MAD SCIENTIST MACHINE: A TELEMATIC CONDUCTION EXPERIMENT

by

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ABSTRACT

The *Mad Scientist Machine* is a software/hardware system allowing a user (conductor/composer) to organize a group of players in a structured improvised performance. A local or remote user can utilize the software to control an LED light that is placed in front of each performer. Each colour indicates a different performance instruction. For instance, white signals long tones, whereas green indicates to play noise.

The *Mad Scientist Machine* is an experiment at creating a balance between freedom and structure and at the same time creates a window for the audience into the process of improvisation in music. Transforming a composer's ideas into specific light cues for an ensemble of players, the *Mad Scientist Machine* is a combination of a game structure and compositional system.

Keywords: Improvisation, Interactive, Telematic Performance, Game Structure, Compositional System

DEDICATION

The *Mad Scientist Machine* is dedicated to all the teachers in my life — to those that taught me violin, viola, and bass, to those that opened the door to improvisation, to the conductors I had in middle school and high school, to the record shop owners who exposed me to all kinds of music, to the teachers that taught me computer programming, to all the amazing musicians I have played with through the years, to the faculty at SFU who have inspired me to think in new ways, to the donors that have supported me, to all the amazing creative folk I have worked with in dance, theatre and art, and to my parents who supported and instilled in me such a desire to see the world in a unique way.

Most importantly I'd like to dedicate this project to my wife Viviane Houle, who is continually teaching me to see things in a new light.

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Introduction

The *Mad Scientist Machine* is a culmination of many years of thinking about improvised music. Often one of the most difficult things to achieve in an improvised musical setting is structure. This is particularly true of an ensemble of more than 5 players. The *Mad Scientist Machine* is a system that helps bring structure to an improvisation while also bringing an awareness of direction and content as a foundation from which improvisation can spring forth.

Improvised Music

Improvised music is a notoriously open ended name for a wide range of music whose focus is improvisation. Derek Bailey perfectly encapsulates the wide range of improvised music approaches in his book on improvisation.

> "Free improvisation, in addition to being a highly skilled musical craft, is open to use by almost anyone—beginners, children and non-musicians. The skill and intellect required is whatever is available. It can be an activity of enormous complexity and sophistication, or the simplest and most direct expression: a lifetime's study and work or a dilettante activity."[i]

While the creative, musical, spiritual and political validity of amateurs improvising is undeniable, it is the possibilities that open up as one looks critically at the "enormous complexity and sophistication" in improvised music that Bailey alludes to, that interests me in this particular context. Improvisation as a finely

honed skill depends on the improviser being aware and listening to all those he or she is performing with and at the same time requires the music to have Direction, Content, and Structure. Most of the focus on improvisation tends to be on the listening and awareness of the musician in both the literature and the training. An in-depth examination of Direction, Content, and Structure will illuminate the often-missing piece from amateur improvisation and facilitate a deeper understanding of the process of skilled musical improvisation. These three components are not in any hierarchical relationship with one another but are three corners of a triangle (see figure 1) with improvisers emphasizing each of these components to their own individual taste and desire. An awareness of all three components can increase the richness that is possible with skilled improvisation.

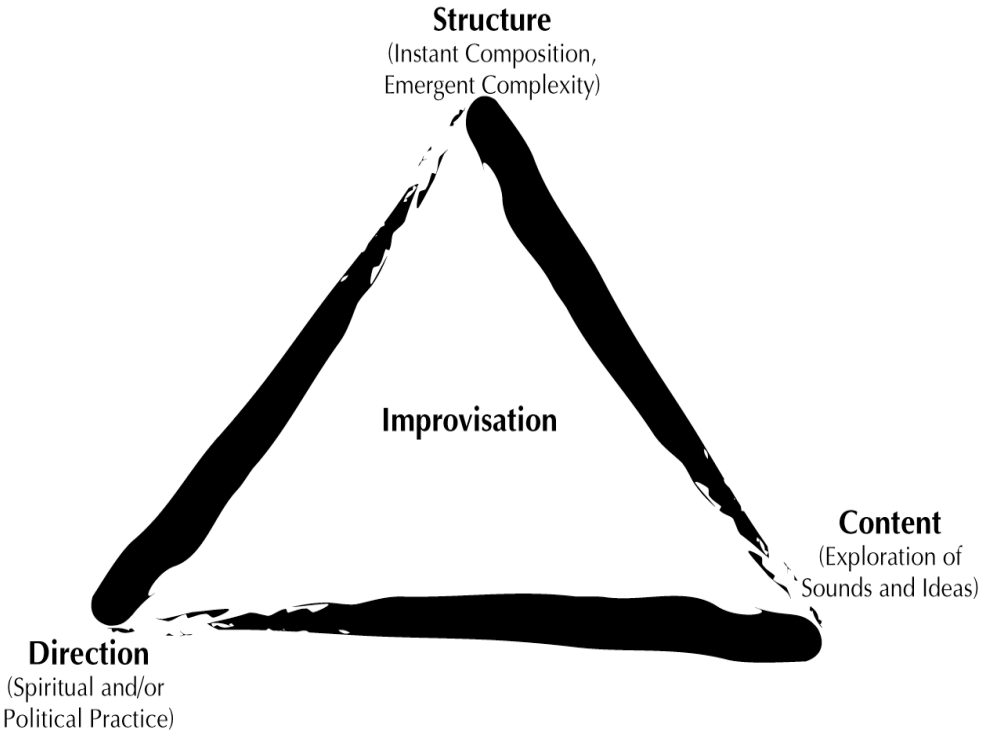

Figure 1: Direction, Content and Structure in Improvisation

Direction

When improvised music works, it takes both the listeners and the performers on a journey. The underlying direction or path that propels the musicians to create the music is key to creating an environment that allows a journey to occur. Some performers see their music as a spiritual path while others as a political act. The spiritual and the political are not mutually exclusive, and many musicians see their music as a mixture of the two. The spiritual path is directly connected to the act of creation that happens while improvising. In fact, to emphasize the importance of creation and the spiritual path in their music some musicians use the term *Creative Music* rather than *Improvised Music*. Improvised music as a political act comes from the notion that improvised music eschews the hierarchy present in other forms of music and creates an environment and community for free and equal expression of ideas.

The continuum between spiritual and political can also be found by examining an Afrological approach versus a Eurological approach to improvised music. As George Lewis points out, “Drones were commonly used as transitional devices in the live performances of the Art Ensemble; moreover, one function of drone textures in many cultures is to evoke the spiritual, a trope that is relatively absent from the European improvisers’ discourses.”[ii] Lewis later points to the political path present instead in European improvised music. “The new European free music could be read as asserting the desirability of a borderless Europe – if not the decline of the notion of the unitary European nation-state itself.”[iii]

Looking first at the spiritual path, we can examine the connection between improvisation and creation. When one listens to John Coltrane's "A Love Supreme", you can hear the call and energy to create. One of the notions of free jazz is to put out as much energy as possible: a wall of sound. This energy then creates a spiritual ecstasy and trance. When one sees Cecil Taylor chanting and reciting poetry while improvising with his group, you get a sense you are witnessing a modern day shaman. All the chaos of the music you hear feels directed towards finding the sublime. The wall of sound improvised by his band swirls around you, and you are swept up in the energy of the music and feel transported. Andrew Bartlett describes how this field of energy merges the performer and listener in "Cecil Taylor, Identity Energy, and the Avant-Garde African American Body."

> "The merger of the performer, s/he who enacts the story or composition, with the listener or reader, is most complete when the feeling, the energy, immerses both simultaneously in a performative improvisation where exact progressions are undetermined and surprise the performers as much as the audience."[iv]

Richard Schechner writes in "Performance Theory" about two processes that a performer can undertake: the shamanic path of ecstasy or the trance state of the Balinese dancer. The shamanic path is a subtraction of self whereas the trance is a doubling of self or possession of self by another. Schechner sees this as a wheel. "No performing is "pure" ecstasy or trance. Always there is a shifting, dialectical tension between the two."[v] When Bartlett describes Cecil Taylor's merger with the listener, he is also alluding to the spiritual wheel of ecstasy and trance. The listener is swept up by the energy of the performance

and taken for a spiritual journey, guided by the musician. It is important to note that Taylor was not content to just think of his music as spiritual, he sees his work as political as well.

> "Spatially, the pianistic decision to utilize the entire keyboard at will, all in the process of "feeding material to soloists in all registers," disrupts even the most far reaching chordal inversions of bebop and the postbop musical interventions prior to Taylor… it is important to recognize the disruptive and resistant modes of performance Taylor enacts,…"[vi]

It is through resistance to current structures that Taylor's music is political. This political draw to freedom and breaking down and re-imagining of new structures is a large part of the appeal to many musicians working in improvised music.

The Eurological, Afrological continuum is not without its exceptions. For instance the intuitive music of Karlheinz Stockhausen encourages a spiritual approach to music. Stockhausen's piece *UNLIMITED* is a simple instruction for players.

