THREE PIECES FOR MUSICIANS AND COMPUTER:

RAMEAUX, NATURE MORTE, MOIRÉ

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*Three Pieces for Musicians and Computer* implements a modular formal structure that allows the performers to experiment with the order and number of movements to arrive at their ideal combination. The piece is a collection of three solo works: *Rameaux, Nature Morte,* and *Moiré* for bass flute with b-foot, metal percussion (vibraphone, glockenspiel, and crotales), and clarinet (A and B-flat instruments) respectively. In addition to the original versions, an alternate version of each piece is included. The alternate versions add new performance elements to the original works: live electronics in *Rameaux* and *Nature Morte* and an acoustic quintet (flute, viola, percussion, piano and harp) in *Moiré.* These additions reframe the original works by introducing new harmonic, timbral, and formal connections and possibilities.

The compositional process of *Three Pieces* relies on the notion of Germinal Elements, which are defined as the set of limited, distinct, and indivisible materials used in the creation of the work. Though Germinal Elements are indivisible, they undergo a type of developmental process through expansion and contraction, which is an increase or a decrease in the range or scope of any musical parameter (time, pitch, density, dynamic, duration, etc.) or set of parameters. Analysis of this cycle of works reveals a variety of recombinations of four GE's as well as processes of expansion and contraction applied to multiple parameters of each GE to generate formal relationships within and between works.

Two electronics systems, the delay/harmonizer instrument and the live performance system are described both in technical and musical terms with specific examples given to show how the electronics influence and expand both the surface material and the formal structure of the work.
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PART I

METHODS AND ANALYSIS
CHAPTER I

INTRODUCTION

Three Pieces for Musicians and Computer: *Rameaux, Nature Morte*, and *Moiré* was composed from June 2007 to August 2008. Preliminary work, gathering of source materials, creating the interactive computer systems, sound design and construction took place at the Rice Electro-Acoustic Music Labs (REMLABS) and the UNT Center for Experimental Music and Intermedia (CEMI). The interactive computer systems used for live performance and sound design were created using Max/MSP\(^1\) Additional processing of soundfiles was done using Soundhack\(^2\). Sounds were edited using Peak LE\(^3\) and assembled using Logic Pro\(^4\).

THE ENSEMBLE

The work as a whole was conceived as a series of solos that could function as a multi-movement work. The decision to use flute, clarinet, and percussion was based primarily on the necessity to deliver certain promised-compositions. Lisa Bost-Sandberg, Rachel Yoder, and Julie Licata, to whom the pieces are dedicated, had each been promised works just as planning on the project had begun. During the composition of *Moiré*, the clarinet and computer

\(^{1}\) http://cycling74.com/products/mmjoverview
\(^{2}\) http://www.soundhack.com/freeware.php
\(^{3}\) http://www.bias-inc.com/products/peakLe6/
\(^{4}\) http://www.apple.com/logicstudio/
movement, the core ensemble of flute, clarinet, and percussion was expanded to a sextet to increase the available harmonic and melodic possibilities.

The use of an ad hoc ensemble may seem less than ideal, but it is not without precedent. In an interview with Rosanna Dalmonte, Luciano Berio jokes when asked if his Sequenzas came “into being by chance” stating that:

My first Sequenza for flute was composed in 1958 for Severino Gazzeloni, and it was certainly no chance that we were both going to Darmstadt at the time. Meeting up with the harp of Francis Pierre was no accident either, and my encounter with the voice of Cathy Berberian even less so.

OVERVIEW, MUSICAL MATERIALS, FORMAL STRUCTURES

Each of the works in Three Pieces for Musicians and Computer is paired with an alternate version of the same work. The alternate versions extend the timbral, harmonic, and formal range of the original work through the inclusion of live electronics or additional instruments. The pieces and their alternate versions are best described as modular movements that may be played as solos or combined to create a single movement or multi-movement work respectively. The modularity of the movements creates a multitude of possible orderings with

6 Berio, p. 90.
which the performers may experiment. This flexibility is also expressed in the smaller structure of the work as each of the pieces contains varying degrees of localized improvisation.

Each of the works in *Three Pieces for Musicians and Computer* is constructed from the same limited set of materials. These materials are referred to as Germinal Elements (G.E. 1-4) in the analyses and subsequent discussions. Each of the four Germinal Elements has a distinct character: the first is obsessive and single-minded, the second floating and placid, the third introverted and contemplative, and the fourth extroverted and confident.

Germinal Elements are not developed in the traditional sense, and they maintain their unique identities as they are presented over time. They cannot be broken down into constituent parts, they do not transform into one another, and they do not fragment and recombine to make hybrid elements. However, they are not static motifs that repeat *ad infinitum*: each of their musical parameters is malleable and may change through processes of expansion or contraction. Here the terms expansion and contraction mean an increase or a decrease in the range or scope of any musical parameter (time, pitch, density, dynamic, duration, etc.) or set of parameters.

Germinal Elements may also be varied. However, instead of the snowballing effect of a typical, cumulatively ornamented Classical variation, Germinal Elements are varied through subtle changes in their pitch, rhythm, and contour. Due to these subtle shifts, each variation is similar enough that distinguishing a ‘theme’ is impossible; at the same time, variations of a Germinal Element are different enough to be unique statements. In this respect, variation of Germinal Elements may be viewed as the variation of a particular musical state or space. In these states or spaces, change affects but does not fundamentally alter the material itself. This is not unlike like the effect motion has on a Calder mobile or within a Tinguely kinetic sculpture.
Germinal Elements are further distinguished by the way in which they are presented in time. Each of the Germinal Elements is developed to create an independent and distinct stream of music with an independent and distinct trajectory. The development of each Germinal Element is interrupted by the development of another. These interruptions are numerous and abrupt, and the constant shifting between them creates a fractured, non-linear narrative analogous to reading a number of books at once: when you put one down, the narrative stops, when you pick up another, the story resumes precisely where it left off.

These types of techniques are certainly not without precedent, and a great debt is owed to three earlier works that inspired them: Franco Donatoni’s *Fili*, Harrison Birtwistle’s *Carmen Arcadiae Mechanicae Perpetuum*, and Alban Berg’s *Three Orchestral Pieces, Opus 6*. The following discussion will illuminate the formal and developmental similarities and differences between these works and *Three Pieces for Musicians and Computer*.

The variation technique used in *Three Pieces* was modeled after the techniques used by Franco Donatoni in *Fili for flute and piano*. Though Donatoni’s techniques were not used rigorously in *Three Pieces*, the musical effect is similar. As in much of Donatoni’s music, variation in *Fili* is achieved through “the general principle of *rilettura* whereby the previous section of music is reread and varied.” In keeping with this *rilettura* principle, *Fili* contains various musical mechanisms that are wound up and allowed to run their course before a new mechanism is juxtaposed and ‘reread’. By articulating distinct musical ideas with very subtle variation, Donatoni creates a unique form where theme and variation are inextricable. The effect

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7 Development will from now on be used as a replacement for the combination of the terms expansion, contraction, and variation.
is one of a static musical energy that is constantly changing while simultaneously keeping its shape: like a multitude of fireflies caught in a jar.

