

SOMETIMES I FEEL THE SPACE BETWEEN PEOPLE (VOICES) IN TERMS  
OF TEMPOS – A WORK FOR PERCUSSION DUO WITH COMPUTER  
ANIMATED NOTATIONAL INTERFACE

A DISSERTATION  
SUBMITTED TO THE DEPARTMENT OF MUSIC  
OF STANFORD UNIVERSITY  
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS  
FOR THE DEGREE OF  
DOCTOR OF MUSICAL ARTS

Justin Wen-Lo Yang

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I certify that I have read this dissertation and that, in my opinion, it is fully adequate in scope and quality as a dissertation for the degree of Doctor of Musical Arts.

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I certify that I have read this dissertation and that, in my opinion, it is fully adequate in scope and quality as a dissertation for the degree of Doctor of Musical Arts.

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(Brian Ferneyhough)

I certify that I have read this dissertation and that, in my opinion, it is fully adequate in scope and quality as a dissertation for the degree of Doctor of Musical Arts.

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(Chris Chafe)

Approved for the Stanford University Committee on Graduate Studies.

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ANIMATED NOTATIONAL INTERFACE

Justin Yang, D.M.A.  
Stanford University, 2008

Reading Committee Member: (Mark Applebaum)

*Sometimes I feel the space between people (voices) in terms of tempos* is a work for percussion duet which seeks to explore the fluidity and multi-dimensionality of time, both in a quantitative sense – employing musical materials which create themselves through continuously shifting tempo and rhythmic relationships, and in a qualitative sense – seeking to explore and evoke various durées (Bergson), both through the sonification of materials and the modes in which performers engage the material, including improvisation, game play, surprise and recontextualization. This piece employs novel notation and scoring techniques using custom-designed software for animated notation, real-time composition and performance based interactivity.

Approved for publication:

By: \_\_\_\_\_  
For the Stanford Music Department

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## INTRODUCTION

Before starting to collect and arrange the materials that would become this work, I sought to examine closely and in some detail what it is that gives a work of music its particular identity. I wanted to understand better the mechanisms responsible for establishing the unique qualities that a particular work has. The score for this piece is a computer animation. The animation is divided into five distinct sections on the screen. Each of these sections is focused on a specific compositional method that is thought to produce a particular musical quality. What follows are three short essays that describe the compositional preoccupations of *Sometimes I feel the space between people (voices) in terms of tempos*. Following these essays are descriptions of the musical materials and a discussion of how musical form is conceived of and developed in this piece.

## THE QUALITIES OF TIME

One of my compositional interests is in using sound to explore the relationship between quantitative time, the time that is counted and ticked out on a clock, and qualitative time, what Henri Bergson calls *durée*: a heterogeneous, non-linear, unique experience formed through complex relationships between the passage of clock-time, our perceptive mechanisms and our memory. This work examines various thresholds in the arrangement of quantitative time that produce dramatic shifts in the qualitative experience due to the particular way quantitative time interacts with our perceptive mechanisms and our memory within these thresholds. Quantitative time, through its construction and iteration, forms particular qualitative expressions. As a time-based

medium, sound manifests this phenomenon. The physics of sound interacts with human perception in such a way that different arrangements of quantitative time produce dramatically different qualitative experiences. Take the instance of pitch which is based on different rates of repetition or frequency. To perceive any sound at all, one must have some articulation that is repeated at some rate over time. At repetition rates under 20hz, articulations are perceived as distinct events; above they congeal into a perceptive experience we describe as pitch. While pitch is an elemental quality of music, it clearly demonstrates how different configurations of quantitative time, in this case repetition rate, produce different qualities in the sound. I believe that this is also the case for more complex and sophisticated musical qualities. In what follows, I seek to demonstrate how our experience of music is fundamentally influenced by the way sound constructs and arranges quantitative time, and our perceptive mechanisms translate these constructions into many varied qualitative experiences.

