UNTITLED –
An Interactive Graphic Score for
Improvised Ensemble Performance

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Personal Statement

My interest in the development of interactive graphic scores comes out of a desire to integrate structural forms that operate on a timescales which over-arch momentary musical actions. For myself, as a musician, these forms can be difficult to keep in my head as I am often concentrating on listening and playing from moment to moment. This is especially true in an improvisational context. Interactive graphic scores can offer a high degree of freedom to explore moments while providing a confidence and knowledge of the overall structure of the work.

Through my exploration into the role of computers in musical improvisation and performance I have become interested not in using the computer as a means to exercise control over musical experience, but rather, as a tool for maintaining a balance between order and chaos. This project will be the creation of a work that will explore this dichotomy.

In combining the elements of algorithmic composition, improvisation, and graphic scores into one interactive composition. I hope to create a unique construct for computers in a musical performance and to create exciting and interesting music using this piece.
Context
At the turn of the century, Arnold Schoenberg’s re-imagining of the accepted tonal system in his creation of dodecaphonic, twelve tone, or atonal music caused the questioning of many other accepted notions about what should be considered music. Perhaps considered to be most revolutionary in this endeavor, John Cage carried this mantle further advocating the liberation of sound from all musical constraints, holding the belief that all sounds were of equal value. Cage’s piece, *Music of Changes* used the tossing of the I–Ching to decide the placement of notes on a staff. He saw these chance processes as a way of letting nature speak for itself: “The challenge of art is not to convey feelings or emotions of the artist but to convey nature in her manor of operation.” With these chance, or aleatoric, compositional processes, Cage introduced the idea of the open work to western music. In his 1959 essay, *The Poetics of the Open Work*, Umberto Eco articulates the significance of the open work form:

“... Every performance explains the composition, it does not exhaust it, every performance makes the piece a actuality, but is itself only complementary to all possible other performances of the work […] "open" works, insofar as they are in movement, are characterized by the invitation to make the work together with the author ”
(Cox and Warner, 171 – 173)
In the postwar period, many composers began to see these new challenges to the traditional modes of composition and performance as emblematic of socio-political struggles going on in Europe and America. Many in the avant-garde saw the status quo power dynamic between composer and performer as un-democratic, with the composer as despot and the performer as subject. Composers such as Cornelius Cardew, and Earle Brown thought of their work as challenging that paradigm. They saw the use of graphic notation as a means for establishing a collaborative relationship between performer and composer. Graphic notation, a characteristically prescriptive approach to notation, often relies heavily on the improvisational abilities of the performers. The creativity of the performer, not just the technical mastery, became intrinsic to the composition. This created a more satisfactory balance of power between composer and performer. (Art Engine “Earl Brown” www.earl-brown.org)

As improvisation became a larger component in art music a dialogue between the classical avant-garde and jazz composers developed. Cornelius Cardew, creator of the graphic score Treatise, who was widely known for his improvisational abilities, eventually abandon notation all together to pursue purely improvisational music. John Coltrane created Ascension, a song cycle visualized in a graphic score as a pentagram. Anthony Braxton's diagrammatic scores combine the aural language of free jazz with aleatoric compositional methods influenced by Cage and Stockhausen. This overlap between these idioms is still evident today in the use of graphic scores by “Downtown” musician/composers Elliot Sharp, John Zorn, Fred Frith, and others.
The graphic scores from the fifties and sixties show a great variation in the voices of each composer and experimentation with different visual languages and mark-making in their design: some are expressionistic, some scientific, some geometric, some are minimalist, others fanciful. Most can be appreciated on a visual level alone. The interest in graphic scores can also be attributed to the influence that visual art movements were having on composers. Earle Brown attributes much of the inspiration for his compositional technique to the mobile works of sculptor Alexander Calder. Iannis Xenakis was highly influenced by his architectural work with LeCorbusier. John Cage, himself a visual artist, was engaged in collaborations with artists, across all media, throughout his career.