"Play a sound
with the certainty
that you have an infinite amount of time and space"[vii]

Stockhausen says in his book Stockhausen on Music: "When one really meditates on this text, it leads to the most incredible actions and sounds."[viii] Stockhausen is interested in using a spiritual direction to both expand the performers consciousness and as an impetus to create music.

One of the leading proponents of improvised music as a political act was Cornelius Cardew, a famous composer and outspoken member of the Communist Party of England (Marxist-Leninist). Cardew became very interested in improvised music as a model for social interaction and political change. The music created by following his improvised scores and instructions at first is often not of particular interest to listen to, but the process of communication learned by the participants is often deep and develops a sense of community and purpose that provides direction for future improvisations. A sense of purpose and reason for communicating via music allows the musicians to invest intensity into their music that is not present by mere directionless playing. One example of Cardew's rules can be taken from his "A Scratch Orchestra: Draft Constitution." "In rotation (starting with the youngest) each member will have the option of designing a concert." When one is breaking all the normal rules of civilization by reordering ingrained structures, there is a sense of playfulness and meaning that is created which gives the music direction.

One can also look at the music of Sun Ra as a political act. Not happy with the political structures present in America at the time, Sun Ra invented his own reality and structures. These new realities became "real" through his music. Sun Ra in his movie *Space is the Place*, dressed in an Egyptian costume, tells a group of young African-Americans that he hasn't come to them as a reality but as a myth, because "That's what black people are: myths". According to Sun Ra, African-Americans can only free themselves from their 'inverted position' on this planet through that same myth, through the power of imagination, and through

music that arouses the spirit and leads it to another world. This aligns his musical explorations into new sonic realities with his search for new political structures that better suit the needs of African-Americans.

A clear direction provides a strong impetus for creating music and strengthens the content and structural choices that are made. The direction and reason for creating one's music profoundly influences the content and structure of an improvisation.

Content

It is in the content of a musical improvisation that the individual nature and character of the musicians comes out. The content consists of an improviser's exploration of sounds and ideas on their instrument. Often the content is born from the direction of an improvisation as in Cecil Taylor's use of the entire range of the keyboard. The political desire to disrupt and reconfigure hierarchies becomes an inspiration for a new approach to playing the piano. What is important when looking at the content of a skilled improviser such as Taylor is his unique way of using his political and spiritual direction to create new content that explores the entire range of the piano. Fundamental to the idea of jazz and improvisation is the creation of your own sound. As Lewis points out:

> "In the context of improvised musics that exhibit strong influences from Afrological ways of music-making, musical sound – or rather, "one's own sound" – becomes a carrier for history and cultural identity. "Sound" becomes identifiable, not with timbre alone, but with the expression of personality, the assertion of agency, the assumption of responsibility, and an encounter with history, memory and identity. Yusef Lateef maintains that "The sound of the improvisation seems to tell us what kind of person is

> improvising. We feel that we can hear character or personality in the way the musician improvises" (Lateef 44)."[ix]

This is not something that comes quickly. It takes time and practice to find and develop your own voice. Since there are generally no written notes when one improvises – there is nothing but your own personal thoughts, feelings, life experiences, and emotions to express. Often when players begin to improvise, they spend most of the time searching for what to say. Developing your own vocabulary, and efficiency in using it, is a long process. Bassist Torsten Müller discusses this in a 2007 interview.

> "Looking back at the playing in the early years it was harder, because you were struggling so hard to keep up or to make sure you actually had something to say and you weren't just making noises or going through the motions. … Now playing is just for the most part more joyful after 30 years of developing instrumental technique."[x]

It is important that one has developed their technique for skilled improvisation to occur. One can often imagine improvisation as a conversation. To be able to say something coherent and interesting mediated through an instrument is not an easy task. As a musician you want to make sure you are not noodling. Noodling is a term used by musicians to indicate aimless searching. It might be best described as musical babbling. Much preferable to noodling ,as Müller says, is to stay focused.

> "There can't be any slack. Improvising isn't about lets go see if something works. There will be noodling and then there would be a few minutes of oh it works. No that is not it – that is the stuff you should be doing at your house, practicing. But when you are on stage and you are performing for people who have paid and you have something to say then you have to say it. Its got to be done and you can't slack off in performance. … Conciseness is another

> thing. Why keep on noodling? If you have said what you need to say why keep on going? … Strictness of your own individual approach and bar that you set for yourself."[xi]

While direction determines why you are saying something, content determines what you are saying. Sometimes an improvisation can devolve into an exploration of new sounds. There are times when finding that new sound is the most magical thing but the danger is that the music collapses to a one-dimensional approach and the music suffers. This is something that musicians themselves can be aware of as Matthew Sansom finds in his interview and analysis of improvisations between two musicians.

> "Right, this is another new technique which I've never used before . . . Barring the strings, I think it was on the thirteenth fret, and using my finger as a capo. Doing a sort of . . . er . . . what do you call it when the two lines move . . . counterpoint . . . yeah, doing a contrapuntal thing. (13'38)
>
> Becoming engrossed in the interaction between himself and the "two lines," he states twenty-five seconds later: "Didn't really hear what Mick was doing here, I must have been concentrating too hard on this new discovery [laughs] (14'03)."[xii]

While the content may have been of interest to the guitarist, it took all of his focus thus collapsing any awareness of direction, structure and awareness of the other performer. As Müller emphasized, it is important that there is no slack in the improvisation and that content remains taut and aware of the direction and structure of the improvisation. There is a large difference between noodling and the coherent transmission of ideas and feelings. Skilled improvisation demands a focused practice and attention to knowing your instrument technically and artistically.

Structure

Often the greatest criticism of improvised music is that it has no form. How can it have form if it is not predetermined? Many improvising musicians will often actively resist form and structure. All of this leads to one of the largest misconceptions of improvised music – that it is formless and without structure. Structure can happen in improvised music in various ways. One is an organic emergent structure, also referred to as an unfolding of the form. Another possibility for the creation of structure is active thought into the compositional form of one's improvisation. I'll start by examining the concept of emergent structures and then look at the more active structural form of instant composition.

David Borgo has written extensively about the concept of emergent structures and how they relate to the new science of swarm intelligence in his book *Sync or Swarm: Improvising Music in a Complex Age*.

> "… there are several ways in which we might wish to locate musical connections to the swarm. Some improvised music provokes such quick reactions from players and evokes such complicated and dense soundscapes for listeners that a literal analogy to a swarm of insects may seem rather appropriate. And the ways in which individual improvisers can be heard to be "picking at" a shared body of modern techniques and sensibilities but in resolutely individualistic ways, or to be following their own creative spark while also being sensitive to and dependent on the evolving group dynamic, may bring to mind the behavior of social insects that seem to have their own agenda while also working in ways that organize the group without supervision."[xiii]

What is so exciting about this new way of thinking is that "organized behaviors can develop in decentralized ways."[xiv] Structure does not need to come from a top down system nor does it need to be predetermined. A form can

unfold from the process. Swarm intelligence is a form of decentralized behaviour that produces the flocking patterns of birds and fish. The beautiful constantly changing patterns have an emergent structure that is easy to perceive but almost impossible to predict.

> "Bonabeau, Théraulaz, and Marco Dorigo, a physicist, biologist, and engineer, respectively, working together at the Santa Fe Institute, offer a list of four basic ingredients that through their interplay can manifest in swarm intelligence: 1) forms of positive feedback, 2) forms of negative feedback, 3) a degree of randomness or error, and finally 4) multiple interactions of multiple entities."[xv]

A group improvisation includes all four ingredients needed to create an intelligent swarm. Being aware of how, as an improviser, you use these ingredients, leads to a better understanding of how a swarm works and opens possibilities of guiding the swarm. One can see positive feedback as a group listening and encouraging one of its member's ideas. For example, a player can begin playing long tones and the rest of the group joins in with long tones as well. Negative feedback balances this by helping to keep things interesting. At some point one of the band members could become bored by the long tones and begin to play very short notes, pushing the structure to a new place.

Randomness and error are integral to improvisation. Randomness can be expressed in many ways. For example, it can come in the form of unexpected actions by a fellow performer, using computers with random number functions to trigger random sounds or events, or randomness can come from the many extended techniques used on instruments while improvising which are inherently unstable and are valued for the randomness they bring into play. One of the key

concepts one learns as you start to improvise is based on the concept of errors. If you make a mistake (play a “wrong” note), do it again and make it into a musical choice. The errors are welcomed as they open up new avenues of exploration.

The final ingredient needed for swarm intelligence is multiple interactions of multiple entities which is a given in a group improvisation. The musicians not only output sound, they must listen and interact with their fellow musicians as well.

In Stephen Nachmanovitch’s book *Free Play* this process of “form unfolding” is explained by thinking about the process as a game of 20 questions.