## THE QUALITIES OF CHOICE, EXPLORATION AND INTERACTION

The new music magazine, *The Wire*, produces a segment entitled *Invisible Jukebox* in which an interviewer plays various excerpts of music to a well-known musician and elicits comments about the pieces played. In one installment of the *Invisible Jukebox*, the guitarist and improviser Derek Bailey provided enlightening details about the qualitative nature of choice, exploration and interaction in a piece of music. When played a piece by Michael Finnissy, *Come Beat the Drums and Sound the Fifes*, which

he had not heard before, Bailey immediately identified certain qualities about the piece:

It's very performed, it's specific, they know exactly what they're doing and they knew what they were doing I think before they did it. (Watson 411)

Interviewer:  
You reckon it's prepared.

DB:  
Not the piano – in the Cageian sense – but in the performance I think they knew exactly what they were going to do before they did it. That's one of the differences, isn't it, between what I do and this. I would say it's a piece. (Watson 412)

But what you played me – you get what you've got, as it were... It's not going to get any different... it's specific to composed things. It reflects a definite intention and it's not open to negotiation. (Watson 413)

Later, Bailey was played an improvised piece, *intermittent*, by New Direction 1970 and made these remarks:

You see, with this there is no reason to stop listening to it. You know what I was saying about the first one, you kind of know what's going on and what's going to go on, here you don't – the story's unfolding, right? But of course it's improvised. (Watson 417-418)

I don't understand why people don't find improvised music totally riveting to listen to. And I mean, good or bad, if it's *honest* improvised music and it's not programmed to prove some kind of point... If there are guys playing together and reacting to the kind of stimuli which they're providing for each other in the way that you do when you play together – I don't understand why people have a problem listening to it. (Watson 418)

Even at this point I don't know what's going to happen next with this music. There's obviously a kind of vein to it, a feel to it, but the detail is not established by details that have gone before. It's truly developmental in that sense, these people are playing and they're not so bothered about what happened earlier on. (Watson 418-419)

What I wish to draw attention to is not the particular merits that Bailey ascribes to one piece or the other, but rather from what he derives these merits. With each piece it was the mechanism of realization, composed rather than improvised, which produced the salient qualities of the piece of music for Bailey. The Finnissey piece is arguably similar in texture, rhythmic activity and sonic structure to many freely-improvised solo piano works, yet Bailey was immediately able to recognize it as composed. With the New Direction piece, the quality or set of qualities that Bailey

attributes to “honest improvisation” stood out as particularly perceivable and attractive ones. Bailey comments that it does not have to be *good* improvisation, just *honest* improvisation. Or another interpretation might be that when music is produced through the mechanism of improvisation, a particular quality, somehow manifested in the sound yet independent from the sonic structure, is produced, one that Bailey finds attractive. Bailey uses key works such as “negotiation,” “performed” and “developmental,” and he is able to hear their sonic traces in the pieces themselves. According to Bailey, performance-time choice-making, interaction and exploration produce their own distinct sonic qualities.

## THE QUALITIES OF COMPLEX SYSTEMS

Complexity Theory is a bottom-up theory of self-organization that describes how complex forms and structures are created, maintained and evolve. The SOS website describes Complexity Theory in the following way:

Critically interacting components self-organize to form potentially evolving structures exhibiting a hierarchy of emergent system properties.

The elements of this definition relate to the following:

- Critically Interacting – System is information rich, neither static nor chaotic
- Components – Modularity and autonomy of part behaviour implied
- Self-Organize – Attractor structure is generated by local contextual interactions
- Potentially Evolving – Environmental variation selects and mutates attractors
- Hierarchy – Multiple levels of structure and responses appear (hyperstructure)
- Emergent System Properties – New features are evident which require a new vocabulary

Stuart Kauffman sums it up quite simply: “complexity involves systems with a large number of interacting parts, where the way the parts effect each other differs from part to part.” *Sometimes I feel the space between people (voices) in terms of tempos* seeks to use the

model proposed by Complexity Theory as a means of creating musical form. It possesses a bottom up structure and is essentially a collection of many independent variables and behaviors that are placed into an interactive context. Like a dynamic, three-dimensional Venn diagram with bodies that are constantly moving at various rates, this work is created at the multiple intersections that occur between many independent parts through their various interactions during the course of this piece.

