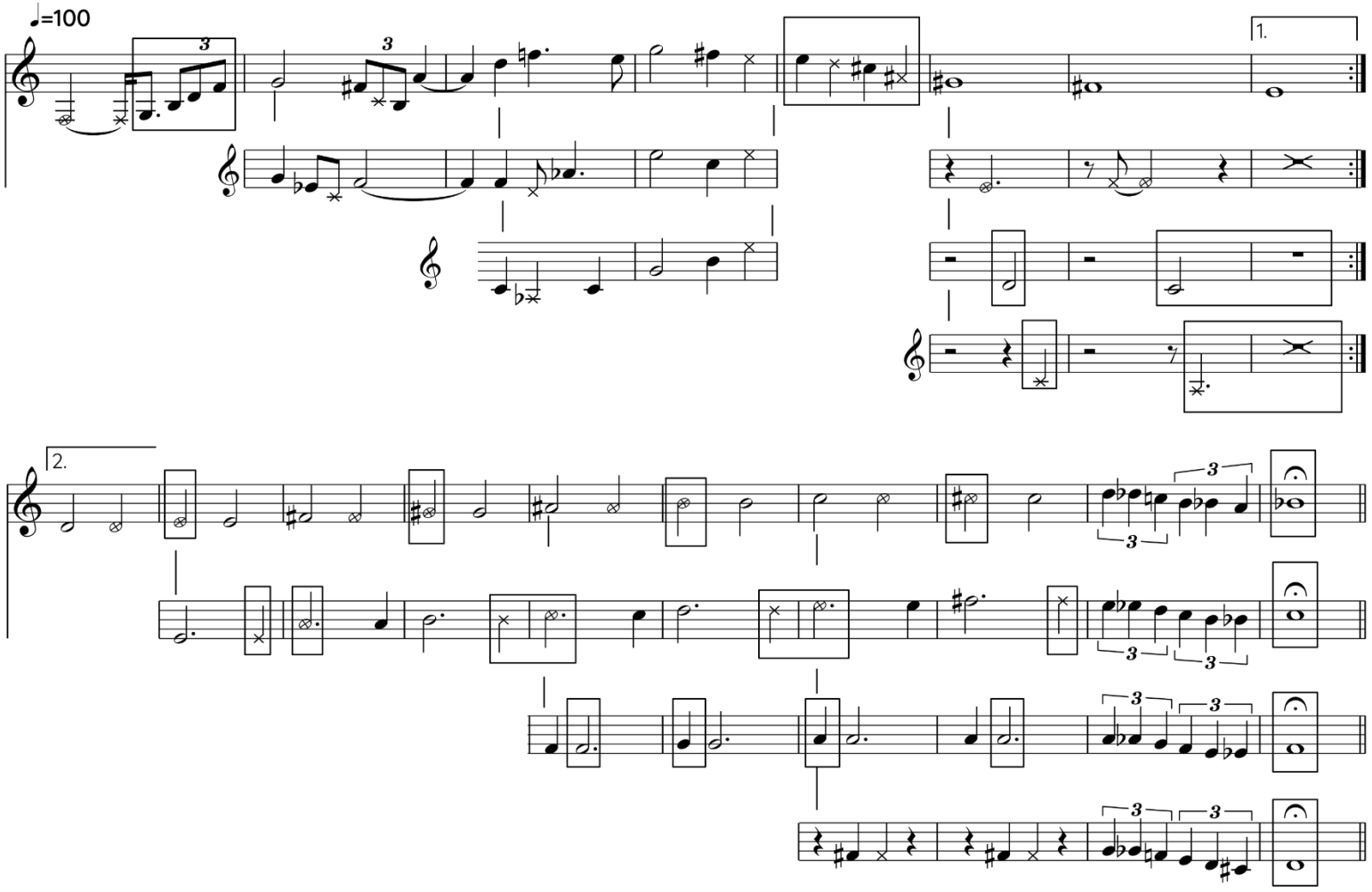
2


Swing
Swing
Swing
30
F-7
F-7♭5
E♭△7
E-7
Swing
Swing
34
A-7
F♯ø7
E-7
C♯ø7
Swing
Swing
38
D-7
D7
G△7
E-7