> “As questions and answers unfold, we feel the excitement of being onto something, of following a lead, as in a detective story… Among the welter of material that comes up in an improvisation, we seek to simplify all that doodling and noodling up and down the keyboard and find the answer to that question, “What is the deep structure of theme, pattern, or emotion from which all of this arises?””[xvi]

Emergent structures arise from the questioning process just as they do in a swarm intelligence approach. The questioning approach leads one to the idea of an improvisation being a conversation. The form of a good conversation involves listening, silence, speaking and questioning – a process that creates new insights and deeper understanding.

It is interesting that in Nachmanovitch’s book on improvisation – the notion of structure does not come up until the last third of the book. While structure is not the first thing that comes to mind with improvisation, it is a concept that is

present in all skilled improvisation. Too often improvising implies that it is only fooling around, as is highlighted by the name of Nachmanovitch's book, *Free Play*. While playfulness and exploration are an important part of improvisation, a critical approach that adds in an awareness of Direction, Content, and Structure leads to expanded musical possibilities and can add depth to the music created.

Instant Composition

Some improvisers put more attention and thought on structure such as the Dutch pianist Misha Mengelberg. Mengelberg's renaming of his own style of music from free jazz to instant composition placed structural concerns as the most important concept in his improvisational practice.

> "In 1958, guitarist Jim Hall, in notes to a Jimmy Giuffre record, used the term "instant composition" to describe improvising. A few years later, Misha Mengelberg, knowing nothing of this, recoined the term, and it stuck. A quiet manifesto, those two English words countered notions that improvising was either a lesser order of music-making than composing, or an art without a memory, existing only in the moment, unmindful of form. Misha's formulation posited improvisation as formal composition's equal (if not its superior, being faster)."[xvii]

I was first introduced to the concept of instant composition by Mengelberg's collaborator and drummer Han Bennink. The renaming of improvised music or free jazz to instant composition had a profound effect upon me as it switched my focus from personal expression on the instrument to a broader sense of music making and composition. As it opened my awareness to the possibilities of thinking as a composer while improvising it greatly improved the quality of my improvisations. It also had the effect of creating a connection

to the western classical tradition I had grown up with playing the viola. A connection to the energy and spontaneity of jazz is still a large part of my music, but a freedom to use a vocabulary from western classical music has opened up as well. This is not to say that similar changes did not happen for others playing improvised music. As Lewis points out, the AACM was very interested in exploring all forms of music in the broadest sense including everything from folk music to world music to western classical music and the new ideas present in New Music of the 20th century.

In my own practice, instant composition not only conveys a better sense of what is happening it also conveys a sense of skill and complexity that removes the often dismissive notion that I am just making it up as I go along or winging it. More importantly, changing the name from improvised music to instant composition also brings with it a number of very useful insights that lead to creating better music.

I first started improvising as a bass player. The standard role for a bass player is to provide the foundation for other musicians to solo on top of. The bass is not generally a solo instrument, so to create interest for yourself you begin to play with and change the structure of a piece. This was my first hint of instant composition. As I continued I became interested in electroacoustic composition and creating soundscapes that would provide structures for improvisation. To create the soundscapes, I eventually developed an extensive vocabulary and library of sounds that were much more compositional in nature than the vocabulary an improviser on an acoustic instrument would have. As a

result, creating form became a large part of my activities as an improviser. In developing my own software for improvisation, *Kenaxis*, I realized that I needed tools that increased my compositional and expressive resources. When music changed quickly, I needed to be able to change what I was doing compositionally to respond to the other players. Once you have the tools to respond you also realize you also have the tools to lead. One of the most exciting things with *Kenaxis* is that you have the opportunity to dramatically control the compositional structure and content of an improvisation. With the computer, I began to focus on compositional processes while improvising. When playing the viola you perform each and every note. Using Kenaxis is very different and much more like composing in real-time since you are not playing all of the actual notes. With the computer you play a sample that you have chosen from a compositional standpoint that already contains all the notes and expressions that you want. While it is possible to be expressive with the computer by adjusting parameters such as volume and pitch, the main expression comes from your choice of samples and when you play them.

> "Mengelberg is currently active as a professor of music in Amsterdam, in which he teaches the fundamental points of improvised music, even more basic than instant composition - noise and counterpoint... This is a grander theme than "playing" (to use Bailey's term), as it adds a level of calculation to what might otherwise be an impulse. Noise, on the other hand, is the use of non-musical sounds in the production of music and has a history going back to the Italian Futurists of the early 20th Century. It is a tactic that is routinely employed by members of the ICP, adding a level of contrast and color as well as giving direction to the improvisation and—you guessed it—counterpoint."[xviii]

Once one starts looking at improvisation as instant composition all of the compositional techniques of 20th century composition become part of your vocabulary as well. While Mengelberg points out noise and counterpoint there are many other tactics such as silence, minimalist use of repetition and phase shifting, theme and variations, and even the simple application of classic ABA form, that add a huge vocabulary and depth to an improvisation. The shift to instant composition also removes the jam session idea of improvisation. In a jam session all of the musician's roles are set, the drummer and bass provide rhythm and any horns or other lead instrument get to solo on top. If all of the musicians consider themselves as composers, there is a good chance that they will subvert these normal roles in an exploration of the many other possibilities that are available.

Refocusing one's attention by calling your music instant composition also makes explicit the awareness of the form that the music is taking and creates a sense of memory and the idea that a group can go back and forth to previous ideas. While renaming the genre to instant composition highlights these ideas, it must be stressed that skilled improvisers consider structure no matter what they call their music. While some focus on creating structure implicitly while they improvise, others are aware of form and either through positive or negative feedback, shape and create structures that emerge from a group improvisation.

Better Music?

> "Who cares if music we are listening to is improvised or notated? I certainly don't. There are enough issues to get in the way of one's

> musical enjoyment than to stratify the conditions of music, music making, or the sheer joy of it."[xix] (Butch Morris)

We have looked at the use of Direction, Content and Structure in skilled improvisation but does this make for better music? It is useful to use Gilles Deleuze's concept of the figurative vs. the Figure, from his book *Francis Bacon: The Logic of Sensation* (Deleuze, 2003). We can look at how the use of Direction, Content and Structure in improvised music help guide the music towards the figure instead of the figurative and thus away from cliché. "It is a mistake to think that the painter works on a white surface. The figurative belief follows from this mistake."[xx] The same is true of any improviser getting ready to break the silence before the first note is played. It is vital that there be an awareness of just how full the silence is with clichés and preconceived notions. According to Deleuze there are three paths of expression with the lowest being the figurative.

> "…two ways of going beyond the figuration (that is, beyond both the illustrative and the figurative): either towards abstract form or toward the Figure.... The Figure is the sensible form related to a sensation; it acts immediately upon the nervous system, which is of the flesh, whereas abstract form is addressed to the head and acts through the intermediary of the brain, which is closer to the bone."[xxi]

Music by its very nature is a more abstract art form than painting. Still there are many tropes in music such as a minor key being sad that can and do fall into the figurative and cliché. The search by improvisers to find their own voice can be seen as the same search a painter undertakes to reach for the figure. One can create abstract sounds just as in painting, and while it is preferable to the figurative and cliché, music of this sort is less coherent and thus

does not achieve the sensation of acting directly upon the nervous system. Even once an improviser has developed his own unique voice, it is easy to fall in a cliché of one's own work.

> "Clichés, clichés! The situation has hardly improved since Cézanne. Not only has there been a multiplication of images of every kind, around us and in our heads, but even the reactions against clichés are creating clichés."[xxii]

Direction provides the inspiration to struggle and find new content. It creates a need to search and find new solutions. Structure is also key to keeping the content fresh, suggesting new sound explorations one would not have considered without looking at the form of the music you are creating. Just as Francis Bacon would make random marks on his canvas to create new situations for himself – randomness is a key element in swarm intelligence and emergent structure. In instant composition, randomness comes into play since you have more than one player. How another player interacts with you creates a completely new random set of responses to what you are doing. These responses become less random as you get to know a player. This is why it is often essential and exciting to play with new people. Randomness forces you to reconnect with your content and drive towards the figure – connecting directly into your own nervous system and the nervous system of those listening to your music.

An awareness of Direction, Content and Structure expand a musician's possibilities, leading to a richer and deeper musical vocabulary, and enhancing

the ability for one's music to connect directly with listeners and those with whom you are improvising.

Concluding Comments

In a larger improvising ensemble it becomes even more difficult to allow direction, content and structure to manifest without some kind of outside influence. In an ensemble of more than five to six players, structure is often the first to suffer. Once structure breaks down it is difficult for any coherent direction or content to emerge – instead you have a number of soloists, duos or perhaps trios pushing in one direction with others pushing in another. While this can make for an exciting chaos – it does not allow for the full expression possible from an ensemble. Butch Morris speaking about Conduction explains how the imposition of structure on improvisation leads to many positive results in a larger ensemble.