## THE MATERIALS

The materials of this work can be divided into four categories, each of which corresponds to specific graphic regions in the animated score. The Northern quadrant is concerned with the quality of flow. In it, a fully-notated animated line contains complex rhythms in a constantly changing tempo. The Eastern quadrant explores structured improvisation within non-pulsed time containers. The Southern quadrant explores gradient materials – materials which experience gradual and continuous changes over time. The Western quadrant explores isolated sound gestures in temporal space.

## NORTH

Max Roach's innovations in jazz drumming were many. For me, the most interesting were the developments he made in the flow of musical time. For Roach, time itself became musical material. He did not regard the flow of time as regular; for him it was constantly shifting, constantly moving. He was able to express this dynamically shifting flow of time by simplifying the time-keeping function to a very

steady continuous pulse and then create a sense of ebb and flow by how he placed fills around this continuous pulse. Depending on where he placed his fills in relation to the beat he was able to control the feel of how time flowed. By moving slightly closer or away from the beat over a series of fills, he was able to create various states of momentum or stasis. All of this was done in a small space of quantitative time, the few milliseconds that surround a downbeat. In Roach's hands, these few milliseconds were enough to produce a subtle variety of musical qualities; these few milliseconds were enough to allow Roach to musically manipulate the quality of time-flow. Clark Coolidge provides a most insightful analysis in an excerpt from his prosody work, *Note on Bop*:

In Bop, especially in its drums which almost purely color and are colored by time itself, there is the sense that sheer continuance gets articulated. Momentum as seduction, in which the "one" of that ever first beat tends very soon to lose its "e." And the shaping of the always initial impact becomes the highest of enveloping tasks.

Awareness of all the room that exists within a single beat, and just exactly which point in that space you want to occupy, though the room itself may be moving at a very high rate of speed. At the time. Bop's fascination with extremes of tempo reveals its major involvement with the realms of time. Time and Changes, Bop's two keystones, nothing more basic.

The feel is that time has a precise center. Like tightrope on a moving pulley clothesline, you're always trying to keep up midway between the poles. It really gets that sharply physical. As a drummer you're holding time's cutting edge in your right hand (ride cymbal), a simultaneity of holding and shaping. You occupy the center of the sonic sphere, the world, and ride it and bear it, inviolable (why heroin is Bop's perfect chemical). And everything that happens there happens once and at once. Once and Ounce, Groove and Chord, Wave and Particle: the Complementarity of Bop.

The material in the North quadrant seeks to emulate this musical manipulation of time-flow. It achieves this by using a group of rhythmic units that have a narrow band of difference in duration between them, and placing these units into the context of a constantly changing tempo. I have constructed thirteen rhythmic motives made up of rhythmic units close to the sixteenth-note. These motives are laid on top of a

continuously changing tempo. The computer-animated score visualizes for the performer the gradual changes of tempo and the precise rhythmic location of the motives within this constantly changing tempo. Through this activity the Northern material creates a sense of multiple strands of time flowing around, but never settling into, regular patterns. To develop gestures within this

rhythmic ebb and flow, irregularly spaced accents and sequences of crescendos and decrescendos are placed over the rhythms (see figure 1).