The multi-narrative paradigm used in *Three Pieces* was patterned after Harrison Birtwistle’s *Carmen arcadiae mechanicae perpetuum*. In *Carmen*, Birtwistle uses “six mechanisms which are juxtaposed many times without any form of transition.” These materials “move from one mechanism to the other…When you go back to them you’re not back to where you left off, so something’s been going on in the meantime which you couldn’t hear…It’s as if the one block of music has done a journey in silence while another block of music is taking place.”

This process is similar to the one used in *Three Pieces* as both works contain multiple streams of music, and both develop limited material that may be ‘juxtaposed without any form of transition’. The difference between the two works lies in how these materials are revealed to the listener. *Carmen* uses a concurrent process with five of the ‘six mechanisms’ hidden at any given time. Dependent on the extremity to which they were privately altered, these mechanisms may be unrecognizable when they reemerge. Similarly, in *Three Pieces*, three of four Germinal Elements are hidden at any given time. In contrast, however, the development of a Germinal Element stops when it stops sounding. Thus the form and trajectory of the music are much clearer; the listener is returned “back to where they left off”. If the form of *Three Pieces* resembles reading several books in alternation, *Carmen* is like flipping channels beween several films on television: as we change channels, we may not recognize characters or situations as we are unaware of how the story has progressed in our absence.

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The structure of the work as a whole\textsuperscript{11} was created using ideas gleaned from Alban Berg’s \textit{Three Orchestral Pieces, Opus 6}. In \textit{Opus 6}, Berg extracts themes and inserts them into each movement. This permeability between the movements creates a complex, self-reflexive, and circuitous thematic structure. The relationships are so complex that any attempt to trace the origin of or the relationships between the themes is all but pointless. Derrick Puffett has expressed the problem:

\begin{quote}
[T]hough it is true to say that each movement takes up and develops material from the movements before, it would be just as true to invert the statement and say that each movement \textit{prefigures} music found in the next one: obviously there is a reciprocal process going on here, such as one finds in the \textit{Lyric Suite} (in other words, it is the \textit{Präludium} ‘quoting’ the \textit{Marsch} as well as the other way around).\textsuperscript{12}
\end{quote}

The multivalent nature of the material in \textit{Opus 6} is wildly different from the developmental structures of \textit{Three Pieces}. Though the resultant structures are different, the formal permeability of \textit{Opus 6} is mirrored in \textit{Three Pieces} as each of its movements necessarily prefigures material found in the next. This is implicit in the structure of the work: since each of the movements in \textit{Three Pieces} uses the same materials, is similar in its development, and may be juxtaposed with others, it becomes impossible to tell which of the movements introduces an idea and which develops it. Even though this type of modular structure is not what Berg created in his \textit{Opus 6}, \textit{Three Pieces for Musicians and Computer} could not have been realized without its example.

Each of the previously discussed ‘model works’ contains structures that result directly from each composer’s unique method of development, and a thorough discussion of these works

\textsuperscript{11} By whole, I mean the combination of movements to create a multi-movement work.

would necessarily entail a discussion of these methods. However, this may be an impossible
task. For instance, in *Fili*, as in many other works of Donatoni’s later ‘joyous’ period, Donatoni
desired that “the number of codes should stay secret and unknowable outside the composition
process itself.”

How are we then to unravel these codes (Donatoni’s name for his serial
processes) when it is the composer’s intention to hide them? In *Carmen*, despite Birtwistle’s
willingness to share the number of mechanisms and the method of their development, is it not
impossible to trace the journey of something we cannot hear or see? Due to the way in which
material is fragmented and recombined in the *Three Orchestral Pieces*, can the thematic
materials or a discussion of their manifestation of and within the larger form be definitively
shown? Though a thorough analysis of these pieces would require that these fundamental
questions be answered, if no new data emerged, the answers would certainly involve a degree of
subjectivity. Thus, if we are willing to analyze works that contain complicated and hidden
structures, we must be willing to make certain compromises. Mark DeVoto concedes this point
in the introduction to his analysis of the *Marsch* from *Opus 6*:

> It is well to keep in mind that the themes as given here have been assembled and
designated with a certain arbitrary exercise of choice, for it is often hard to decide, on the
basis of any criteria other than first appearance, whether or not a given melody is more
validly characterized by a collateral part, by a collateral harmony, by association with or
dissociation from other melodies that occur in succession with it, or by the degree to
which subsequent transformations (including fragmentations) are or are not
independently used.

It could be concluded that nothing meaningful would come from an analysis predicated on such
an extensive caveat, and it is true that the DeVoto analysis fails to produce an unequivocal

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13 Gorodecki and Donatoni, p. 249.
14 Mark DeVoto, Alban Berg’s “Marche Macabre”, in *Perspectives of new music* XXII/1-2
explanation of the movement; however, what the analysis lacks in pure analytic verity, it makes up for in descriptive relevance. In other words, though the analysis is incomplete, it is a valid and thorough description of DeVoto’s understanding of the thematic elements and their structural ramifications. Therefore, and in spite of its subjective slant, DeVoto’s descriptive analysis is a valuable glimpse into the connections and transformations of the thematic material contained in the Marsch even if it does or cannot illuminate Berg’s actual methods.

In the following analysis of Three Pieces for Musicians and Computer, I will give specific examples of the Germinal Elements and demonstrate how their contraction, expansion, and variation produce the formal structures of the movements. The previous discussions will serve as the basis for the analysis and will be referenced often. However, these discussions should not be read as the delineation of an overarching composition system; they simply describe the compositional ideas and parametric ranges used in the construction of the work, and any outlying data is welcomed and expected. Though the analysis will be predominantly descriptive, salient analytic structures will be discussed and no ‘codes’ will intentionally be hidden.
CHAPTER II

IDENTIFICATION AND ANALYSIS OF THE ACOUSTIC ELEMENTS

GERMINAL ELEMENTS

Germinal Element 1 is obsessive and single-minded. G. E. 1 consists of melodic material and establishes a pitch center that acts as a pivot around which the grace note figures orbit. Both regular and grace notes may be transposed to any pitch level, and regular notes may be of any length. An example of Germinal Element 1:

![Figure 1. Germinal Element 1 (G.E. 1)](image)

Germinal Element 2 is floating and placid. G.E. 2 is repetitive and consists of harmonic material. G.E. 2 consistently uses spatial notation to express repetitive structures. Moreover, spatial notation must be present to constitute an example of G.E. 2. An example of Germinal Element 2:
Germinal Element 3 is introverted and contemplative. G.E. 3 consists of melodic tremolandi material. G.E. 3 consistently uses metered notation which distinguishes it from instances of G.E. 2. An example of Germinal Element 3:

![Figure 3. Germinal Element 3 (G.E. 3)](image)

Germinal Element 4 is extroverted and confident. G.E. 4 consists of melodic material that may ascend or descend. G.E. 4 may be notated with regular notes or grace notes. G.E. 4 may be linear, disjunct, or a combination of the two. An example of G.E. 4:
ANALYSES

Rameaux

Rameaux’s title gives a hint as to how the piece is constructed. Various ‘branches’ of the material are presented and then developed as a set of juxtaposed variations. After one branch has been exhausted, a new one is introduced and the piece continues. The variations may overlap and even share elements. Variations are created in a number of ways. The first variation begins with the juxtaposition of Germinal Elements 1 and 2 (G.E. 1 + 2) (Figure 5).  