> "Results are ever present: enhanced musicianship; discovery of structure and substance in the arc of the performance; the evolution of a social logic based on new reciprocities between human and music, and between composer and conductor, conductor as composer, instrumentalist and conductor, instrumentalist and composer -- and audience, attaining new levels of momentary logic and new clarities about the character of the work itself."[xxiii]

The *Mad Scientist Machine* was created with all three corners of the direction, content and structure triangle in mind. The genesis of the idea came from the basic notion of using lights to communicate musical ideas. To go beyond the rough structural idea I needed the direction corner of the triangle - I needed a reason why communicating with lights would be interesting. Visiting

lecturer John Crawford from University of California Irvine was speaking about why one would use a telematic system and presented a slide with a pivotal concept.

> “Ascott conceives art as a "map of actual and potential relationships" in contrast to "the idea of art as a window onto the soul.""[xxiv]

While I would not have used the phrase “a window onto the soul”, I had always seen the creative impetus for my work to be a search for universal truths, a similar concept. I was interested in trying a new approach, and seeing the power of Crawford’s telematic work to actualize virtual relationships, I decided to explore mapping of relationships as an impetus for creation.

I used the concept of linking/mapping our local improvising music community to the global improvising music community to inspire the direction of the piece. This linking is a political act, transversing borders and facilitating the spread of ideas around the globe. Of particular excitement was the inclusion of Paul Cram in Halifax and Lisle Ellis in New York who were founding members of the local orchestra that performed the piece. Not only was I connecting to improvisers around the world but also I was revitalizing lost links to the history of the orchestra. John Oswald in Toronto had performed and composed for the orchestra in the past, so again there was a dual link to the orchestra. As well, Oswald’s ideas about plunderphonics had been very influential on my work as an improviser using a laptop. Pauline Oliveros had never worked with the orchestra, but a workshop with her deeply influenced me. Oliveros is an innovator and major thinker in expanding music and community across the web. To bring the

four of them together along with the local players was an exciting endeavour. The *Mad Scientist Machine* allows the compositional ideas of the world's leading improvisers to be communicated to a local orchestra. The performance created a real sense of excitement in the players as well as the conductors. The direction and excitement created by connecting these communities pushed the piece to a level that would not have happened otherwise.

Structure was the next item to tackle. By creating a light cueing system with one light for each performer, structural decisions could be imparted to each member of a large ensemble. I wrote software so that it would be easy for a conductor to cue each player. The compositional ideas of the conductors could then be imparted as the structure in which the improvisations would occur.

Content was the last piece. Each colour of the lighting system triggered a different musical idea. This system thus focused the players to consider a certain sound world and stay with it until the conductors chose otherwise. The driving force was the direction and structure of the piece but within the parameters of each colour the choice of actual content was up to the performer. The players still had a chance to invest their own personality and choices into the content.

The musical ideas of the conductors were limited to organizing the light cues in time. While the cues were very open ended to allow for multiple interpretations, I specified their definitions, not the conductors. I created a broad palette using basic concepts that would enable many approaches but musical ideas are very diverse and complex. Everyone has a different concept of how to

define a musical idea and how he or she defines their own musical ideas. The conductors had to filter their approach to organizing musical ideas through the vocabulary I established. The basic building block of composing is organizing a sequence of sounds in time. The conductors had full control of this dimension and were thus able to express a version of their musical ideas as mediated by the *Mad Scientist Machine*.

The *Mad Scientist Machine* takes an innovative approach, combining a comprehensive approach to improvised music with the Internet, the single greatest resource to emerge in recent years. The Internet makes it easy to communicate ideas worldwide and allows the *Mad Scientist Machine* to work not only locally but also globally. Using Direction, Content and Structure to create an environment enabling a high level of improvised music creation, the *Mad Scientist Machine* allows for global collaboration facilitating the creation of music with enormous complexity and sophistication.

CHAPTER 2: TECHNOLOGY, IMPROVISATION, AND CONDUCTION

Introduction

The *Mad Scientist Machine* implements my personal theoretical concepts about improvisation as well as two other areas of intersecting interest. These two interests are the use of technology in improvised settings, and, conduction– the act of conducting a group of improvising performers.

I will begin by exploring the technological systems and then move on to the various conduction systems that have informed my work.

Technology and Improvisation

Pauline Oliveros' tape piece *I of IV* (1966) is the first use of improvisation in a technological setting that I heard about. She transformed the studio into a performance environment using tape loops and other analog components.

Computers are very effective at managing many small details and have been used in improvised settings as soon as they were fast enough to compute in real-time. Computer systems of particular interest are Max Mathews *GROOVE* system (1967), which was further developed into the *Radio Baton* with Robert Boie in 1987; Joel Chadabe's system for his 1978 piece *Solo*; and my own improvising music software *Kenaxis* (2000-2010).

Pauline Oliveros – *I of IV* (1966)

Born in 1932, Pauline Oliveros is a central figure in the development of electronic music. She was one of the founding members of the San Francisco Tape Music Center in the 1960s and has developed a practice called Deep Listening that has influenced many contemporary composers including myself She is also a skilled improviser and can be heard improvising on the accordion on many recordings. *I of IV* is one of her earlier pieces, created by transforming the studio into a performance environment and then listening and experimenting with the sonic possibilities.

> "I wanted to bypass editing, if I could and work in a way that was similar to performance… As I was making *I of IV*, I was also listening to it. At one point in the piece there's a rather climactic scream-like melody that sweeps through most of the audible range. When that started coming out, I didn't expect it; it was incredible and very delightful. I was laughing and was amazed at that particular moment…"[xxv]

The playfulness and interactive improvisation that Oliveros achieved while using a completely new vocabulary of sounds, inspired me when I first heard the piece. Chadabe describes her setup as an "… interactive performable system involving tone generators, tape delays, and amplifiers to produce combination tones, repetitions, layering of sounds, and different kinds of reverberation."[xxvi]

I found Oliveros' concept of subverting the normally meticulously edited genre of tape music into a performance system liberating. It inspired me to explore methods for setting up performance systems myself. The *Mad Scientist Machine* is my latest exploration of such a system.

One of the most important lessons learned from Oliveros is that there should be enough freedom in the system in order that it can surprise you. Those moments of surprise are often the strongest part of a performance.

Max Mathews – *GROOVE* system (1967) & Radio Baton (1987)

Max Mathews is considered the father of computer music. He wrote *Music 1 (1957)*, which eventually evolved into *csound,* a language still used to this day. Mathews is also the inspiration for the creation of the programming language *Max/MSP*, the programming language I used to code the *Mad Scientist Machine*. Mathews wrote the following in March 1997 for the *Horizons in Computer Music* event.

> "Starting with the *GROOVE* program in 1970, my interests have focused on live performance and what a computer can do to aid a performer. I made a controller, the Radio-Baton, plus a program, the *Conductor Program*, to provide new ways for interpreting and performing traditional scores. In addition to contemporary composers, these proved attractive to soloists as a way of playing orchestral accompaniments. Singers often prefer to play their own accompaniments.
>
> Recently I have added improvisational options which make it easy to write compositional algorithms. These can involve precomposed sequences, random functions, and live performance gestures. "[xxvii]

The *GROOVE* program was the precursor to the modern day sequencer. It could record actions by a performer (twisting knobs or playing keys) or have a score entered and then *GROOVE* would play these back using an analog synthesizer. Particularly notable compositions using the *GROOVE* program include Emmanuel Ghent's *Phosphones* (1970-71), *Dualities* (1972), and *Brazen* (1975) written for the Mimi Garrard Dance Company. "…music, lighting, strobes,

projections, and dance were coordinated by digital signals encoded on magnetic tape."[xxviii] The ability for a computer to control all of these facets opens many avenues of exploration, particularly when the sequence can be manipulated. Later versions of GROOVE allowed you to change in real-time how the sequence was performed. In 1978 after having used the GROOVE program for many years Ghent reflected:

> "It opened opportunities that had been unthinkable—it enabled me to try all kinds of ideas, listen to them in real time, modify them in real time and thereby get a chance to experiment in ways that would be prohibitive using standard methods like paper and pencil and human musicians."[xxix]

After the computer needed to run the GROOVE program was discontinued, Mathews continued working on similar ideas with the creation of the Radio-Baton and his *Conductor Program*.

Figure 2: Max Mathews with the Radio Batons[xxx]

> "The Radio-Baton is a controller for musical performances. It consists of two batons, a receiving antenna board, and an electronics box. It tracks the motion of the two batons as they are moved in three- dimensional space by a performer."[xxxi]

The manual for Mathews ' Radio Batons *Conductor Program* is available online[xxxii]. A highly technical manual, one can deduce from it that the main interaction is triggering the score with downbeats. The downbeats can be programmed anywhere in the score and the software adjusts the playback to the speed of the conductor. There are special cases where the Y parameter of the baton can also be used to control speed to allow for an accelerando. While the music score is pre-programmed – the speed at which it is played back is not set. In fact, if a second downbeat is given before all of the material is played between two trigger points, the software will skip ahead and leave notes out. The x and y positions of the batons also can control the volume of the various voices in the score. By changing the dynamics and tempo each performance is unique.