It was also in this period that these composers began using sound-making technologies such as audiotape and synthesizers in compositions and performance. The availability of these new means for generating and manipulating sound presented new questions when it came to notation. The Western conception of harmony, which had in the previous century been paramount in compositional technique, had, to many composers, become secondary. Composers began focusing more on timbral and dynamic qualities as structural devices (massie,30). Traditional western notation was inadequate to convey these types of information to the player. These new circumstances pushed the
need for graphic and other non-traditional notation to the fore as composers struggled with ways to communicate musical ideas for a these new breed of instruments. Edgar Vares who pioneered electronic music employing sirens in his piece Ionization, speculates on the future of notation in his 1936 essay “The Liberation of Sound”:

As frequencies and new rhythms will have to be indicated on the score, our actual notation will be inadequate. The new notation will probably be seismographic. ... At the beginning of two eras, the Mediaeval primitive and our own primitive era... we are faced with an identical problem: the problem of finding graphic symbols for the transposition of the composer’s thought into sound. ... Formerly the curves of the musical line indicated the melodic fluctuations of the voice; today the machine-instrument requires precise design indications.” *(The Liberation of Sound)*

Technological advances in electronic musical instruments and tools continued to transform and expand the landscape of graphic score technique. As music technology advanced, the access to sophisticated computers often through academic institutions became a central tool for composers like Charles Ames and Herbert Brun, who created complex graphic scores from algorithms. *(Rhodes Music Machine, Composing Gradient)* (Massie, 161)
Brian Eno states in the liner notes of his 1975 album Discreet Music, “if there is a score for this piece it must be an operational diagram of the apparatus I used for its production.“ (Eno, *Discrete Music*)

Although there exists a great variety in the intention and design of these scores, it could be said that the underlying message of these works is that there are many ways to communicate musical ideas, structures, and processes. Without a universal theory of music there can be no one form of musical notation. (Massie, 36) Pulitzer Prize winning avant-garde composer Roger Reynolds’ offers a concise context on the current state of notation.

“If you look at the residue of these decades of experimentation, I would guess that the biggest factor that remains a force... is the idea that we don’t need to remain within one frame of reference from moment to moment.” (Massie, 172)
Personal Statement II

With this project I am interested in fostering a sense of resistance on the part of the computer. I want the score to react in a sensible yet surprising way. If the ruleset is clear enough the outcomes will be different the character of the piece and the overall structure will be similar. This the participants will not feel the need to “control” the system if there is enough consistency in the feedback. One artist who has explored these issues is trumpeter George Lewis, the creator of Voyager: an interactive system for improvisation. As Lewis improvises, Voyager analyses the sound it receives and makes decisions about what sounds to play based on what it hears acting as another musician might. Here Lewis makes a philosophical distinction between his work and the trends in computer music interface design.

“The discourse of computer music is really shot through with prosthetic conceptions. I'm not dealing on a prosthetic basis. So when people talk about instruments as 'controllers', the language of mastery and power, or where a musical instrument becomes just a kind of 'user interface', I start to get a little nervous. That's not animistic enough for me; I've got to have an incarnative conception.” (Person to Person? www.l-m-c.org.uk/texts/lewis.html)

This was interesting to me because it places this concern, which is, for me, physical in nature, within a larger philosophy of interface design. It also echoes the motivations of many composers working with graphic scores and indeterminate music in the last century. The concern over the creative relationship between orchestra and composer is now between the user interface and the user. Although these are fascinating points to contemplate, the motivation for introducing these ideas into my project is essentially practical. My hope is that it will add a more deliberate and causal aspect to the
relationship between the human and digital components in the performance of this work. I also think it will make it more fun.

Another set of ideas which has influenced the design of this project are those articulated by Fredric Rzewski in his essay *Little Bangs; A Nihilist Theory of Improvisation*. Here he presents a list of seven of what he calls “the most basic propositions of free improvisation”.

(1) Anything can, and does, happen all the time.
(2) At the same time, things happen in predictable chains according to preconditions and agreed upon conventions.
(3) These chains are constantly being broken, according to changes in conditions. Our expectations of what must or will happen also change.
(4) At any moment, my activity or inactivity may influence, actively or passively the state of the whole
(5) At the same time my perception of this state may influence my activity.
(6) A circular causality may exist between present and future, so that not only does the present influence the future, but the future influences the present
(7) Likewise the past determines the present, but the present also constantly changes the past (something which, according to Augustine, even God cannot do).