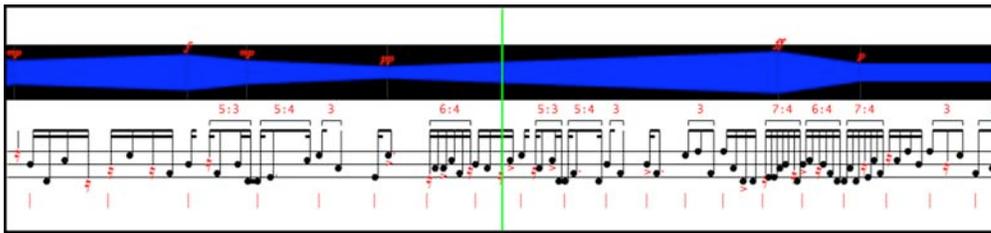


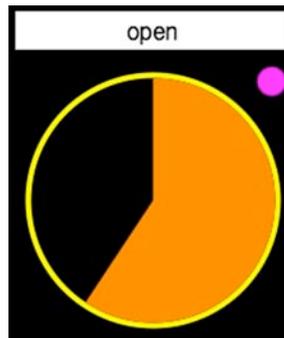
figure 1

## EAST

The material of the Eastern quadrant is a series of structured improvisations set within non-pulsed clock conductions. John Cage developed the clock conduction in pieces such as *Concert for Piano and Orchestra* and *103*. In these pieces, Cage transforms the time keeping element, changing it from a pulsed one, where time is counted in short, regular intervals, to a non-pulsed one, where a longer section of time is blocked off with no internal divisions of time within the longer block. This technique allows a sense of temporal and rhythmic freedom within a larger-scale time structure. This way of structuring time gives the music a particular quality and encourages a specific type of engagement between performer and score. In this piece the clock conductions are

animated, color-coded pies (see figure 2). Within these time-containers, musicians are asked to improvise based on one of several color-coded text instructions:

Red: *intensely hushed*  
Green: *sparse & explosive*  
Blue: *quiet, dense, busy*  
Orange: *open*  
Magenta: *complex, unpredictable*  
Purple: *subtle, enveloping*  
Turquoise: *interrupted*



*figure 2*

With this device performers need not respond to or evaluate some continuous external input such as counting or a conductor's beat, yet they can look at the pie and understand at a glance where they are in the unit. It allows performers a freedom to produce rhythmically idiosyncratic gestures and stay connected to the overall structure and phrasing of this piece.

## SOUTH

In his *Study 21* for player piano, famously known as “Cannon X,” Conlon Nancarrow focuses on a particular musical process and uses it in a radical way to develop many of the musical properties of the piece. This musical process is *accelerando/decelerando*. *Accelerando/decelerando* is traditionally used for local musical articulation; here it is developed into a device capable both of defining larger

scale musical structure, and of generating local musical events. Through his use of a pair of voices which accelerate/decelerate over a long period of time, Nancarrow is able to delineate musical form through the length and precision of the pair's accelerating/decelerating action. Because of its complex internal rhythmic movement, the accelerating/decelerating pair is also able to generate local musical events at the same time. With this study, Nancarrow articulates a very specific and particular type of time. With any precise acceleration or deceleration, the space between each articulation is different than the last. No two are the same but the pattern is completely regular with each gap being proportionately shorter or longer than the last. Using an accelerating/decelerating pair, Nancarrow achieves something similar to what Ligeti accomplished with his harmonic masses – materials with overall stasis but vigorous internal movement. In each example, a monolithic process shapes both the local detail and larger phrase structure. With either example, any time window chosen at random would demonstrate interesting local detail. However, a consistent process defines the movement from the beginning of the structure to the end. In Ligeti it may be a gradual layering of voices or a gradual increase of harmonic density, in Nancarrow it is the natural motion of acceleration/deceleration. Time is frozen for the duration of the entire structure. Yet, within the frozen time, there is constant and complex temporal articulation. There is structural stasis with dynamic internal motion. Qualitative time moves forward at the rate of blocks. Here quantitative time is constructed in such a way as to create a specific quality. With his *accelerando*/*decelerando* experiments, Nancarrow created a new type of musical material with a special temporal quality. After Anthony Braxton, I call this type of