When working with the *Conductor Program* there are three modes that can be used.

> "First, in the score-entry stage, notes were input to the computer's memory. Second, in the rehearsal stage, phrasing, accents, and other articulations were added to each voice. Third, in the performance stage, all of the voices were played back together. Different devices were used to "conduct" different aspects of the music during the performance stage."[xxxiii]

This system is optimized for playing back a preset sequence with as much expression as possible. In future versions of the *Mad Scientist Machine* it might be interesting to create a preset sequence and conduct it much like Mathews ' *Conductor* program.

Joel Chadabe – *Solo* (1978)

A major figure in interactive music, Joel Chadabe along with Roger Meyers in 1977 co-authored the PLAY program, the first software sequencer. In 1978 Chadabe created a piece call *Solo* for computer, Synclavier system and two Theremins.

> "My software automatically composed the notes of a melody. The melodic concept was based on a clarinet improvisation by J. D. Parran that I had heard in New York…. I performed with two proximity-sensitive antennas, actually Theremins modified to communicate with the computer without themselves making sounds… As I moved my right hand towards or away from the right antenna, I controlled tempo by increasing or decreasing the duration of each note. As I moved my left hand towards or away from the left antenna, I controlled the timbre by bringing in or fading out the different sounds. The gestures of moving my arms in the air to control tempo and cue instruments in and out reinforced the performance metaphor of conducting an orchestra. It was, in fact an "improvising" orchestra… I could not completely predict the result, so I would be reacting to what I heard in deciding how to perform yet the next event. It was like a conversation with a clever friend."[xxxiv]

Chadabe's system is similar to that of Mathew's Conductor Program in that you control a few parameters and let the computer deal with the details. The big difference is that Chadabe's *Solo* has slightly more unpredictability thrown in. The melody is determined randomly and not just from a score. This was one of Chadabe's first interactive composing systems. Chadabe describes his interactive composing systems as "… a method for using performable, real-time computer music systems in composing and performing music."[xxxv] In a Computer Music Journal article published in 1984 Chadabe continues by describing the improvisatory nature of the system.

> "But although I trigger each set of changes to begin, I cannot foresee the details of each change. I must react to what I hear in deciding what to do next. It is a distinctive characteristic of interactive composing that a performer, in deciding each successive performance action, reacts to information automatically generated by the system."[xxxvi]

The emphasis is on creating a musically expressive and satisfying performance by controlling tempo and timbre. To do so it is necessary that the system is seen as an instrument.

> "An interactive composing system operates as an intelligent instrument—intelligent in the sense that it responds to a performer in a complex, not entirely predictable way, adding information to what a performer specifies and providing cues to the performer for further actions."[xxxvii]

Both Mathews' and Chadabe's systems use a gestural input system to create a natural visceral interface to the software. They are interested in producing a musical expression from the computer by conducting it.

Initially, I began the *Mad Scientist Machine* project considering the use of a Wii-Mote controller, the hand held wireless game controller for the Nintendo Wii System. It can detect velocity in three axes and has eight buttons. I had tried previous experiments using a Theremin as well. I found that the complexity of the vocabulary I wanted to get across could not be expressed without a more precise interface. I switched to using an iPod Touch with a touch screen. While this worked for accurately selecting one colour it did not have enough additional screen space to offer a method to choose which light you were controlling.

I decided to use a computer, which allowed for the most control and also allowed visual feedback to indicate what the lights were doing. Of course there is

a loss in the visceral feel of using something like a Theremin or a Radio Baton, but in this case the benefits of the specificity of control that a standard keyboard and mouse interface offered, were the better option. This highlights an important difference from Mathews and Chadabe's work and mine; the *Mad Scientist Machine* is transmitting ideas and not the final sonic musical performance. The musicians interpreting the ideas create the sonic musical performance.

Stefan Smulovitz – *Kenaxis* (2000 – present)

I learned the programming language *Max/MSP* from Arne Eigenfeldt at Simon Fraser University in 2000. Immediately I began to develop software to allow me to use the computer in the improvised music I was creating. The first version was called *Sound Mangler*, a basic sample player that allowed a number of simple manipulations to four samples at a time. Over the next few years it developed into a full-fledged performance environment for creating improvised music and was renamed *Kenaxis* in honour of Greek composer Iannis Xenakis.

One of the most interesting things that happened with *Kenaxis* was the iterative nature of its development. I would code the software and then use it for a number of performances. Inevitably, I would discover bugs, but more importantly, I would also think about new ways of doing things. I also received feedback from other *Kenaxis* users pointing out flaws or better or more interesting ways to do things. I would then revise the code and implement the changes in the next version. This cycle happened many times to finally create what *Kenaxis* is today. I realized how important this iterative process is in creating software performance systems so I made sure to have multiple test runs

of the *Mad Scientist Machine* in order to generate the best final software system possible. The initial idea was first developed in June of 2008. Many experiments and versions were created. The first trial and release version was used in May 2009 at a MFA show at 611 Alexander. The system only used four lights and was controlled locally. After a long period of refining the system, a series of rehearsals using the full telematic system and eight lights happened in mid October 2009. The final system was then optimized for use at the end of November 2009.

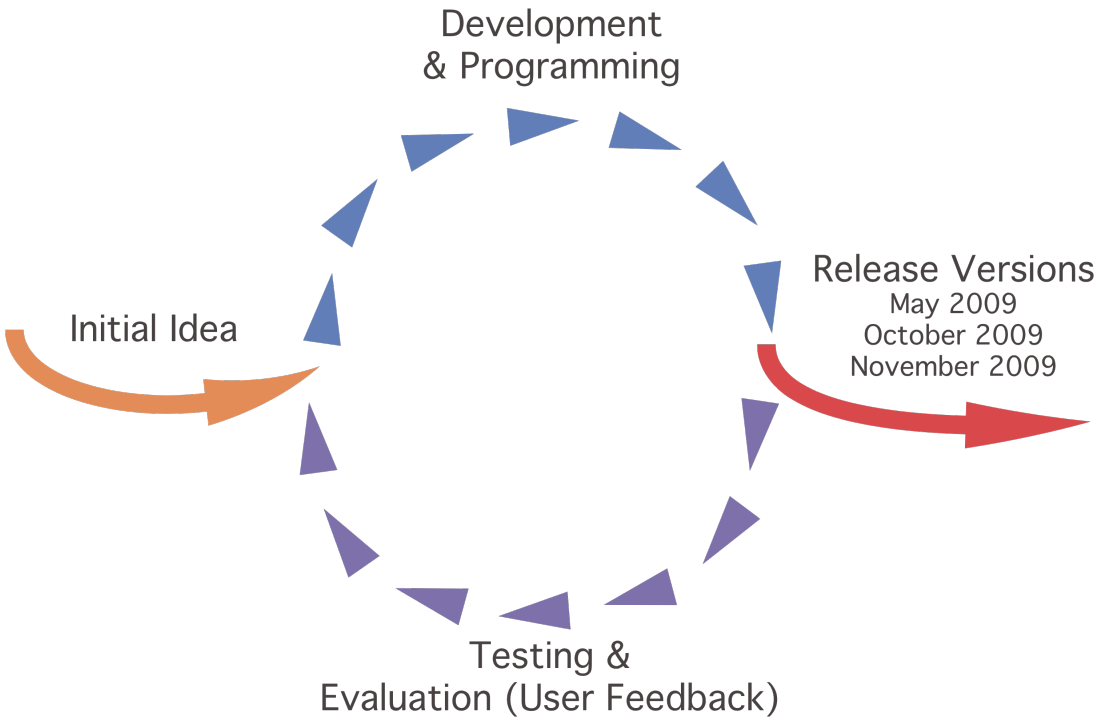

Figure 3: The Iterative Process

One of the most important developments in *Kenaxis* was the idea of creating automated processes that would develop over time so that I could work as a meta-composer instead of dealing with every detail. The simplest of these was the idea of changing pitch over time. For instance in a normal system you would have to physically slowly move a knob or mouse if you wanted a glissando to occur over eleven seconds. While you were changing the pitch you would have to focus all of your attention on this one detail and not be able to move on to other things. In *Kenaxis* I implemented a simple ramp that let you set a time for the glissando. Thus you would simply enter the new pitch and the computer would change the pitch over time, allowing you to deal with other parameters while this was happening.

I expanded this idea to include random modulators. There are many flavours of random and it took a bit of experimenting to find a system that would produce musical results. The inclusion of these processes happening over time is one of the things that make *Kenaxis* so powerful. With *Kenaxis* you are able to set up an interesting process with one sound and then focus on a different sound to manipulate in a more focussed manner.

This is exactly what the *Mad Scientist Machine* does as well. You can set up a musically satisfying random parameter for how the lights should fade in and out, allowing you to focus on the next idea instead of having to control each light individually.