(Cox and Warner, 268).

To me, this is about more than free improvisation. It is a very simple and insightful look at how we humans process music, and its relationship to the unconscious. I am referring, in particular, to the idea of circular causality and non-linear time. I wanted to
explore more ways or expressing these ideas through a graphic score. This has become an important justification for the structure of this piece. I hope that in illustrating these ideas through a score, visually and aurally, will help to attune the players to each other and the intent behind the composition. As a result, the participants should be more acutely aware of the impact of their actions or lack of actions in an improvisational context.
**Project Description**

This project uses a screen-based interactive graphic score to create a structure in an improvised ensemble performance. The score acts as a map to the time based algorithmic component of the piece as wells eliciting certain musical actions or interactions between the players.

This project will be implemented in Max/MSP/Jitter using FFT analysis to control the time based signal processing in the "back end" of the system. The implementation of ActionScript via jitter will be used to “draw” the dynamic graphic score. Open Sound Control will be used to communicate between the computers.

**How This Will Work**

The score is designed with the intent to be played by a trio of any instrumentation. In this diagram the instrumentation is arbitrary.
The piece is designed to be played by three non-percussion instruments. The musicians are situated in front of three laptops and three hyper-cardioid shotgun microphones. On the screen the application is open and the score is displayed. When ready, the three players hit the space bar simultaneously on each laptop, beginning the piece. The score is in three colors (Red, Green, Blue). Each player is a color. Three “playheads” of corresponding colors indicate to the performers their position in the piece. The piece is performed at the outset with each player spaced equally apart in time. Red begins. After a period of time Green begins. After an equal period of time Blue begins. The players interpret the graphic information on the screen as they see fit. There are instructions, which are equally spaced throughout the score to create simultaneous events. The structure dictates moments of departure for each player as well. All the while, each computer is listening to the performer and comparing what it hears to thresholds that are preset within the score. The program is monitoring the relative metronomic time of each player, the frequency saturation, and the average amplitude. It also looks for dramatic spikes in volume or a sudden preponderance of certain frequency ranges. If a player exceeds or falls below a threshold at any given time for a significant stretch, the score alters itself visually; “ripples” or “refractions” occur. These alterations effect parts of the score not yet played as well as parts that have already been played. The score of that particular player becomes altered as well as those of the others.
These ripples or refractions in the score are designed to elicit simultaneity between the players in an echoing fashion. For example one player’s spike would create a kind of visual delay in the score. Subsequent spikes would appear on the other players’ scores as a result of the one player’s action. The same will work for sudden silences. These would function as rhythmic elements within the piece.

Sudden shifts in the score may be jarring at first but are not meant to be a punishment or a reward for a certain behavior. Different players may use the piece completely differently. Some may find it more suitable or challenging to play the piece through within the thresholds without causing changes to occur. Others may choose to create as much disturbance as possible. My hope is that an ensemble could spend enough time with the piece in order to coordinate with each other to recreate certain reactions. If this project is successful different performances of this piece should yield very different results.

**Methodology In Process**

My initial plan to create an algorithmic composition with a graphical score as a front end has undergone noteworthy changes through the process of the project. I quickly realized once I embarked on the production of the work that the most immediate question was “what will this look like?” As I described to others what I wanted to achieve this was often the first response I would receive. When I began the process I had only a vague idea of the kinds of things I wanted to evoke. After looking at many graphic scores through my research I gained a sense of the kind of work I was attracted to. In general it was the work I felt was the most divergent from traditional scores yet employed a strict internal logic, unique to the piece individually. One inspiration was
Xenakis’ Metastasis. Clearly a world unto itself, it follows its own rules strictly and fully. I tried to imagine a variety of metaphors that I thought could be suitable to the ideas I was interested in exploring and could be explored and elaborated upon. This design challenge became the foremost concern. Consequently, the functionality of the audio and interactivity elements became secondary.

The first step was to create a family of shapes that I thought would work well visually and had enough iconic power to be seen as symbols, graphic directions, or guides. I wanted them to appear derived from another source yet not random or strictly aesthetic.