material, “gradient material,” as the effect Nancarrow achieved with acceleration and deceleration can be generalized for any continuous gradual change over time. This gradient material is what I explore in the Southern section of this work. To produce his gradually changing rhythms Nancarrow could not rely on live performers and traditional notation, instead he relied on the mechanics of a player piano and precisely punched piano rolls. In this work, I use computer-animated notation to facilitate the production of these gradient materials (see figure 3). The South quadrant of the score is designed with scrolling curves that move past a “now” execution cursor. As the curves move past the cursor, there is an ascending/descending bar that is a graphical representation of the current vertical position of the curve. With this device, the performer can see both what is coming and where they are in their present. This notational metaphor is powerful as not only are linear curves available, but any shaped curve is possible. The percussionists are asked to play seven different gradients that are color-coded:

- red: Drum roll changing speed.
- green: Tam tam or large cymbal roll changing dynamic level.
- blue: Seven instrument loop changing speed. For this texture the percussionist will choose seven instruments and play them in a loop always keeping the same order.
- orange: Temple block changing speed.
- magenta: Two-handed ratio changing speed. For this texture, the percussionist will choose two sub-divisions (e.g., 3 against 4), one for each hand, and speed up or slow down while keeping the ratio relationship constant.
- purple: Three instrument loop changing dynamic level.
- turquoise: Any minor-second on the glockenspiel changing both speed and dynamics.



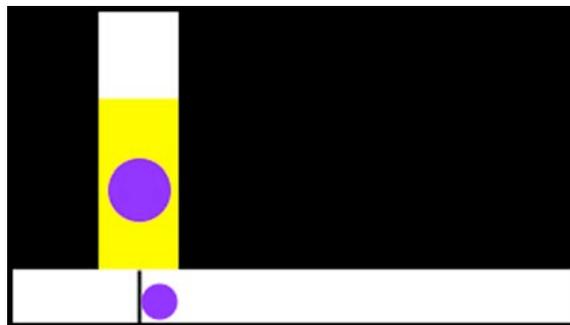
*figure 3*

## WEST

Morton Feldman often talked about “leaving the sounds alone” and producing “sounds as themselves.” Using some basic techniques, he sought to isolate individual sounds in order to let them exist independently from adjacent sounds. One technique employed by Feldman involves leaving space between sounds. In an analysis of Feldman’s work *Last Pieces*, Dirk Moelants describes a perceptual category of sounds with intervals greater than 3000ms between them. He states that these intervals “...exceed the normal buffer of our working memory. This leads to a succession of isolated events, in which grouping and hierarchical perception disappear.” (126) Feldman uses this perceptual gap to isolate individual sounds. Another technique involves the irregular spacing of sounds. By slightly varying the intervals between sounds, Feldman prevents the formation of a regular pattern of repetition. Another device, suggested by Catherine Hirata, is that of “touch.” She speaks of Feldman’s piano teacher Madame Press who could imbue notes on the piano with her special touch. When Madame Press played a Bb on the piano, it was unique, imbued with special qualities only Madame Press could produce. In many ways, “touch” suggests intimacy, affection and familiarity. I propose that sounds can be imbued with unique qualities through a performer’s familiarity with and affection for the sounds. The sounds are unique because only a particular performer can produce these sounds in this particular way.

These concepts are the foundation for the Western section of materials of this piece. In this section, the percussionists are asked to choose seven of their most

interesting sounds. It is left this way, so that the sounds produced in this section have a sense of “touch” – they are sounds for which the performers have a familiarity and affection. There are seven colored bouncing and scrolling circles in the animated score that represent each of the seven sounds (see figure 4). They are placed in a context where they are articulated in random order with irregular gaps, most longer than 3000ms. The goal of this section is to explore the temporal threshold where sonic gestures become isolated, creating a special quality of “sounds as themselves.” Additionally, there is an animated bar that instructs the performers to change some aspect of the chosen sounds throughout the piece, creating a situation in which each new repetition of a sound is slightly different, thereby giving rearticulations of the same sound a uniqueness, a sense of being the same but not the same.