Appendix D: Score for Return

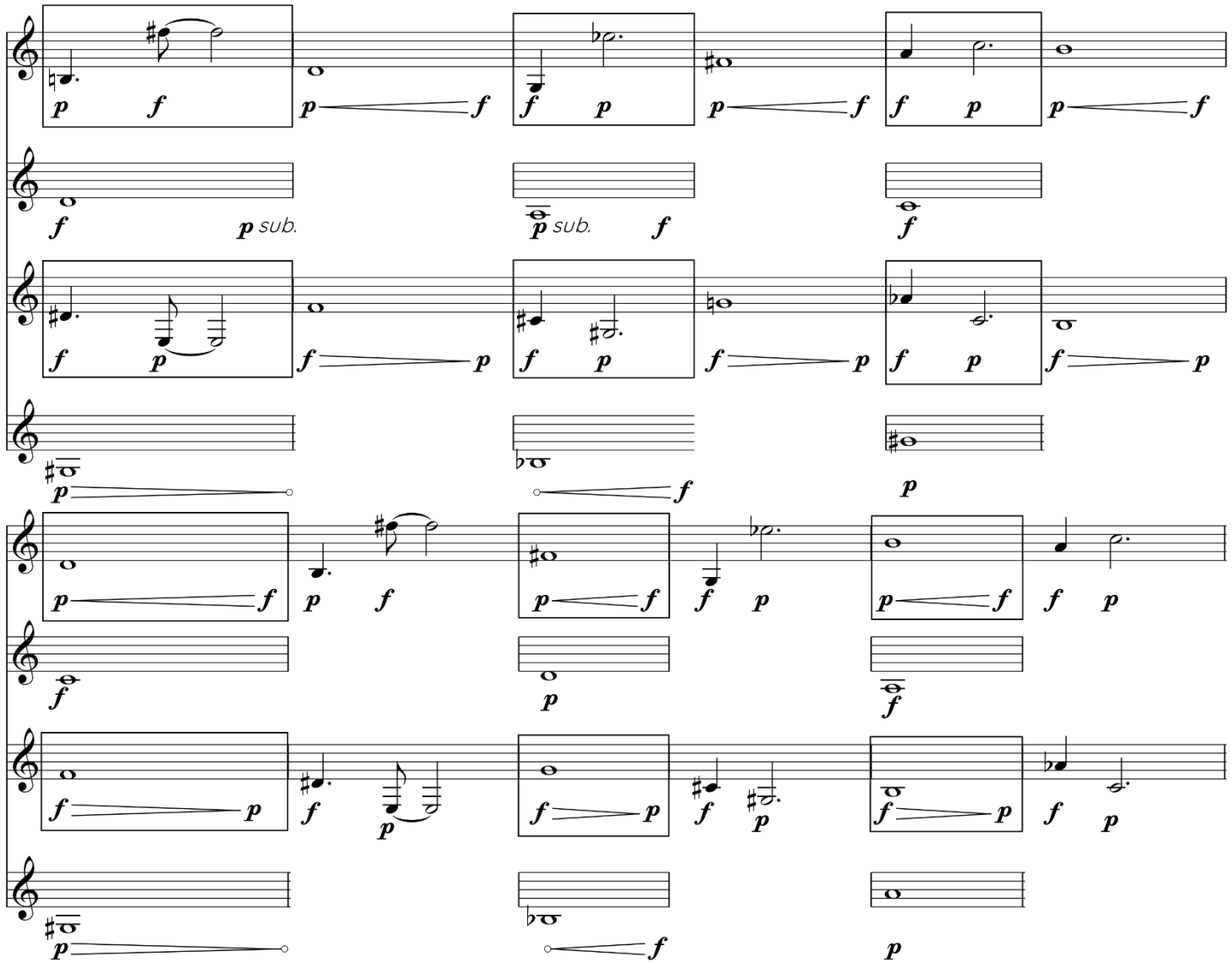
Treble Clef

G. Blake Harrison-Lane

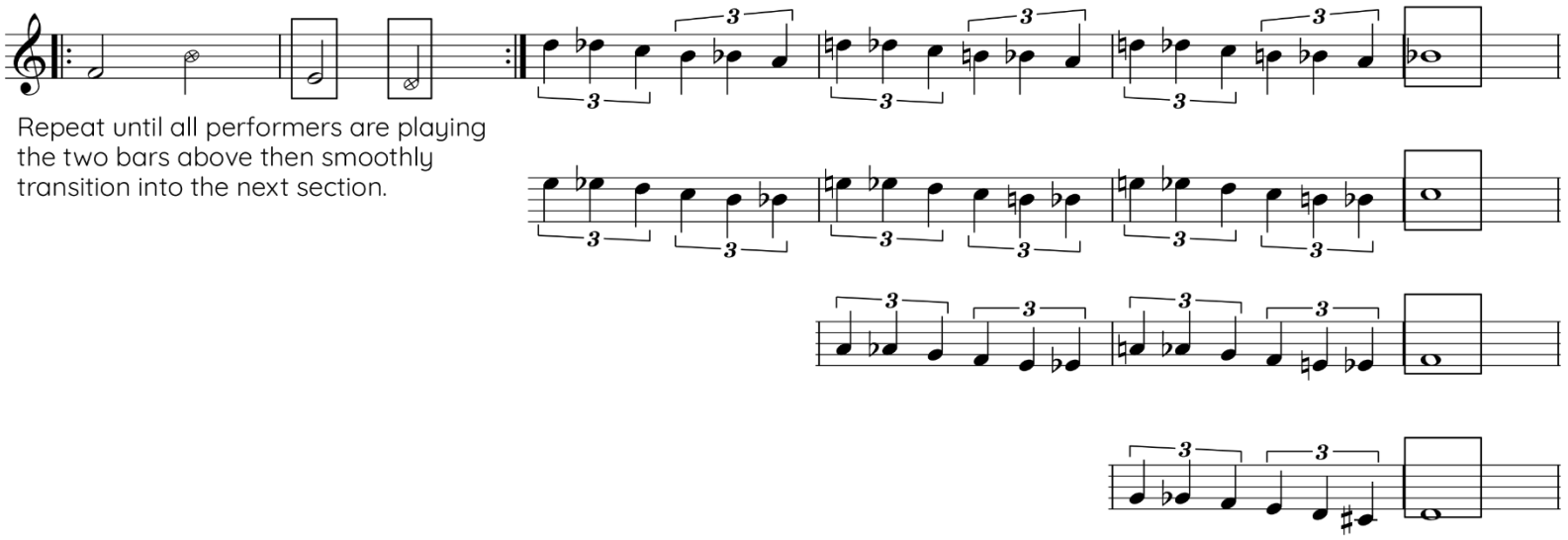


Grid Mode. Change to new performer mapping. This