The attached analyses provide more insight into each of the pieces and should be used as supplements to the analyses that follow.
This idea continues with the expansion of the grace note range as it moves around the established G-axis. The introduction of G.E. 3 at measure 23 signifies the beginning of the dissolution of G.E. 1 + 2 which is complete at measure 42. The second variation consists of tremolo melodies (G.E. 3, mm. 43-54). The stark b-flats at measure 55 serve both as an ending to the second variation and as the initial impulse for the third variation. The third variation (m. 56-72) consists of G.E. 4, expressed as a dramatic passage in which a sequence of alternating minor sixth ascents and half-step descents heralds a nearly complete chromatic series (Figure 6).

**Figure 6.** Pitch-class set [0, 1, 2, 3, 5, 6, 7, 9, 10, e]. Rameaux measure 56.

The introduction of the trills at measure 73 interrupts the current variation before combining into a cumulative gesture (G.E. 2 + 4) at measure 86 (Figure 7). The passage from mm. 86-99 serves as the climax of the section before receding into silence.
The final variation from mm. 101-124 is a combination of Germinal Elements 1, 2, and 4. This section serves as the resolution to the tension created by the stark exposition of the Germinal Elements in the previous variations. G.E. 3 is conspicuously absent until its reappearance at measure 125. This statement of G.E. 3 creates a sense of unfinished arrival, not unlike a tonal half-cadence: it simultaneously completes the last variation and implies the possibility of a new one. This ambiguous ending type becomes a recurring element in the later movements.

**Nature Morte**

Like *Rameaux*, *Nature Morte* contains clues about its construction within its title. On the surface of the work, there are two competing elements: accelerating grace note passages\(^\text{16}\) (G.E. 4), and sustained sonorities (G.E. 2) (**Figure 8**).

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\(^{16}\) The performer is instructed either to play the grace note gestures as fast as possible or to accelerate through them. This instruction is the same for all grace note passages in all movements.
Figure 8. Opening of *Nature Morte*. Accelerating passage (G.E. 4) and sustained sonority (G.E. 2).

The form of *Nature Morte* follows the multi-narrative paradigm discussed in the introduction: it presents a series of separate and distinct musical narratives that are expressed concurrently. To elucidate the larger form, it is necessary to identify these narratives streams and show how each is developed.

The first narrative stream is the simple melody created by the eighth-note chords of the introduction. The melody is obfuscated by the juxtaposition of G.E. 2 and 4. Figure 9 shows the chords contained on pages 1 and 2 without interruption or octave-displacement. This narrative is complete at this point though a portion does reappear at the end without the juxtapositions/interruptions of G.E. 2 and 4.
The second narrative stream is created from G.E. 4. Throughout *Nature Morte*, G.E. 4 serves to both interrupt the other streams and/or set them in motion. However, this interruptive function belies the ultimate goal of the narrative. This goal is revealed after the long G.E. 4 passage that ends with G.E. 1 (Figure 10).

This passage occurs directly before the extended melodic line starting on page 7. During this section, the grace notes serve purely as melodic ornaments working to support the other Germinal Elements rather than interrupting them. This material builds toward its climax on page 9. The G.E. 4 narrative stream ends with an ascending melodic line that fades to nothing.

The third narrative stream is created from G.E. 2. There are five of these frozen or ‘still’ passages whose stasis is maintained consistently, with just one exception (a G.E. 4 interruption).
During these passages the harmonic and dynamic ranges are expanded and contracted. Like the G.E. 4 narrative, the G.E. 2 narrative also has a hidden goal. This goal is established on page 6 where the G.E. 2 phrases are suddenly given in time and their expressive qualities revealed. This shift in mood does not last long, and, just as the passage is reaching its climax, the expressive phrases stop and return to another ‘frozen’ instance of G.E. 2. G.E. 2 continues on page 8, but this time serving as melodic material. The final example of G.E. 2 occurs after the restatement of the opening melodic chord material. Like the G.E. 3 found at the end *Rameaux*, the G.E. 2 material at the ending of *Nature Morte* serves as a quasi half-cadence and creates an unstable conclusion.

*Moiré*

In contrast to the variations of *Rameaux*, or the broken narrative of *Nature Morte*, *Moiré* is a study in timbre framed within various harmonic states of spaces. Aspects of Moiré were inspired by the playing of the shehnai virtuoso Ustad Bismilah Khan, in particular the fluidity of the bends, slides, and microtonal inflections one hears in his recordings.

Much of the pitch material used in *Moiré* is created from the set class (0 1 5 6). This set class was extracted from the variation that occurs from measure 61 of *Rameaux* (**Figure 11**).
The set class (0 1 5 6) occurs throughout the piece in a variety of transpositions, registrations, and orderings.

The opening page of Moiré bears a resemblance to the opening of both Rameaux and Nature Morte and may be viewed as the combination of the two as it fuses the grace note interjections of Nature Morte with the timbral inflections of Rameaux (Figure 12).
The opening passages consist entirely of alternations between G.E. 2 and G.E. 4. At the end of first page, the initial appearance of G.E. 1 occurs serving as the transition to the next section.

The second page contains the first ‘harmonic state’ passage as well as the initial entrance of the additional quintet. Harmonic state passages are sections in which the combined effect of all the parts is one of rhythmic suspension where unpredictable bursts of frenetic melodic energy are set against a static harmonic landscape. During this section each of the instrumentalists and the conductor has a special set of instructions unique to their instrument or group of instruments.\textsuperscript{17} The slow tempo of the passage coupled with the length and rhythmic nature of the phrases work against the establishment of a defined pulse.

\textsuperscript{17} See the performance notes of Moiré for complete instructions to each of these sections.
The harmonic state passage on page 2 consists mainly of G.E. 1 and 2 with the occasional entrance of G.E. 4 in the flute and viola parts. The clarinet is instructed to play mainly from the first boxed cells (quiet examples of G.E. 1). The clarinet soloist is also instructed to occasionally overblow through the harmonic series (G.E. 2) and or produce a ‘squawking’ sound. This squawking interjection does not fit any of the germinal element archetypes and is referred to as Element X in the attached analysis (Figure 13).

Figure 13. The first solid box contains examples of G.E. 1. The two overblown harmonics (arching lines) and two squawking sounds (square noteheads) are examples of G.E. 2 and Element X respectively.

The predominance of G.E. 2 makes the entirety of the harmonic state passage a composite example of G.E. 2. This composite serves as the harmonic/timbral background against which G.E. 4 and Element X are framed.

The clarinet bursts into the next section with a statement of G.E. 1 (a variation of the opening section of Rameaux this time with the pivot played first) and erupts in a glissandi climax before settling on a fading instance of G.E. 1 (Figure 14).
An extended computer solo follows that uses materials from the opening. The clarinetist cues the next section with a trill and a string of inverted examples of set class (0 1 5 6) (**Figure 15**).

**Figure 15.** Excerpt from *Moiré* page 4. Set class (0 1 5 6) in inversion. Transposition relationships between the figures are also shown.