While *Kenaxis* controls sampled sound in time, the ideas developed in the creation of *Kenaxis* were crucial in developing the *Mad Scientist Machine'*s ability to control musicians in time.

Conduction

Conduction is a term coined by Butch Morris to describe the act of conducting an improvising ensemble and creating musical structures in real-time by the use of gestures and cues.

There are many musicians engaged in one form of conduction or another. Sun Ra, Frank Zappa, Charles Moffet, Lukas Foss, Alan Silva, and others are some of the musicians who used improvisational cueing systems. Even Leonard Bernstein recorded an LP with "Four Improvisations for Orchestra" that he conducted in 1965. When I began creating the *Mad Scientist Machine*, Earle Brown's *Available Forms 1 & 2*, John Zorn's *Cobra*, Butch Morris's *Conduction* and Walter Thompson's *Soundpainting* were the systems that I was aware of and are the lineage from which the *Mad Scientist Machine* sprang forth.

Earle Brown – *Available Forms 1 & 2* (1961 – 1962)

Earle Brown was one of the innovators of open form scores and the use of improvisation in western classical music. In 1952 he composed *December 1952* – one of the first graphic notation pieces. In 1953 with *Twenty Five Pages* and culminating in *Available Forms 1 & 2* in 1961,1962 he moved back to notated music but asked that it be performed in a spontaneous fashion. In *Available Forms 1 & 2* the conductor is able to choose when and in which order the

sections of the piece are performed. It was Brown's concept of the open form, the idea of cueing the players to create a real-time composition, that opened the door for later composers to develop their own systems.

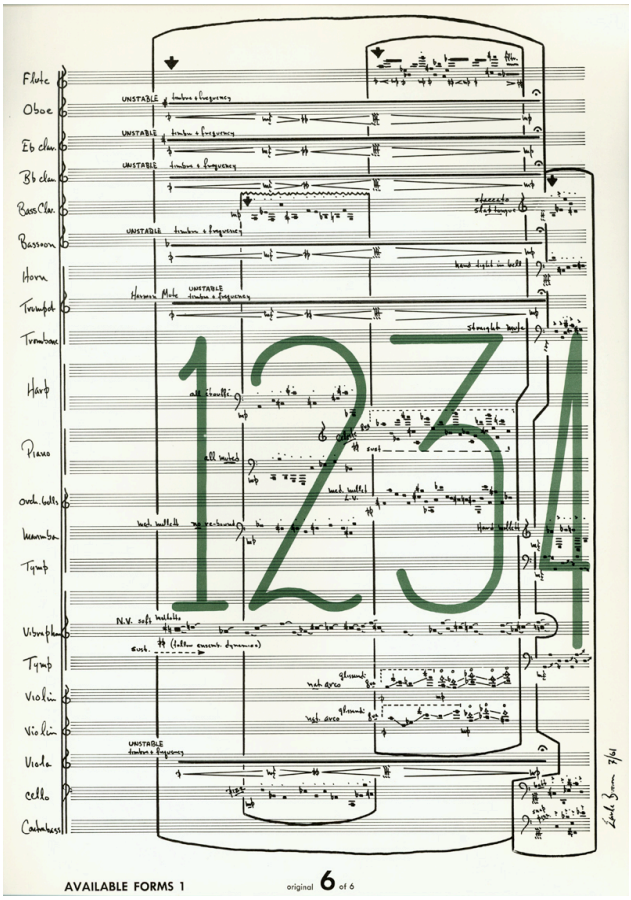

Figure 4: Earle Brown - *Available Forms 1*, Page 0

> "Spontaneous decisions in the performance of a work and the possibility of the composed elements being "mobile" have been of primary interest to me for some time; the former to an extreme degree in FOLI O (1952), and the latter, most explicitly, in TWENTY FIVE PAGES (1953). For me, the concept of the elements being mobile was inspired by the mobiles of Alexander Calder, in which, similar to this work, there are basic units subject to innumerable different relationships or forms. The concept of the work being conducted and formed spontaneously in performance was originally inspired by the "action-painting" techniques and works of Jackson Pollock in the late 1940s, in which the immediacy and directness of

> "contact" with the material is of great importance and produces such an intensity in the working and in the result. The performance conditions of these works are similar to a painter working spontaneously with a given palette." [xxxviii]

John Zorn – *Cobra* (1984)

One of the composers in the next generations heavily influenced by Earle Brown was John Zorn. In the mid 1970s Zorn became very interested in game pieces and created a number of them named after sports. His final game piece to date is *Cobra*, written in 1984. Zorn describes *Cobra* in an interview with William Duckworth in *Talking Music*: "Yes, that is the peak of my game pieces. There's something special about it, because I put together ten years of thinking in that one piece." [xxxix]

Zorn is based in New York and is a key figure in the experimental music scene, particularly the "downtown" scene of New York. He continues to be an innovative force in improvised music. Zorn's early game pieces came from the appeal of working spontaneously and in direct contact with material that Brown allowed in *Available Forms*. Zorn continues in *Talking Music*:

> "With early pieces in high school and college, I was dealing with Earle Brown-kind of ideas, *Available Forms*, I moved that into a little more open area in pieces I called *Linear Bubbles*, that dealt with choices, like George Crumb's circle, where you start anywhere in the circle and go around. And from Earle Brown's *Available Forms* things, where I the conductor would actually make a cue— "Do number one, do number four" — towards games, where the musicians would cue off of each other." [xl]

In September 2003 I was introduced to John Zorn's improvised music game *Cobra*. Zorn has not published the rules for *Cobra* but instead insists on teaching it himself. Fortunately, keyboardist/composer Wayne Horvitz, one of the

original *Cobra* musicians, taught us the piece in preparation of Zorn coming to conduct it in Vancouver. Unfortunately Zorn was not able to come, but luckily I had the opportunity to learn the piece.

The game uses a series of cue cards that the conductor shows the players. Each card has a different instruction. Many of the light cues in the *Mad Scientist Machine* were directly influenced by the cues that Zorn chose for *Cobra*. The game is highly democratic with players being able to request cues to the conductor. There is also a provision that if a player does not want to follow the cues he can put on a hat and become a rebel and do whatever he or she likes. The only rule is that there is only one rebel at a time. These additions go a long way to enable group interaction instead of a top down hierarchy. The performers can make the larger structural decisions. Wayne Horvitz explained to us that as performances of *Cobra* happened over the years, Zorn had a greater interest in freedom and autonomy and eventually moved conceptually from the role of conductor to that of facilitator.

> "It's a pretty democratic process. I really don't have any control over how long the piece is, or what happens in it. I pick the band when I perform it. And when you're picking improvisational players, that pretty much determines what the sound is going to be like. "[xli]

Butch Morris – *Conduction* (1985 – present)

Lawrence D. "Butch" Morris is an American jazz cornetist, composer and conductor. A few years older than Zorn he is a member of the same New York scene. In fact, on February 1st, 1985 at the Kitchen in NY, Zorn was a member of the ensemble for Butch Morris's first Conduction.

> "Conduction®: a vocabulary of ideographic signs and gestures activated to modify or construct a real-time musical arrangement (of any notation) or composition. Each sign and gesture transmits generative information for interpretation and provides instantaneous possibilities for altering or initiating harmony, melody, rhythm, articulation, phrasing or form."[xlii]

While attending a workshop on Conduction by Butch Morris in New York in January 2010, I was struck by the economy of his signals. Over the course of two hours he taught ten signals. What was interesting was that the same signal could have multiple meanings depending on context. For instance his sign for repeat would mean to create a loop if signalled in silence. If someone else were already playing, the repeat sign would instead mean to imitate the other player. These subtleties lead the musicians to a deeper level of concentration and interpretation of the signs. The musical intention of the conductor had to be intuited by the player and then interpreted and performed in the player's own manner.

Morris is very specific in what he wants. While context allows a specific cue to have more than one meaning, the player must concentrate and pay attention so that what is asked for in the Conduction is achieved. More than anything else I was struck by this specificity during Morris's workshop. Morris appears to be thinking like a composer – not an improvising musician. He wants to get very specific results. Of course since the material is improvised it is like working with water – its constantly flowing. What was exciting about Morris' work was that he was controlling how and where it was flowing. According to Morris:

> "Conduction is the art of "environing," the organization of surrounding things, conditions or influences. It is a technique to

> capture and discover sonic information, structure and sub-structure, meaning, implication and expression (as we construct together) -- all primary values in our pursuit of coherence and poignancy, and the immediacy of place."[xliii]

From the player's perspective this is very different than either Zorn's *Cobra* or Brown's *Available Forms*. In Zorn's *Cobra*, the players themselves can influence the form and a much more playful atmosphere of a game where everybody gets to play is created. The emphasis is on the performer. In Brown's *Available Forms 1 & 2* the music is all notated – the role of the musician is to follow the conductor with no input of their own. In Morris' Conduction the players must follow the conductor but the performers create the actual musical material. As Morris says in his essay *The Science of Finding*:

> "To contribute to Conduction, the musician reveals explicit content within the evolving work. As such, musical flexibility and potential expand as we explore a new condition of liberty to foster individual and collective freedoms in real time."[xliv]

Walter Thompson – *Soundpainting*

Walter Thompson is another interesting figure in live improvised conducting. He calls his form Soundpainting. Instead of the economy of using a few signals in many different ways, Thompson has developed a large vocabulary of signals that can be learned from his DVD and two volumes on Soundpainting. The Soundpainting history can be found on the Soundpainting website.