page should last 2-3 minutes.
Once finished, independently move to first two bars of next page.

2

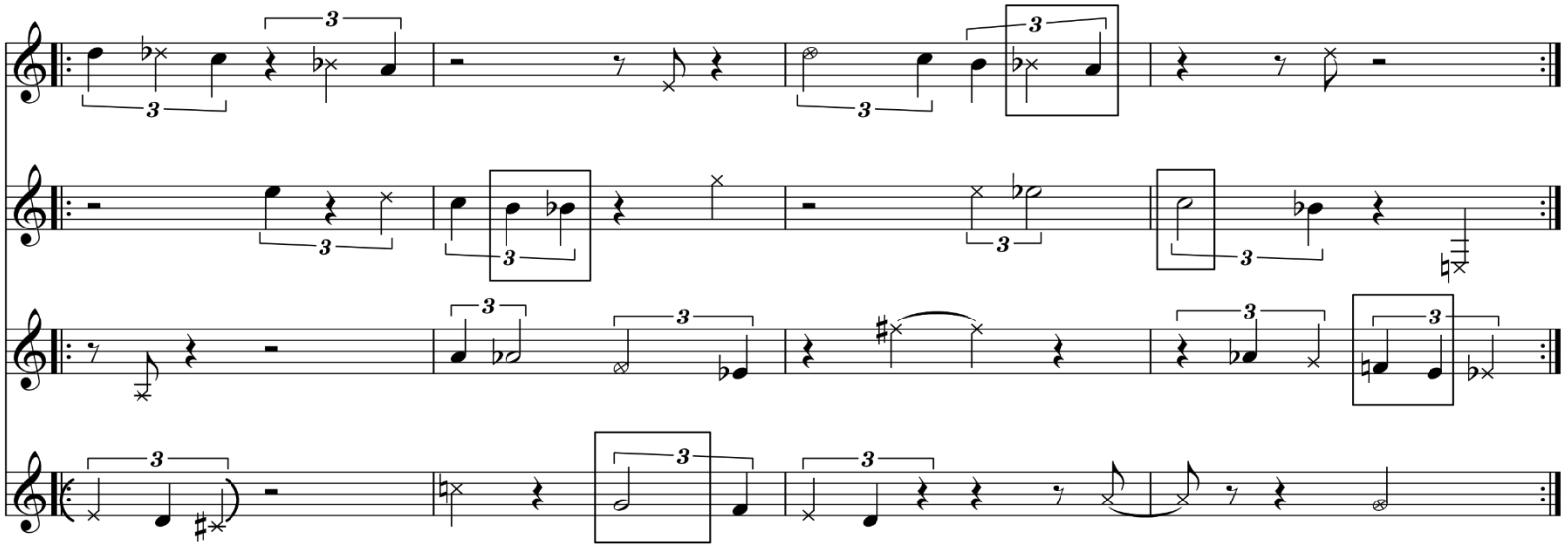


Phrase Mode. Return to original performer mapping.