I settled on the moree pattern motif relatively late in the process. It was a choice I made to try to give the project a singular look. My process up till then had yielded little that didn’t seem to scream “generic flash animation”. This was also a useful method because it seemed to unify the variety of shapes I was using and to allow them to exist in simultaneous places in the score without overlapping each other. I wanted to avoid overlapping shapes because I felt that would create a whole other question of hierarchy of events that I wanted to avoid as it would complicate further the visual language of the work. With the moreé pattern, up to four events could exist at the same moment. I like how that fit into the concepts I had been turning over in reading about sonic perception. Specifically Mccluhan’s writing about the difference between aural and visual perception. In his essay, *Visual and Acoustic Space*, He talks about the dominance of visual media as eroding our connection to the spiritual by emphasizing a concrete linearity and an inflexible perception of reality. “The eye creates a space where there can only be one thing at a time. Light focused on the back of the eye ensures that two objects will not occupy the same place at the same time…sound comes from above below and all sides and is rarely limited by the density of physical objects.”(Cox, Warner. 67–75)
I wanted to try to communicate that to the player through a score. It was also an answer to the problem of the musicians playing in overlapping times. It was a useful visual device in terms of handling intervals, echoes, and simultaneous events in the score.

What I now see as the central challenge of this project is the decision to design the score so that all participants are playing simultaneously but at staggered times. This is a defining characteristic. It was essential that this be easily read. The user had to instinctually know how to approach the piece. It also had to be justified sufficiently. As a result I have ended up spending the bulk of the production time thus far fleshing out the design and the interface of the score in Flash.

The flexibility of the Flash environment was essential for prototyping the visual appearance of the score. The authoring environment was a useful tool in the creation of the look of the work. Being able to create shapes and work with layers to move symbols around the stage with a mouse was very helpful. In the implementation of the interactive component the complexity of it became a hindrance.
The dynamic animated aspects of the score created some unexpected hurdles in terms of the interaction design. The moree patterns required multiple mask layers, which were easy to code in Flash, but caused the score to run very slowly. Additionally I had difficulty with the drawing of the amplitude trails. The problem was in the code and symbol structure of the flash document. Although theoretically the structure was practical, it ended up being very CPU intense.

The other goal of this project was to build a robust system in Max/MSP. Something I've been working towards all year. These problems caused me to spend too much of my time working in Flash and not enough in MSP. I had originally envisioned the project as being visually and aurally symbiotic. However, the aural half ended up being less of a priority because I was attending to what I knew would be the most challenging part first. I am now considering remaking the visual component in Processing or possibly the entirety in the Max environment via Jitter.
Each player is represented by a color.
The height of each panel represents the frequency range of the instrument.
The darker areas represent recommended actions.
The colored areas represent recommended actions for a particular color.

Since we know the exact spacing of each player, we can create simultaneous events by spacing them accordingly.
The "Leader" leaves a "trace" which acts as a record of the loudness of a player playing in time. This becomes a guide for the other players as to how loud to play at particular times.
The DSP Component

The aural half of this project uses a sequence of settings in a dynamic time-stamp looping patch to create a time based DSP composition. Time-stamp looping uses values to assign indices to points in a buffer. These points are stored in a text file and processed separately from the audio. The stamps are written. This material is played back using the text file as a reference, index-by-index, in this case in a Brownian motion. The patterns repeat unless they are over-written by new indices. This process creates a truncated and quantized version of events as they are recorded. The captured patterns create an accompaniment of a unifying texture that intertwines with the live sound. Using different settings in this patch, a variety of distinct rhythmic effects can be achieved. Values from the audio analysis patch trigger these different settings and values from Flash trigger different transitions in the piece.

Conclusion

Making this project was a valuable experience in the arrangement and execution of algorithmic composition using graphic scores. In using the piece to create music I do feel that its functionality in creating structural forms while not dictating the specifics of those forms makes this a powerful and provocative tool. I look forward to the completion of the work and the experience of seeing others perform the piece.
References


7. George Lewis, "Person to... person?". http://www.l-mc.org.uk/texts/lewis.html 1997


Software Resources and Assistance:

Flosc: Flash Open Sound Control - http://www.benchun.net/flosc/

Eric Socolofsky flosc tutorials - http://transmote.com/flosc/