> "…Thompson developed Soundpainting into a comprehensive sign language for creating live composition from structured, jazz-based improvisation. In the early 1990s Thompson expanded the Soundpainting language to include gestures specific to actors, dancers, poets, and visual artists. To date, Soundpainting comprises more than 800 gestures…"[xlv]

The specificity of Thompson's system allows for a highly developed and exact musical dialogue. It requires a serious commitment from the performers to learn the system but in return the ideas of the conductor are silently and accurately conveyed to the performers. He has developed a musical sign language that has expanded into other disciplines. The creation of a unified method for real-time structuring of many disciplines is a very exciting idea.

Concluding Comments

Improvisation and cutting edge technology have a long history. The *Mad Scientist Machine* builds upon the work of pioneers such as Oliveros, Mathews, and Chadabe and integrates one of the most important technological leaps of the 20th century, the Internet. It not only goes forward technologically, but also incorporates the progress made in methods for conducting an improvised ensemble by composers such as Brown, Zorn, Morris, and Thompson.

There are many approaches to conducting an improvising ensemble. One of the main differences is the amount of freedom the players have as creative musicians to make choices versus the specificity of what is asked for by the conductor. Zorn has taken a player-centric view creating a game piece where the musicians have autonomy and control of the piece. Earle Brown was very much interested in freedom but his pieces are composer-centric. Butch Morris' Conduction system and Walter Thompson's Soundpainting are somewhere in the middle of the continuum. They allow more freedom for the players; letting them improvise, but imposing strong structures. The structures keep the control of the piece in the conductor/composer's hand.

CHAPTER 3: THE *MAD SCIENTIST MACHINE*

Introduction

The *Mad Scientist Machine* is a software/hardware system allowing a user to conduct a group of players. It is combined with a composition system to structure live improvisations. A local or remote user can use the software to control an LED light that is placed in front of each performer. Each colour indicates a different performance instruction. For instance, green indicates to play noise, whereas white signals long tones.

There are two things that are particularly exciting about this project. First it uses the Internet to transmit ideas instead of streaming audio, so latency is not a problem. Latency is a delay that is typically found in Internet applications. With the musicians all in the same room, as opposed to telematic performances with players in separate locations, it is relatively easy to stay in sync and play together. Second, the piece is uniquely transparent in communicating what is happening to the audience. They are able to see the structures and ideas that the conductors are sending, allowing them a window into the compositional process. It is exciting for the audience to see how the performers will translate these ideas into music. Improvised music then has a structure that the audience can understand which helps to make the music more meaningful to the audience.

The Performance

The original performance was by Orkestra Futura in Vancouver, BC on November 28, 2009 at The Cultch. Stefan Smulovitz conducted part one of the performance locally. Parts 2-6 were conducted remotely via the Internet. Conductors included: Pauline Oliveros (Oslo, Norway), Lisle Ellis (New York), John Oswald (Toronto), and Paul Cram (Halifax).

Performers were: vocalists Viviane Houle, Christine Duncan, DB Boyko, Peter Hurst; strings Jesse Zubot, Eyvind Kang, Dave Chokroun, Tommy Babin, Chad MacQuarrie; percussionists Joseph Pepe Danza, Kenton Loewen; horns JP Carter, Brad Muirhead, Coat Cooke; and Chris Gestrin keyboards.

Figure 5: Orkestra Futura at the Cultch

Physical Manifestation

To create the cueing system I used an Enttec DMX USB Pro interface from my computer to control fifteen Chroma–Q Color Block 2, LED DMX controllable lights. Each LED light was placed inside a plinth that I designed made of Coroplast – a corrugated recycled plastic. Black vinyl was placed on the sides of the plinth to keep the light focused. A vinyl sticker featuring an excerpt of the graphic code I used to program the *Mad Scientist Machine* was visible to the audience on the front of each plinth. The top was angled down to make it easier for the players to see the changing colours.

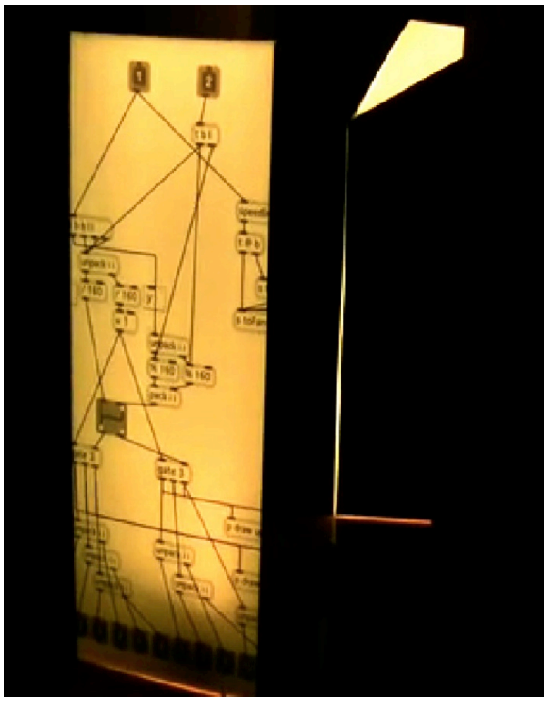

Figure 6: One Lit Plinth with Rear View in Mirror

The players were arranged in a semi-circle so that it was possible to see the colours of the plinths of the other players. This allowed for the ability to sync with other players visually through the composition system as well as using their ears.

A projection of the Skype chat, at a slightly larger than human scale, was projected behind the band. This helped establish the presence of the virtual conductor in the space without overwhelming the band. (See Figure 5.)

Rules of the Game

The rules for the *Mad Scientist Machine* are very simple. Pay close attention to the coloured plinth in front of you and play the appropriate material for each colour. (See Figure 7.) The second rule was that the intensity of the colour corresponds to volume. There were numerous discussions with the group of performers during the rehearsal process as to exactly how the simple cues should be interpreted. The cues were: *Melody, Noise, Drops, Loops, Long Tones, Imitator, Open,* and *Silence*. Some comments on the instructions follow.

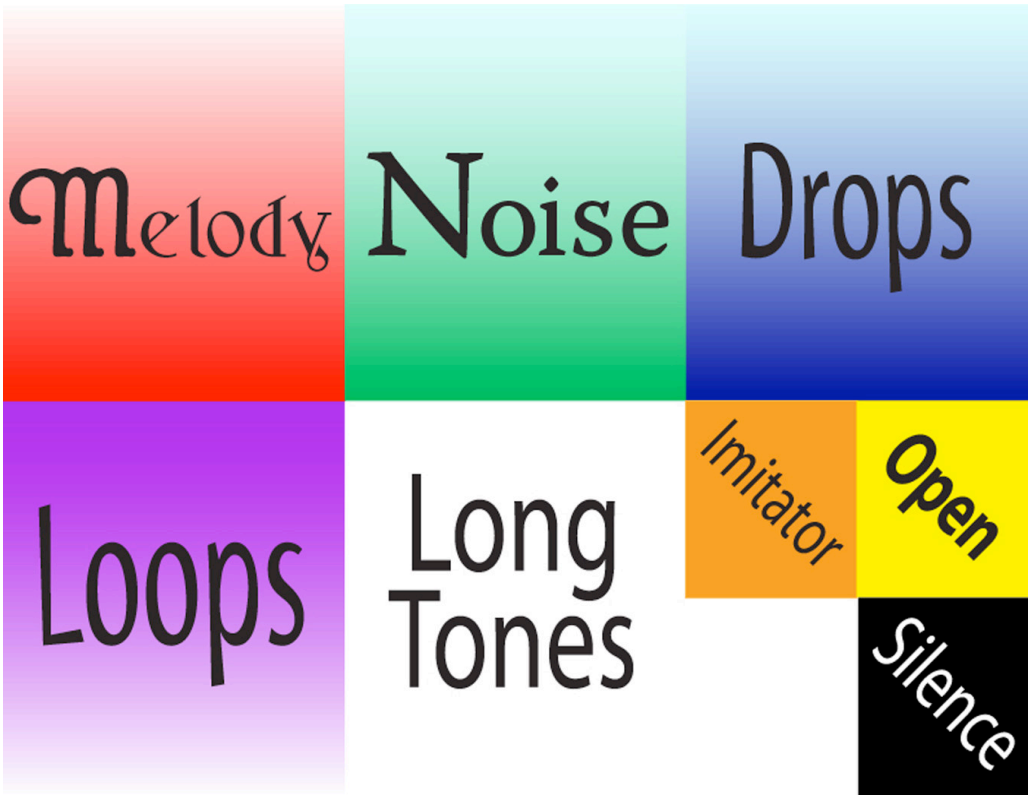

Figure 7: *Mad Scientist Machine* Score

The cue *Melody* was intended to have a literal meaning, that is, play melodically. While quite vague and similar to solo, the intent was that *Melody* was to be a more specific songlike approach.