Pages 4 and 5 contain the first entrance of G.E. 3 which serves as transitional material into the second harmonic state passage found on page six. Like the first harmonic state passage, the second also contains a set of instructions for each of the individual instrumentalists as well as
During this section, the clarinet part contains slid and bent melodic fragments (G.E. 2). The harp and piano reinforce the harmonies established by the computer and serve as the harmonic support for the clarinet phrases. The flute and viola parts are constructed from the set class (0 1 5 6) and serve as harmonic and rhythmic counterpoint to the clarinet material. Unlike the previous state passage, the increased tempo coupled with the patterns found in the percussion has the potential to establish a defined pulse.\(^1\) The clarinet changes from the boxed pattern and plays the quarter-note triplet phrases to signal the movement to the next section.

After the brief transition/climax on page 7, the clarinetist begins an extended ‘cadenza’ on pages 8 and 9. Page 8 consists of G.E. 2 with brief G.E. 1 interjections. As the cadenza appears to be winding down, it is suddenly restarted with the sudden computer hit on page 9. After the hit, the clarinetist improvises with G.E. 1-4 before launching into an extended G.E. 4 passage. On page 10, G.E. 3 in the clarinet builds to the final entrance of the quintet. *Moiré*, like *Rameaux* and *Nature Morte*, ends with an ambiguous cadential passage, this time using a decelerating G.E. 4 phrase before receding into silence.

**CONCLUSION**

The previous analyses show how each of the movements was conceived and composed, and how their structures are revealed over time. As *Rameaux*, *Nature Morte*, and *Moiré* share the same Germinal Elements and even quote one another, the interconnections between the movements are complicated and ambiguous. As will be shown, the inclusion of electronics further adds to this interconnectivity. However, before discussing how the electronics expand

\(^1\) The percussionist is given the option to establish the pulse or not.
the relationships between the pieces, it is first necessary to explain the electronics systems
themselves. The following discussion will explain some technical aspects of the systems, and
put the resulting musical effects into their context within the compositional scheme of the work.
CHAPTER III

THE ELECTRONIC SYSTEMS

The two electronic systems were created with specific musical goals in mind. The first system was designed to produce cascading phrases and/or melodic lines that would chase the performer’s input in a loosely canonic way. These ‘canons’ would have the potential to speed up or slow down exponentially as well as maintain a consistent pulse. Further variation of the gestures would be possible through changes in pitch and dynamic. The second system was designed to be a live performance environment that could process and react to performer input, play back soundfiles, and mix all of these elements to create a sense of depth and separation between the layers. Once created, each system revealed unforeseen limitations as well as unexpected uses.

DELAY/HARMONIZER INSTRUMENT

The first system was initially intended to be the live performance environment. It contains a 32-tap delay/harmonizer instrument, a granular resynthesis instrument, and a soundfile playback system that may be triggered by any of the delay taps. A diagram of the system (Figure 16):
Figure 16 Basic flowchart of the delay/harmonizer system.
Though the system produced the desired musical effects, a number of factors precluded its use as a live performance environment. First, when the entire system was in use, its CPU usage was unstable, which made it susceptible to crashes. Second, the system was excessively level dependent: input into the system had to be within a narrow range of amplitude or else the resulting gesture might be frail, underwhelming, or even virtually nonexistent. Furthermore, if the input level was too low, the delay based soundfile playback system would not trigger consistently. These factors greatly increased the chances of an unsuccessful live performance, and, ultimately, the system was used only to create sound files for live playback.

The delay/harmonizer instrument uses 32 delays taps that may be distributed in three ways: becoming exponentially closer, exponentially farther apart, or spaced evenly. These distributions may occur over the range of 100ms to one minute. Figure 17 shows a diagram of the delay/harmonizer instrument and Figure 18 shows the user interface for the delay unit.

![Diagram of the delay/harmonizer instrument](image)

**Figure 17.** An overview of the delay/harmonizer instrument.
Figure 18. Delay interface used to set the length of the delay line, the number of taps, and their distribution (in this case, 32 taps speeding up exponentially over 4000ms). The patcher to the right does the calculation for the distribution,

Each of the taps is routed into a separate harmonizer that may be used to create new melodic material from the input. These harmonizers may also be fed back into themselves to create arpeggio-like patterns. Figure 19 shows the interface for the harmonizer section of the instrument.
Figure 19. The controls for the harmonizer units used in the delay/harmonizer instrument.

The volume and panning for each of the taps of both the delay and harmonizer sections of the instrument are implemented using the Max/MSP matrix~ object, a simple but flexible matrix mixer (Figure 20).
LIVE PERFORMANCE ENVIRONMENT

In contrast to the usual interactive paradigm in which a highly specialized system is created for each new work, *Three Pieces for Musicians and Computer* implements the same live electronics system in each work. **Figure 21** contains an overview of the system.
Figure 21. Basic flowchart of the live performance patch.
As illustrated in Figure 21, input into the system may be divided into two parts: post EQ input and enveloped input. Using the 2x8 matrix mixer, the equalized and/or enveloped input is selectively passed to the system. The envelope system contains six separate envelopes triggered by six separate pitches that allow input to pass when any of the six MIDI note numbers are received from the pitch-tracking system. Figure 22 shows one of the six envelope input systems.

Figure 22. The buffer and internal patch for each of the six envelope systems.

The effects system consists of four separate units (FX1, FX2, FX3, and Harms). Three of these units (FX1, FX2, FX3) are identical. Each FX unit contains five instances of flanger-style

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19 Pitch tracking was done using CNMAT’s pitch~ object.
variable delay processor along with controls for changing the output level, panning, delay time, feedback level, modulation depth, and modulation speed of each (Figure 23).

**Figure 23.** Multi-use polyphonic flanger patch.

The harmonization unit (Harms) is an amplitude-controlled harmonizer. Input signal is routed via a matrix mixer to a bank of eight harmonizers; the amplitude of the input signal determines the number of harmonizers to which signal is passed. Thus, the performer may expand and contract the harmonizer chord through dynamic variation, making harmony a function of dynamics. Each of the harmonizers has unique volume and panning controls. Figure 24 shows the harmonizer system.
Figure 24. Amplitude controlled harmonizer system used in the live electronics system.

The live-electronics system also contains four stereo and two mono soundfile players. The amplitude of the input signal from a performer may be used to control the playback speed and level of these soundfile players. Each of the mono players may also be sent to a separate auto-panner that is also controlled by input amplitude. Figure 25 shows the entire live electronic system.
Master Control: panning and volume controls for the entire system. Also contains controls for all of the pattr preset systems.

Figure 25. Flowchart of the complete live electronic system. Solid lines indicate audio signals and dotted lines indicate control data.
The entire system is controlled from the input mixer patch. From the input mixer, the user may control EQ and envelope input, amplitude following for each of the EFX and soundfile playback systems, pre and post fader reverb sends, FX1-3 presets, and the overall volume of each system. **Figure 26** shows the input mixer system.