*figure 4*

## FORMAL STRUCTURE

The characteristics of the materials of this piece – their type, duration and times of execution – are all algorithmically generated through many independently acting functions. Perhaps the most complex example is that of the Northern quadrant.

An algorithm generates a series of tempi between 33 bpm and 121 bpm. A separate process generates a set of time points during this piece at which the tempi will be reached. Using this information, a beat map is created that consists of a list of time points at which every beat will occur based on the constantly changing tempi. Then, an algorithm chooses the rhythmic motives and the order in which they will appear, and maps the rhythms onto the beat map, thereby generating the final notated rhythms seen in the score. A separate process generates a set of dynamics and timings that govern when the dynamics will change. Another process generates a set of timings that determine when accents will appear. It is through the intersection of these independent processes that allows the material for this quadrant to be created. All of the aforementioned materials and structure of this piece are generated at the run time of the score software. The algorithms are based on a random number generator with a random seed function. Each seed represents a different but fixed set of numbers. As such, this work will be different with each change of seed.

## THE MYSTERY OF NAVIGATION THROUGH FORM

Anthony Braxton has developed a concept he calls the “mystery of navigation through form.” While respecting the implicit sense of mystery Braxton associates with this concept, pragmatically I understand it to be the real-time development of musical structure through the process of active navigation. With much of Braxton’s music, musical structure is not predetermined, musical structure is developed in real-time through the interactions between the players and the score, and among the players themselves. Performers are called upon to move through many different possibilities

from improvisation, to an assortment of different types of notated materials, to various interactive situations (conductions, structured ensemble improvisation). The choices performers make are important, but equally important is the process of active navigation. In other words, the process of active navigation gives a dynamic quality to the musical structure that would not be present if the structure were preconceived. In the case of this piece, a process of active navigation is developed through the use of a computer-animated device, a navigational dial located in the center of the score (see figure 5). One or more of the moving dials appear and point to one of the four quadrants. There are three types of dials: a solid dial, a dashed one and a dotted one. The solid dial indicates that the performer is to continuously play one of the materials. The dashed one suggests more intermittence; the material is to be played in chunks with pauses in between. The dotted dial indicates that little bits of material are to be played with longer gaps. When there is more than one dial present, they represent how the performer is to negotiate between various quadrants. For example, if there is a solid dial in the North and a dotted dial in the West, the percussionist will play the Northern material with short interruptions of the Western material. There is a certain ambiguity in this system that promotes real-time negotiation. For example, many of the materials have long pauses in playing and this raises questions. If these materials are being intermittently selected, would you play the pauses or only choose the material when there is some activity? What should be done as a dial transitions from one material to another? What happens when there are two solid dials pointing to different materials? These questions are a sampling of the many issues that provide a welcome sense of ambiguity and provoke performers to make real-time decisions.

Through the process of active navigation, performers create this piece in real-time through the decisions they make.