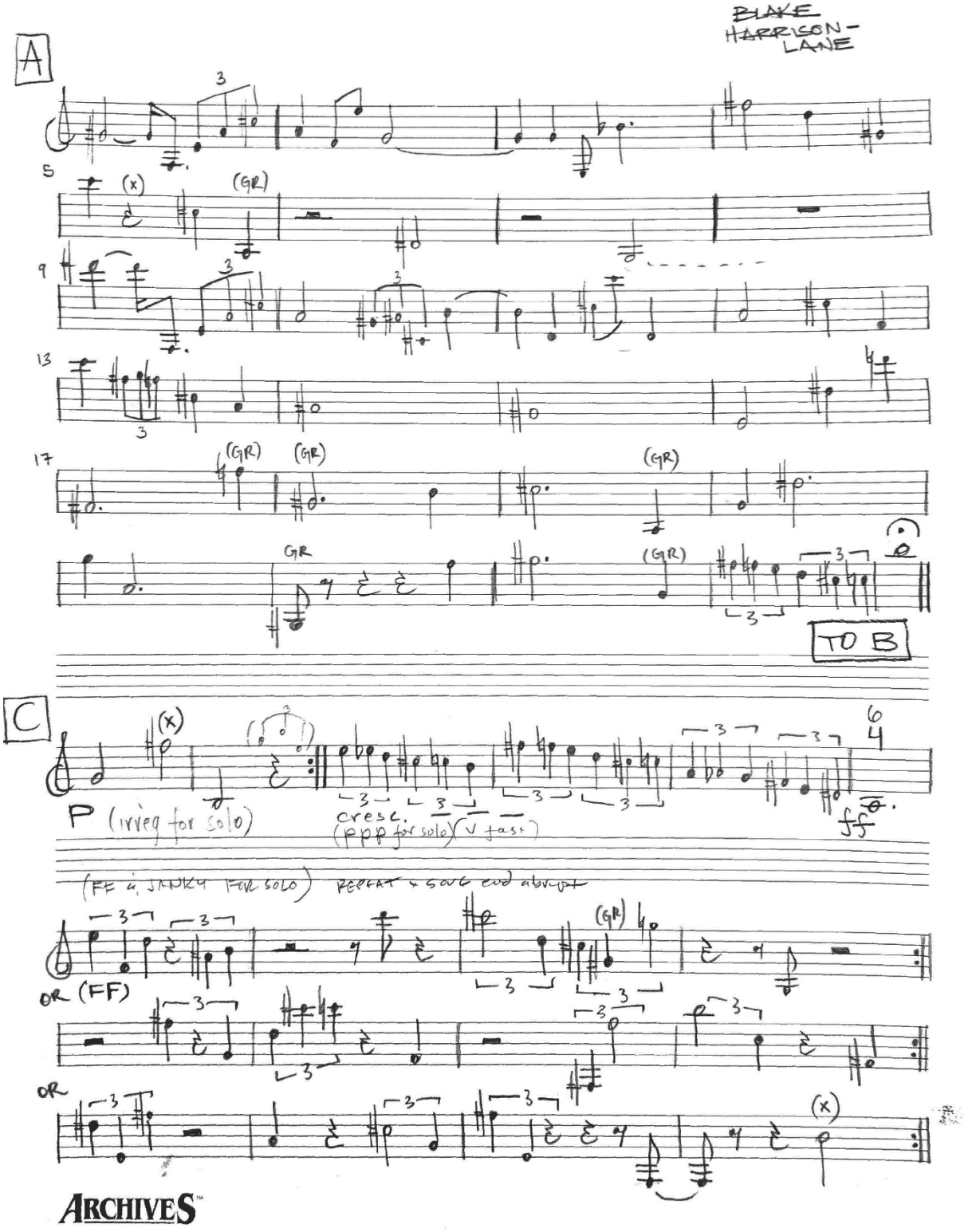
Repeat until all performers are playing the two bars above then smoothly transition into the next section.