![Figure 26](image)

**Figure 26.** Input mixer system. Control station for the live electronics patch.

Due to the complexity of both the mixer and effects, a control system was created to store, change, and morph between presets. The preset system was implemented using the Max/MSP pattr objects, a group of objects that allow settings within a patch to be saved and

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20 This preset system was also used to change the panning and level controls in the delay/harmonizer instrument.
recalled. This preset system allows the user to recall presets immediately or morph between presets over a specified amount of time. For instance, the message ‘FX1 2000 2001 4000’ would morph the FX1 patch from preset 2000 to 2001 over 4000 milliseconds while the message ‘FX1 2001’ would change the FX1 patch to preset 2001 immediately. The effects and the mixer have unique preset systems, and each system may be controlled independently. This creates a more flexible environment than would be possible with a single interlocking environment controlled by a single preset system. For performance, these presets are recalled and the live electronics patch is controlled with a qlist object, a Max/MSP object that allows the user to store a series of messages and advance them sequentially. **Figure 27** shows the mixer patt system.²¹

![Figure 27](image)

**Figure 27.** Input mixer patt system. Identical systems are used for FX 1-3.

²¹ Besides receive names, FX1-3 patt storage systems are identical to the mixer patt system.
The electronics systems in *Three Pieces* expand and reframe the musical material found in each of its component works. This will not be a blow-by-blow account, but will instead focus on the most influential ways in which the electronics inform the construction of each of the works.
CHAPTER IV

ELECTRO-ACOUSTIC INFLUENCE

SOUNDFILE CREATION

As was mentioned in the previous chapter, the delay/harmonizer instrument was used to create soundfiles for each of the works. With the instrument, it was possible to create accelerating or decelerating phrases using the same pitch material found in the instrumental parts. These phrases were varied using octave displacement and/or by increasing or decreasing the overall length of the gesture. Once recorded, the phrases could be combined to create complex variations of the instrumental pitch material. These phrases were used in varying degrees in each of the works, and serve as a connection between the pitch world of the computer and the performer. As it is only necessary for the performer to line up with these phrases in an approximate way, the phrases were not notated specifically, and a simplified notation was created to express them. **Figure 28** shows an example of this notation.

![Figure 28](image)

**Figure 28.** Notation used for decelerating and accelerating gestures. Boxed materials contain the pitches and contour used for the gesture.
SOUNDFILES AND THE LIVE PERFORMANCE SYSTEM

Acoustic material from each section of Rameaux and Moiré was recorded and then processed using the same system used in real time during performance. A montage of these processed instrumental soundfiles was created and then placed back into the middle of the works. Since the soundfiles contain material from later sections of the work, they prefigure the music that is to come. This foreshadowing technique is also extended to the works as a whole. For instance, Rameaux and Moiré use the same soundfiles within each of the works, and, though there are slight variations in the sound and placement of these files, they are unmistakably similar. Thus, when Rameaux is performed first, the soundfiles prefigure music from Moiré, and when Moiré is first, the soundfiles prefigure music from Rameaux. To better explain this, two of these soundfiles will be traced through both of the works.

In Rameaux, one of these soundfiles is triggered after the f-sharp in measure 55. This soundfile serves as transitional material and is used to connect the two flute variations. The soundfile begins with phrases that the flute performed during the previous variation. To intensify the connection between the soundfile and the previous variation, the opening of the soundfile is processed with the same effects setting that was just applied to the live flute. As the soundfile continues, melodic and rhythmic material from the subsequent variation is introduced, and the soundfile becomes increasingly dense and noisy. This last section of the soundfile is processed using the settings applied to the live flute in the next variation. By constructing and processing the soundfile in this way, the music prefigures both the acoustic and the electro-acoustic material of the next variation. This creates new formal and timbral relationships that

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22 In this chapter, refer to the electro-acoustic versions of the scores.
could not be achieved by the flute alone. A section of this same transitional soundfile is used during the ‘cadenza’ of Moiré (page 9). Here the soundfile serves as frenetic counterpoint to the clarinet cadential material and does not undergo any changes.

A similar connection is created between Moiré and Rameaux. Like the Rameaux example, the transitional soundfile from Moiré (page 3) contains material from both previous and upcoming sections. Once again, the opening of the soundfile is processed using the settings that the clarinet has just used, and, as the soundfile becomes increasingly aggressive, the remainder of the file is processed with the upcoming clarinet setting. This soundfile also appears in Rameaux (measure 101-end), but this time it serves as the harmonic support for the last flute variation.

Relationships generated by electronic sounds create a great deal of structural permeability between the works. Though this multivalent structural paradigm is in contrast to the immutable nature of the Germinal Elements, the two approaches work together to strengthen the relationships between the movements in ways that neither approach could accomplish singularly.

EXPANSION OF TIMBRE

The electronics also expand the timbre of each of the instruments. Though this occurs to a degree in Rameaux and Moiré it is most notable in Nature Morte. Despite the homogeneity of the orchestration, Nature Morte is timbrally complex, and, when all of the instruments are sounding, a rich and shimmering landscape is created. This richness is due to the imperfections
in tuning between the instruments, and is most noticeable during the ‘frozen’ passages where the instruments are allowed to remain on a sustained harmony. To enhance the dreamlike effect of these purely acoustic passages, multiple flangers with unique speeds and depths were used. This effect, coupled with a slight amount of auto-panning, creates a subtle extension of the naturally occurring harmonic relationships between the instruments.

HARMONIC EXPANSION

The live electronics extend the harmonic palette in each of the works. This is accomplished using the harmonizer section of the live processing environment and using the soundfiles created with the delay/harmonizer instrument. As was discussed in the chapter three, the harmonizer section of the live performance environment is an amplitude driven harmonizer. This means that higher and lower input levels from the live performer expand and contract the range of the chord respectively. This is effect most striking in the opening of *Rameaux* where the bass flute’s microtonal inflections slowly changes the focus of the harmonizer’s chord (Figure 29).
This addition reframes the flute material and establishes a concrete harmonic structure that had previously only been implicit. Though this effect also occurs on page 6 of *Moiré*, since both versions of *Moiré* contain identical computer parts, this effect is present in both works and should not be considered an example of harmonic expansion.

The computer harmonies create new relationships between the acoustic and electro-acoustic materials. Though this occurs in each of the works, the most dramatic reframing of materials happens in *Nature Morte*. Besides the incidental harmonies created by the addition of the accelerating/decelerating gestures, the harmonic structure of *Nature Morte* remains unaffected by the addition of the computer. However, a shift occurs at page 7 after the long grace note gesture in the vibraphone. After this gesture, the computer introduces sustained harmonic material that reframes the previously non-tonal percussion part within a quasi-diatonic background. These harmonies continue until the end of the work, and profoundly reshape both the harmonic and gestural material of the purely acoustic percussion part.
CONCLUSION

The addition of live electronics to the acoustic versions of the movements creates significant changes on both the surface and the deeper structural levels of the work. Furthermore, by expanding the harmonic, gestural, and timbral palette of the acoustic works, the electro-acoustic versions alter and expand the structural relationships both within and between each of the movements. The previous discussion omits many possible examples; for example, the introduction of periodic rhythms by the computer on page 7-8 of *Nature Morte* is one of the only instances—and by far the longest—where a distinct pulse may be felt). The most far-reaching and significant examples have been explained. In order to discuss these techniques further, new works with entirely new relationships will need to be created. With this in mind, I present the following discussion of future projects for and enhancements to the acoustic and electronic systems discussed in the previous chapters.