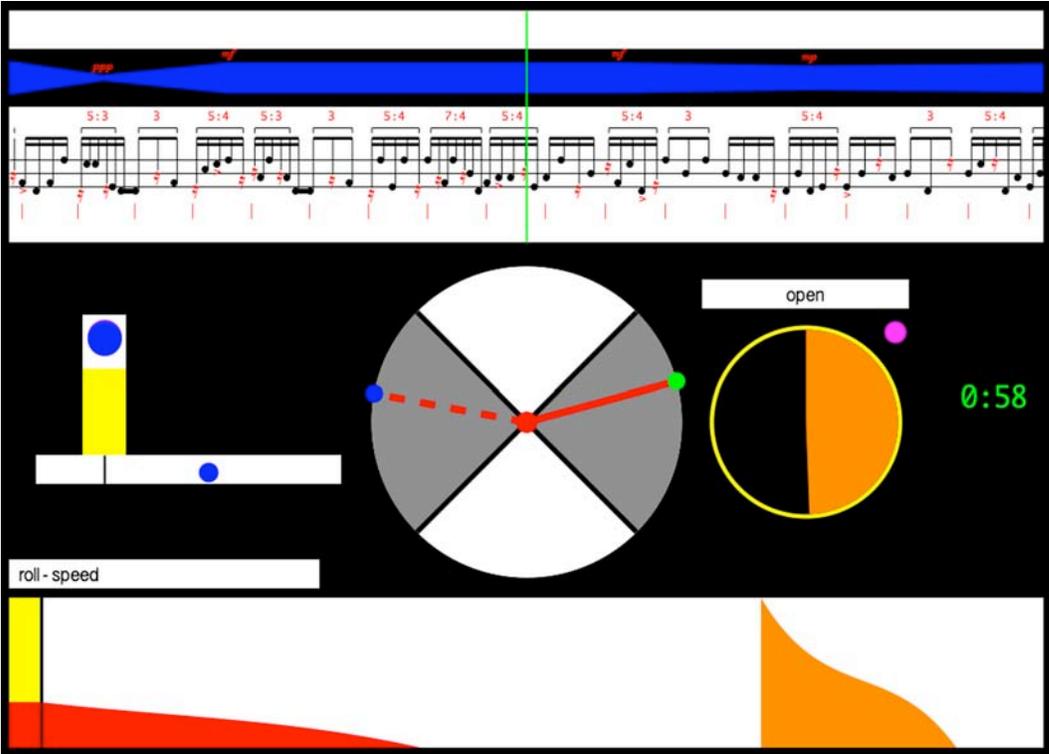


figure 5

## APPENDIX A – PERFORMANCE INSTRUCTIONS

### **Structure**

The score for this work is divided into four quadrants (North, South, East, West). Only one quadrant is played at a time. The center dial is a meta-conductor that gives instructions on how to navigate between the quadrants.

### **North – Notation**

There are three staff lines representing three categories of instruments:

- top – wood
- middle – skin
- bottom – metal

Each staff line has three positions: space below, line, space above. Percussionists are to choose three instruments or three families of instruments for each of the three categories, one instrument/instrument family per staff position.

The scrolling notation displayed is derived from thirteen motives (included as an appendix to this document). However, these motives are mapped on to a constantly changing tempo thereby resulting in the displayed notation. The thin red lines at the bottom of the window are beat markers that shift according to the tempo. They can be used as guides for executing the notation.

Ties are expressed as straight lines that connect noteheads horizontally.

Dynamics are displayed above as a scrolling curve with traditional symbols.

The notation is to be executed at the cursor.

### **East – Improvisation**

The eastern quadrant is a color-coded clock conduction. Each color represents a guided improvisation:

- red: *intensely hushed*
- green: *sparse & explosive*
- blue: *quiet, dense, busy*
- orange: *open*
- magenta: *complex, unpredictable*
- purple: *subtle, enveloping*
- turquoise: *interrupted*

### **South – Gradients**

The southern quadrant displays scrolling curves that indicate change over time. Each color represents a different texture to change:

- red: *drum roll changing speed*
- green: *tam tam or large cymbal roll changing dynamic level*

- blue: *7 instrument loop changing speed*  
for this texture performers will choose 7 instruments and play them in a loop always keeping the same order
- orange: *temple block changing speed*
- magenta: *two-handed ratio changing speed*  
for this texture performers will choose two subdivisions (i.e., 3 against 4), one for each hand, and speed up or slow down keeping the ratio relationship constant
- purple: *3 instrument loop changing dynamic level*
- turquoise: *any minor-second on the glockenspiel changing both speed and dynamics*

### **West – Gestures**

For this conduction, percussionists are to choose seven of their most interesting percussion sounds, one for each of the seven colors. The bouncing and scrolling circles indicate which sound to play and when.