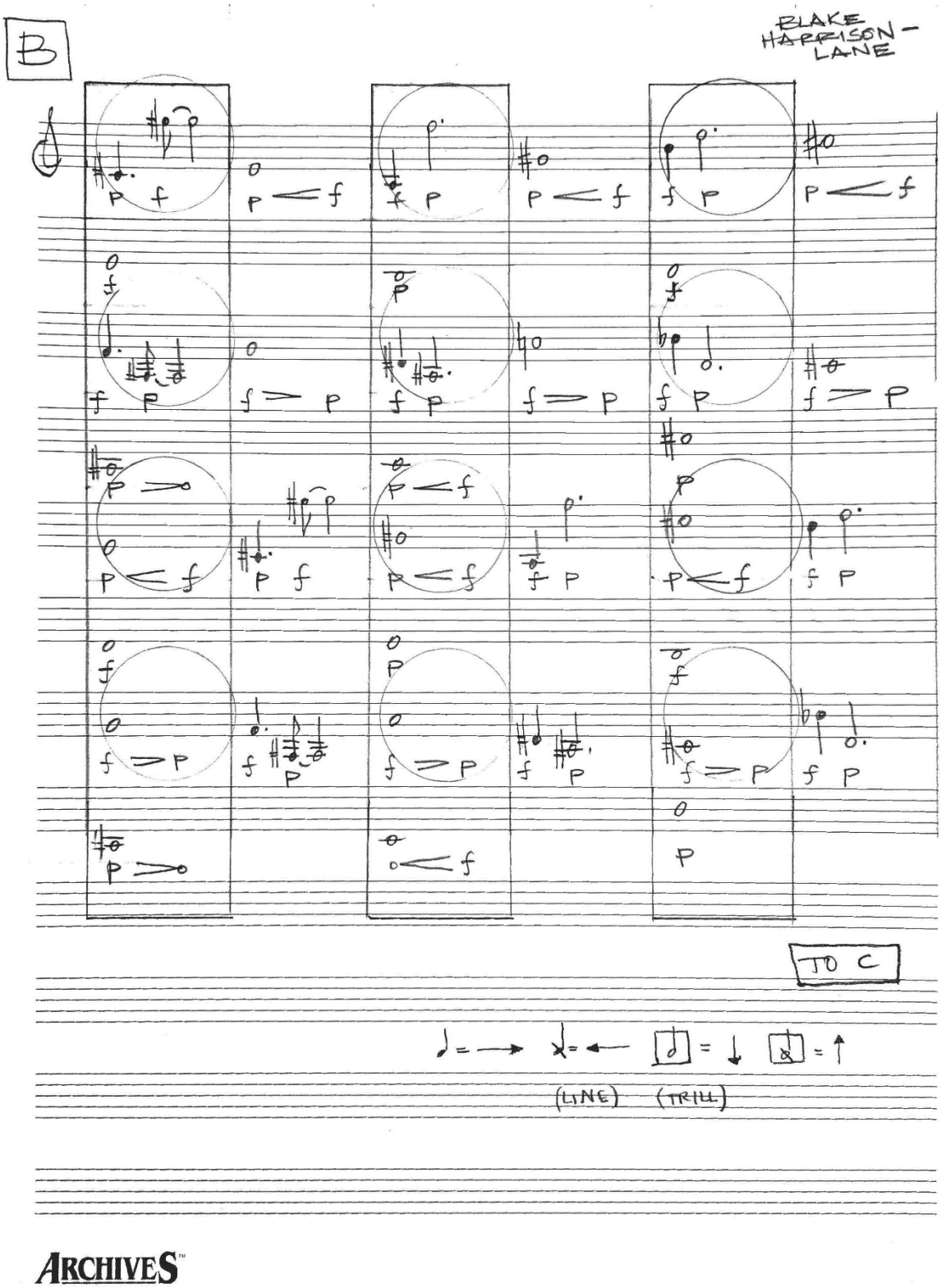
Repeat 4-6 times. Start loud and get steadily slower and quieter.
The passage may start desyncing after the fourth repetition.



Don't play first time through

Appendix E: Realization of *Return* by Isaac Otto





Appendix F: Link to *Specific Ambiguities* Concert Media

https://www.gblakeharrisonlane.com/media/

https://soundcloud.com/specific-ambiguities/