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23 Both the rhythms and harmonies of this section were created using delay/harmonizer instrument with the ‘evenly spaced’ setting.
CHAPTER V

FUTURE WORK

FURTHER INTEGRATION OF PERFORMER INPUT

Performer input could be further integrated by increasing the number of parameters that they control and the means by which they control them. Currently, performer’s dynamics may control auto-panning speed, soundfile levels, and input into the harmonizer system while pitch triggers allow input to pass to the effects systems. These ideas could be expanded to include tracking of composite gestures. For instance, instead of responding to single instances of a pitch trigger, the system could respond to melodic sequences and/or contours. These same ideas could be applied to volume by tracking crescendos and decrescendos or other composite dynamic contours. This could be especially effective during the improvised sections of the work as the computer could react differently to the various phrase choices the performer made. Also, by tracking new parameters such as spectral energy and note onsets, it would be possible to identify certain extended playing techniques (e.g. overblown passages, tongue rams, key clicks, etc.).

DATA COLLECTION

Collection and analysis of data will be implemented using the SQLite object in Max/MSP 5. This will require porting the project to Max/MSP 5 as the SQLite object is a new addition to
the file structure of the program. The data would be gleaned from the performer input during the improvised sections of the work and stored in an SQL database. Once collected, the data could be analyzed to reveal the statistical distribution of performance choices, and the live electronic system could then be customized to suit individual tendencies. This paradigm would make it possible to create wholly improvised works that become increasingly personalized with each performance.

FORMAL IMPLICATIONS

As has been discussed, the separate movements may be combined and performed in any order to create a single or multi-movement work. This creates over 700 possible combinations of the movements. The following chart shows the method for determining these permutations:

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24 [http://cycling74.com/story/2008/9/5/16230/12047](http://cycling74.com/story/2008/9/5/16230/12047) from the tutorial *Data Collection: Building Databases Using SQLite* by Andrew Benson. Note: I have studied the SQL object in Max 4 and implemented SQL databases before the release of Max 5. Though this can be done in Max 4, the integration and support that Max 5 offers for database data collection makes it the obvious choice for future work.
Figure 30. Possible permutations of the movements. 15 possible for the first movement, 10 for the second and 5 for the third for a total of 750 (15 x 10 x 5). The ‘all movements excluded’ option is subtracted.

With each of these permutations, the internal relationships between the movements are profoundly changed. Due to the large number of permutations and the complexity of their interrelationships, it becomes unfeasible to accurately determine which ones will be most successful. Though this lack of control could be viewed as a liability, a certain amount of ambiguity has been ‘composed into’ each of the movements allowing them to function this way. In other words, the way in which the Germinal Elements are developed yields a fluid structure in which beginning, middle, and end are interchangeable. So, just as Rameaux’s variations are an example of Donatoni’s rilettura principle, each of the movements is in fact a ‘rereading’ of the Germinal Elements themselves, and, as each of the Germinal Elements is distinct and whole, it does not matter which movement introduces them.
These types of modular structures will be explored further, and new pieces are planned where sections may be inserted, taken out, or mixed around within the modular movements. This would allow performers to choose among a series of inner sections to arrive at their ideal combination. By extending the modular principle to include both internal sections and complete movements, an exponentially greater number of permutations would be possible.

CLOSING REMARKS

_Three Pieces for Musicians and Computer_ explores and combines ideas that have been of interest to me for a number of years. These ideas include non-linear formal structures, structural multiplicities, modular formal structures, controlled improvisation, extended instrumental technique, and the extension of instrumental timbre with electronics. Though the piece utilizes all of these concepts in varying degrees, all of them invite much further exploration. In light of this, _Three Pieces for Musicians and Computer_ is both a complete work and the foundation for future work or, more accurately, the first stage in a series of works. Similarly, the previous chapters are both the illumination of a compositional process and the unique opportunity to stop this process to ask fundamental questions: What are the materials? How _exactly_ are they being used? What is the process of their development? What structures does this process yield? Though these questions have been answered to the best of my ability, it is likely that some details were consumed by the white heat of creation. Thus, as reflective distance grows and more work is done, it is certain that new relationships, new possibilities, new constraints, and new questions will be revealed.
BIBLIOGRAPHY


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PART II

ANALYSES, ELECTRO-AcouSTIC SCORES, ACOUSTIC SCORES
ANALYSES
**ANALYSIS**

**RAMEAUX**

for Lisa Bost Sandberg

Chapman Welch, 2007

First variation

\[ \text{G.E. 1+G.E. 2} \quad \text{violently} \quad \text{G.E. 1+G.E. 2} \]

G.E. 1+G.E. 2 continues varying in length of each expansion of range

Expansion to f-sharp (signals end of range expansion)

G.E. 3 beginning of dissolution of G.E. 1+2

* Make the gesture as long as possible (at least 7 seconds).
G.E. 1 + G.E. 3

Gradual movement toward G.E. 3.

Pivot shifts from G to F-sharp here and continues through next section.

F-sharp becomes 'stuck' (no longer a pivot).

More juxtaposition of G.E. 3 with less instances of G.E.1.

G.E. 3. Variation Two

G.E. 4. Third variation

Pcs \{0, 1, 2, 3, 5, 6, 7, 9, t, e\}

Pcs \{5, 6, t, e\} subset of Pcs \{0, 1, 2, 3, 5, 6, 7, 9, t, e\}

F-sharp interjection transposed to B-flat

end of second variation

impulse for third
G.E. 4. \[\text{Pcs}[0, 1, 2, 3, 5, 6, 7, 9, 10, e]\] continues
G.E. 4 moving toward composite gesture G.E. 2 + G.E. 4

* Take the shortest breath possible between each trill/gliss.
Last statements of Composite Gesture
G.E. 2 + G.E. 4

Fourth variation G.E. 1, 2, 4

G.E. 1 G.E. 2

G.E. 4

F-sharp interjection moves to B-flat
[0, 1, 2, 3, 5, 6, 7, 9, 10, e]Pcs continues moving toward composite gesture G.E. 2 + G.E. 4notated instead of spatial serves as interruption

Composite Gesture
Last statements of G.E. 1, 2, 4
G.E. 1, 2

G.E. 3 completes variation and implies continuation
G.E. 4 Second narrative stream. Serves as interruptive material throughout aggressively, without warning

\[ \text{\textit{G.E. 4}} \]

\[ \text{\textit{G.E. 2 (role expanded later)}} \]

\[ \text{\textit{G.E. 2 etc.}} \]

\[ \text{\textit{ANALYSIS}} \]

\[ \text{\textit{First narrative stream}} \]

\[ \text{\textit{ca. 6"}} \]

\[ \text{\textit{ca. 6"}} \]

\[ \text{\textit{ca. 4"}} \]

\[ \text{\textit{ca. 6"}} \]
* Play boxed notes evenly. Move between crotales and glockenspiel without changing the four note pattern.
G.E. 2  Second 'frozen' passage

pitch expansion

G.E. 4  only interruption of third narrative

pitch expansion
Move between crotales and glockenspiel without changing the four note pattern.
G.E. 2  Fourth ‘frozen’ passage (continued)

pitch expansion

ca. 4"

ca. 4"

ca. 4"

G.E. 2  Fifth ‘frozen’ passage

ca. 6"

ca. 2"

ca. 2"

64
G.E. 2  Fifth ‘frozen’ passage continued, but now in time. Hidden goal of third narrative stream revealed.

\[ q = 80-90 \]

freely, rhapsodic

\[ q = 50-60 \]

G.E. 2 outlying notated version

\[ q = 50-60 \] ‘frozen’ interruption

frozen
‘Frozen’ interruption continued

G.E. 4

Second ‘frozen’ passage

G.E. 2

Suddenly faster

Third ‘frozen’ passage

G.E. 1

Interruption

| 66 |

G.E. 4 second narrative revealing true nature

G.E. 2

Extended melodic line with G.E. 4 serving as ornaments as well as melody

G.E. 1

freely, expressive

\( \frac{1}{8} \)q = 50-60

66
After playing the entire phrase one time, play boxed patterns in any order. Become increasingly aggressive (crescendo and accelerando).
Climax of melodic line and second narrative stream

molto rit.