For each of the seven sounds, there should be at least one or several aspects of the sound that can be changed. The window that contains the bouncing circle fills and empties with yellow. The amount of yellow indicates the degree of change to apply to the sound. For example, if the sound chosen is rubbing a superball on a bass drum, the aspect to change might be pressure and speed. When the window is mostly white with the yellow at the bottom, this could be light pressure and maximum speed, and when the window is filled with yellow, this could indicate maximum pressure and minimum speed.

### **Center Dial – Meta-conductor**

The center dial is divided into four sections, one for each of the four score quadrants. There are hands that scroll around the dial that indicate which quadrant is to be played.

If there is just one hand present:

- a solid hand = play continuously
- a dashed hand = play short phrases with rests in between
- a dotted hand = play very short gestures with rests

If there is more than one hand present, then the musician must navigate between the different hands. For example if there is a solid hand in the North and a dotted hand in the East, this would indicate playing the notated material with short interruptions of improvisation. If there is a solid hand in the East and a dashed hand in the South and a dotted hand in the North, this would indicate playing the gestures cross-cut with short phrases of the gradient material and short interruptions from the notated rhythmic material. Solid hands and dashed hands, in particular for the West and South, imply that percussionists play the silences as well. If there is more than one

hand in the same quadrant, the player can choose one hand or alternate between different modes of playing.

### **Instrumentation Summary**

Percussionists will need:

Three instruments/families each: wood, skin, metal.

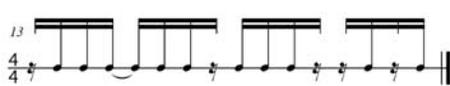
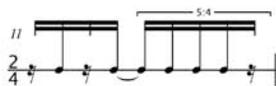
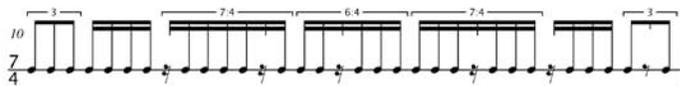
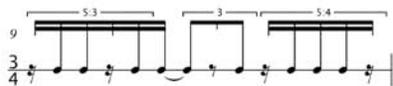
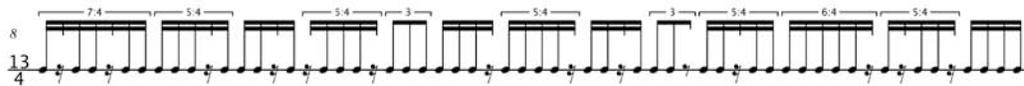
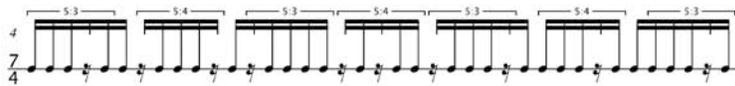
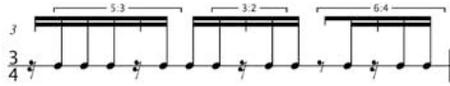
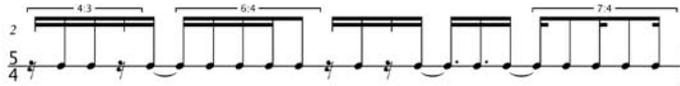
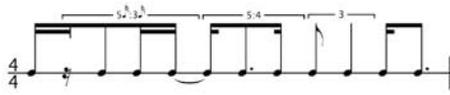
Drum, tam-tam or large cymbal, glockenspiel, temple block and any additional instruments for the 7-instrument and 3-instrument loops.

All the instruments necessary to play the seven selected most interesting sounds.

### **Software Notes**

The keys l – 0 and q – p represent twenty evenly spaced time markers that move to different times in the score. The ‘;’ key will move back 5 seconds ‘.’ will move forward 5 seconds. ‘<’ will move back 1 second and ‘>’ will move forward one second.

## APPENDIX B – RHYTHMIC MOTIVES



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## ANIMATED SCORE SOFTWARE

For the most recent version of the computer-animated score software please go to:

<http://ccrma.stanford.edu/~jusyang>