(molto rit.)

End of second narrative stream

(fading away)

First narrative returns briefly (continues)

(Quasi G.E. 2)

Allusion to other frozen states, but quickly dissipates

G.E. 1

ca. 4”

ca. 6”
First narrative continued

Third narrative returns. Unstable cadence.

G.E. 2

pitch expansion

ca. 15-30"

* Repeat boxed pattern evenly with no accents.
Moiré
for Rachel Yoder
chapman welch, 2008

G.E. 2 overlapping from Nature Morte

ANALYSIS

Clarinet in A

Computer

drone volume controlled by clarinet volume

A Cl.

Comp.

G.E. 2 + 4

G.E. 1

\[
q = 50-60
\]
Dotted lines used to avoid confusion with other boxes

The cumulative effect of all the within the ‘state passage’ is G.E. 2

clarinet cues next section

attacca
Variation of G.E. 1
(inversion of Rameaux pivot gesture)

Change to B♭ clarinet during this section

15″-1’00″

Phrases turn to noisy gestures
Supported with a full sound

\( q = 120-130 \)

New rhythmic material. Could establish pulse.

Set class \((0 1 5 6)\)

Harmonic support

G.E. 3 becomes G.E. 2

G.E. 3

G.E. 3/2

B♭ Cl.

Fl.

Vla.

Crt.

Vib.

Perc.

Hpd.

Pno.
Set class (0 1 5 6) 1'00" - 2'00"

G.E. 4

1
2
3
4

Harmonic Support

Free

Fl.
Vla.

rhapsodic, legato

Clarinet cues next section

Melodic G.E. 2

Harmonic Support
Reorchestration of *Nature Morte*

G.E. 2 ‘frozen’ interruption

G.E. 2

G.E. 2

G.E. 2

G.E. 2

G.E. 4

G.E. 4

G.E. 4

G.E. 4

G.E. 4

G.E. 4

G.E. 4

G.E. 4

G.E. 4

G.E. 4
very aggressive, freely

G.E. 2

10"

G.E. 1 (inverted pivot)

6"

all boxed figures controlled by clarinet volume

8"

4"

2"

8-10"

noise
Play boxed material in any order. Elements may be repeated any number of times and every element need not be played. Spatially notated material may be of any length. Create a frantic cadenza that leads to the next system. (30"-?)

G.E. 1, 2, 3, 4 counterpoint to computer G.E. 4

Agitated, processed flute phrases

Clarinet cues next section

G.E. 4 continues

G.E. 4 continues
delays and reverb.
ELECTRO-ACOUSTIC SCORES
RAMEAUX
for bass flute and live electronics

chapman welch, 2008
Notes to the performer

A bass flute with a B foot is needed for the piece. If one is unavailable, a notated B3 may be subsituted with C4 bent down as far as possible. Unless notes are repeated, accidentals affect only the notes they precede.

Special Notation

Flute

Held lip bent note. Bend the note a quarter-tone above and below (wavey line) the original itch (straight line)

Quarter tone bend down or up

Computer

Boxed material ends

Boxed material continues until noted
Technical Requirements

Computer

The computer used for the creation and performance of the piece was a MacBook Pro 2.4 GHz Intel Core 2 Duo with 4GB 667Mhz DDR2 SDRAM. The average DSP Status ranged from 30-40% with an I/O and signal vector size of 32 at a sampling rate of 44100.

Miking

One condenser mic placed 6-12” above the main body. A second condenser mic may be used closer to the head joint (6-12” above) if more of an attack sound is desired.

Sound Requirements

3-4 mixer inputs are required depending on the number of mics used. Miked Input and Computer Input should be kept separate to create a wet/dry mix. The overall balance should be equal with a slight boost in the Miked Input if needed.
Drone volume controlled by flute volume.

Harmonizer chord with (x) input (here G).

This relationship continues through the section.

* Make the gesture as long as possible (at least 7 seconds).
harmonized chord with drone
triggers delay/comb input
with Delay and Reverb

FM noise controlled by input volume

flutist cues next section

Taped flute phrases begin

Becoming more aggressive/noisy
aggressively

short, slapback delay throughout
delays

white noise

Comp.
short, slapback delay delays
white noise
* Take the shortest breath possible between each trill/gliss.
NATURE MORTE
for percussion solo and live electronics

chapman welch, 2008
Notes to the performer

Unless notes are repeated, accidentals affect only the notes they precede. All grace note figures may accelerate exponentially or be played as fast as possible.

Special Notation

Percussion

Stop playing boxed material

Continue playing boxed material

Computer

phrase speeding up exponentially

phrase slowing down exponentially

multiple phrases slowing down and/or speeding up exponentially
Technical Requirements

Computer

The computer used for the creation and performance of the piece was a MacBook Pro 2.4 GHz Intel Core 2 Duo with 4GB 667Mhz DDR2 SDRAM. The average DSP Status ranged from 30-40% with an I/O and signal vector size of 32 at a sampling rate of 44100.

Miking

Two to three condenser mics should be used. If using three mics, mic the higher and lower registers of the vibraphone with two mics 2-3’ above the bars and another mic 2-3’ above the crotales and glockenspiel. If using two mics, mic the vibraphone 2-3’ 2-3’ above the bars and place another mic 2-3’ above the crotales and glockenspiel.

Sound Requirements

4-5 mixer inputs are required depending on the number of misc used. Miked Input and Computer Input should be kept separate to create a wet/dry mix. The overall balance should be equal with a slight boost in the Miked Input if needed.
Nature Morte
for Julie Licata
chapman welch, 2008

Crotales
aggressively, without warning

Glockenspiel

Vibraslap

1. Inits
2. Computer
slapback delay and reverb
delay and reverb continue until noted otherwise

3.

4.
* Play boxed notes evenly. Move between crotale and glockenspiel without changing the four note pattern.
* Move between crotales and glockenspiel without changing the four note pattern.
rhythmic, undulating

* After playing the entire phrase one time, play boxed patterns in any order. Become increasingly aggressive (crescendo and accelerando).
* Repeat boxed pattern evenly with no accents.
MOIRÉ

for solo clarinet (B-flat and A), live electronics, and optional ensemble

chapman welch, 2008
Notes to the performer

Unless notes are repeated, accidentals affect only the notes they precede. All grace note figures may accelerate exponentially or be played as fast as possible.

Instructions for pages 2 and 6

Page 2

The first solid boxed materials should be played more with the occasional insertion of second boxed materials.

Page 6

Play through entire phrase once before creating new phrases from boxed materials.

Special Notation

Shape mouth to form vowels while sustaining notated pitch

Bend up to and around a note (ranges are notated approximately)

Short, intense overblown note

Quickly fall off pitch

Overblow through harmonic series without maintaining fundamental

Overblow through harmonic series maintaining fundamental

Stop playing boxed material

Continue playing boxed material
Instructions for Page 2

Conductor
The conductor begins the count before or after the clarinetist begins their boxed patterns. The conductor may give density cues (cue to play more gestures) to groups and individual instruments, but they may not cue entrances directly. The clarinetist gives a cue to begin the next section, and the conductor must cue the piano chord slightly before the clarinet begins.

Flute and Viola
Play any of the three boxed gestures on any of the four beats. It is not necessary to synchronize which gestures are played. A designated leader cues the entrances for the beginning of gestures. The number (density) of entrances are up to the designated leader. The conductor may give density cues (cue to play more gestures), but does not give entrances. The conductor also cues the end of the page. The end should be as abrupt as possible, and should stop even if the current phrase is incomplete.

Percussion
Play the rolled figure or any of the boxed pitches (singly in any register) on any of the four beats. The number (density) of entrances are up to the performer. The conductor may give density cues (cue to play more gestures), but does not give entrances. The conductor also cues the end of the page.

Harp
Play any of the four boxed gestures on any of the four beats. The number (density) of entrances are up to the performer. The conductor may give density cues (cue to play more gestures), but does not give entrances. The conductor also cues the end of the page.

Piano
Play any of the four boxed gestures on any of the four beats. The number (density) of entrances are up to the performer. The conductor may give density cues (cue to play more gestures), but does not give entrances. The conductor also cues the end of the page.
**Instructions for Page 6**

**Conductor**
The conductor begins the count before or after the clarinetist begins their boxed patterns. The conductor may give density cues (cue to play more gestures) to groups and individual instruments, but they may not cue entrances directly. The clarinetist gives a cue to begin the next section, and the conductor must cue the final boxed material for the flute, viola, harp, and piano during the extended c-sharp glissandi in the clarinet part.

**Flute and Viola**
Play any of the four boxed gestures on any of the four beats. A designated leader cues the entrances for the beginning of gestures and also cues which gestures are to be played. The number (density) of entrances are up to the designated leader. The conductor may give density cues (cue to play more gestures), but does not give entrances. The conductor cues the final boxed material during the extended c-sharp glissandi in the clarinet part.

**Percussion**
Play any of the phrases as written. Phrases may be repeated as many times as desired and may even establish a rhythmic pulse. The number (density) of entrances are up to the performer. The conductor may give density cues (cue to play more gestures), but does not give entrances. The conductor cues the next section.

**Harp and Piano**
Play the boxed figures in order as instructed (starting from nothing, crescendo, and fade to nothing over 5-15 seconds with 1-8 seconds of rest). A designated leader cues the entrances for the beginning of gestures. The conductor cues the final boxed material during the extended c-sharp glissandi in the clarinet part. This should be played immediately even if the current phrase is incomplete or all boxes have not been played.
Technical Requirements

Computer

The computer used for the creation and performance of the piece was a MacBook Pro 2.4 GHz Intel Core 2 Duo with 4GB 667Mhz DDR2 SDRAM. The average DSP Status ranged from 30-40% with an I/O and signal vector size of 32 at a sampling rate of 44100.

Miking

One condenser mic placed 2-3’ in front of the keys. A second condenser mic may be used closer to the mouthpiece (6-12” above the performer) if more of an attack or breathy sound is desired.

Sound Requirements

3-4 mixer inputs are required depending on the number of mics used. Miked Input and Computer Input should be kept separate to create a wet/dry mix. The overall balance should be equal with a slight boost in the Miked Input if needed.
Moiré
for Rachel Yoder
chapman welch, 2008

Clarinet in A

Computer

A Cl.

Comp.

Crotales

Glockenspiel

Vibrphone

\[ q = 50-60 \]

Drone volume controlled by clarinet volume

\[ f_p \]

Second 'frozen' passage

\[ 1 \] Inits

\[ 2 \]
\[ q = 60-70 \]

\[ 30''-1'30'' \]

\[ \text{attacca} \]

\[ \text{clarinet cues next section} \]

\[ \text{distant delays and reverb} \]
Phrases turn to noisy gestures
supported with a full sound
very aggressive, freely

B♭ Cl.

all boxed figures controlled by clarinet volume

Comp.

noise
Play boxed material in any order. Elements may be repeated any number of times and every element need not be played. Spatially notated material may be of any length. Create a frantic cadenza that leads to the next system. (30”-?)

Comp.

noisy computer hit

agitated, processed flute phrases

clarinet cues next section

2-4” 2-4” 4-6” 10-15”

Comp.

~ 120

\( \text{ff} \)

\( \text{fff} \)

\( \text{fff} \)

\( \text{fff} \)
5-10" delays and reverb
ACOUSTIC SCORES
RAMEAUX
for bass flute

chapman welch, 2008
Notes to the performer

A bass flute with a B foot is needed for the piece. If one is unavailable, a notated B3 may be substituted with C4 bent down as far as possible. Unless notes are repeated, accidentals affect only the notes they precede.

Special Notation

Flute

Held lip bent note. Bend the note a quarter-tone above and below (wavey line) the original itch (straight line)

Quarter tone bend down or up
* Make the gesture as long as possible (at least 7 seconds).
* Take the shortest breath possible between each trill/glissando.
NATURE MORTE

for percussion solo

chapman welch, 2008
Notes to the performer

Unless notes are repeated, accidentals affect only the notes they precede. All grace note figures may accelerate exponentially or be played as fast as possible.

Special Notation

Percussion

<table>
<thead>
<tr>
<th></th>
<th>Stop playing boxed material</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Continue playing boxed material</td>
</tr>
</tbody>
</table>
Nature Morte
for Julie Licata
chapman welch, 2008

\( \text{\( f \)} = 50-60 \)

aggressively, without warning

Crotale

Glockenspiel

Vibraphone

ca. 6”

ca. 6”

ca. 4”

ca. 6”

ca. 8”

ca. 6”

f

ff fp

f

ff fp

ff p

f

ff fp

f

fp

pp mf p pp

f

fp

pp
* Play boxed notes evenly. Move between crotales and glockenspiel without changing the four note pattern.
* Move between crotales and glockenspiel without changing the four note pattern.
\[ q = 80-90 \]

freely, rhapsodic

\[ q = 50-60 \]

c. 3-6”

frozen

ca. 3-6”

subito \textit{p}
suddenly faster

freely, expressive

ca. 8"

\( \text{\textit{f}} \)

\( \text{\textit{pp}} \)

\( \text{\textit{mf}} \)

\( \text{\textit{mf}} \)

\( \text{\textit{p}} \)

\( \text{\textit{fp}} \)

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After playing the entire phrase one time, play boxed patterns in any order. Become increasingly aggressive (crescendo and accelerando).

* After playing the entire phrase one time, play boxed patterns in any order. Become increasingly aggressive (crescendo and accelerando).
violently

molto rit.

fading away

$\sum U$

ca. 6”

$\approx 50-60$

ca. 4”

ca. 4”

mf

pp

n

p
Repeat boxed pattern evenly with no accents.