Noise did not necessarily mean blasts of noise. If the *Noise* cue was indicated quietly by using a low intensity green light it would be more of a texture. The intent was that this was non-pitched material. In retrospect it may have been better to call this texture.

Drops were to be interpreted as a pointillist raindrop soundscape, with the use of space being encouraged.

Loops had two meanings. If the light was flashing at a tempo that could be perceived as a beat it meant to play a loop at a specific tempo, most likely a one or two-bar phrase. When the light flashed at a much longer interval, it was to be interpreted as a switch from one loop to another.

Long Tones were single held pitches that faded in and out with the intensity of the light. *Imitator* was a cue to imitate one of the other currently playing musicians. Any currently performing player could be the source of the imitation. *Open* signified that a player could do whatever they wanted and finally *Black* signified that the player should be silent.

Composition

The piece was arranged into three main sections with a total of six parts, each about ten minutes in length. Section one began with myself using the *Mad Scientist Machine* to conduct the orchestra locally. Section two was a solo conduction by each conductor and Section three was a group conduction by the four guest conductors.

The idea behind section one was to introduce the concepts of how the different colour lights related to different sounds to the audience. This section was intended to be somewhat didactic in nature as well as musical. One of the challenges of the composition was to include time and space to make Skype connections to each conductor before they started. I decided compositionally to take a break between sections one and two while I established a Skype connection to Pauline Oliveros.

Section two featured a ten-minute conduction by each of the guest conductors. I started with Pauline Oliveros in Oslo then switched to Lisle Ellis in New York. Next was John Oswald in Toronto and finally Paul Cram in Halifax. It was extraordinary to see Pauline, obviously early in the morning, in her hotel room, start the first conduction. To cover the time it took me to establish a Skype connection when switching conductors, I decided to set the lights to highlight a different section of the orchestra each time, instead of going to silence. The voice, strings, rhythm section and horns each took a turn performing long tones.

Section three was a group conduction. While the horns were playing long tones I established a four way audio chat with all of the remote conductors and had each conductor controlling a section of the ensemble. Oliveros had control of the voices, Ellis the strings, Oswald the rhythm section, and Cram the horns. After about seven minutes, I briefly took over control locally of the entire ensemble and composed a solid ending.

Colours

I first started working with the DMX controllable LED lights for a dance piece called *Touched* during a directed study with Henry Daniel. Mark Coniglio, the creator of interactive graphic software Isadora, was a visiting guest lecturer and part of the project. For *Touched* I created a small stage emanating light on which a classical Indian dancer stood upon. The ability to subtly pulse colours and choose any colour instantly was exciting and freeing.

Interactive visuals have always been of interest to me. The main challenge I encountered was that I was not personally interested in creating projections. The art of lighting I find much more exciting and intriguing. The world of lighting has an abstractness with which I am much more comfortable, as sound has an inherent abstractness as well.

I started exploring the use of the lights by creating a simple colour organ. It converted various frequencies of sound into a series of colours. The effect was quite striking using the powerful LED lights. One interesting aspect of the colour organ was that it made you more aware of the frequencies you were playing. It was enjoyable but was not substantial enough to make it worth further development.

Following this exploration I turned my thoughts to a Terence McKenna essay on Virtual Reality that I read in his book *Archaic Revival*.

> "The octopus literally dances it thoughts through expression of a series of color changes and position changes that require no local linguistic conventions for understanding as do our words and sentences. In the world of the octopus to behold is to understand. Octopi have a large repertoire of color changes, dots, blushes, and travelling bars that move across their surfaces; this ability in combination with the soft-bodied physique of the creature allows it to obscure and reveal its linguistic intent simply by rapidly folding and unfolding different parts of its body."[xlvi]

This spawned the idea of using the lights to communicate ideas instead of just helping to set the mood for the music. McKenna continues by saying "Like the octopus, our destiny is to become what we think, to have our thoughts become our bodies and our bodies become our thoughts." [xlvii] As a concept it was very satisfying to think about transforming ideas into colours and have them

interpreted by the performers. It truly felt like a technological form of communicating telepathically.

My original thought was to have a series of pieces using different colour schemes – each of which would communicate different cues. The first thing I did was to take a picture of the various shades of green found in the ravine at my home in Roberts Creek, BC. Once I had the LED lights assembled and attempted to determine the difference between shades of green, it became clear that this was not an option.

While the eye can tell that there are different shades, what is difficult, in particular for musicians who focus on the aural world, is to identify a colour. In some senses it's like having perfect pitch. To distinguish a particular shade of green from a score is almost impossible. On the other hand, the primary colours – red, green, and blue are easy as are white and black. The LED lights work by mixing a red, a green and a blue light to create any colour you want. When you start to mix colours - yellow, orange, and purple are easy to recognize. Teal on the other hand was very difficult, although you would expect it to be easy as it is the blend of green and blue light at full value. It was difficult to quickly determine that the colour was teal and not a shade of green. If you saw green and teal back to back colour recognition was easy, much like relative pitch. On the other hand if you saw teal by itself, it was hard to know what shade it was. As the piece required the musicians to respond quickly and accurately it was not possible to use any of the in-between colours.

The colours I chose were the eight most easily recognizable colours (including black / no light) that I could find. The palette needed to be these easily recognizable colours so that the ideas could easily be communicated. Another factor was that intensity equalled volume, so I needed to ensure that the colours would be recognized at any intensity.

Skype vs. QuickTime or other Telepresence Software

When creating a telematic work there are a number of issues that need to be addressed. More specifically, there is the type of Internet connections available, the ease of set up for the participants, and latency versus quality. (You can always increase the quality of a streaming video or audio feed, but this requires buffering and can add significant delay in the transmission, known as latency.)

None of the conductors for the performance had access to a higher speed Internet2 connection. This would not have made any difference as the performance was at The Cultch, in Vancouver BC, which also does not have access to Internet2. If the performance had required a higher speed connection, the performance would have had to take place at a few select locations at Simon Fraser University, and arrangements with other universities or research institutions would have had to be set up so that the conductors also had access to the specialized Internet2 network. As a result, the project had to work on standard consumer level “high speed” Internet. This bottleneck meant that I had to be very careful about the load on the system to keep latency low. Luckily the actual transfer of data to control the lights is extremely low – on the order of 100

bytes/ second. In comparison, CD quality audio is 44,100 bytes / second. This meant my main concern was with the video and audio being sent to the conductors.

The conductors were all respected musicians and improvisers but not computer programmers. While Oliveros has had a lot of experience in setting up telepresence systems, I knew that some of the other conductors did not have the technical expertise required, so I needed something that was simple and robust. After trying to set up a jacktrip server, a telematics project spearheaded by CCRMA at Stanford, I realized that while the audio quality was much better and the latency near zero, this would be too technically difficult for some of the conductors involved. I then looked into a number of conference systems including Adobe ConnectNow, and gotomeeting. They were adequate but did not seem to provide any serious advantages to using Skype. In terms of simplicity and the least latency, Skype seemed the best solution given the current technology.

There was one other serious contender, specifically, QuickTime Streaming Broadcast server. The quality of QuickTime Streaming Broadcaster is phenomenal and it would have allowed me to send excellent audio and video streams to all of the conductors. There would also have been the benefit that as a broadcast and not a point-to-point call, all of the conductors could have seen and listened to the whole show instead of starting from a place completely in the dark. It is also very easy to use, I simply would have had to send a URL to each conductor and QuickTime player would have automatically opened to show each

of the conductors the stream. There was one flaw – the latency. There is no way to control latency in the QuickTime Streaming system. At high quality the latency was up to 30 seconds. At the lowest quality it was still unusable going down to about seven to eight seconds. For the interaction between conductor and ensemble to work the latency needs to be as small as possible with a maximum usable latency of at most one second.

In tests with Pessi Parviainen in Finland – the roundtrip latency when using Skype was significantly less than half a second. This means that Pessi would use the *Mad Scientist Machine* software to select a colour for a light and would see the change via his Skype video feed within half a second. However, the disadvantage of Skype s that the audio quality leaves much to be desired when you need to respond to the subtleties of a musical performance.

Mad Scientist Machine Software

The *Mad Scientist Machine* software was coded using cycling74's *Max/MSP 5*. The software provides an easy interface for the conductor to control all of the lights for 15 players including on-screen visual feedback so that the conductor knows what the lights are doing.

On the right side are four items. (See figure 8.) The first is the Host IP. This is the IP address of the computer that is physically connected to the lights. The remote conductors need to enter this IP so that they can communicate with the host. If the software is being used locally or it is the host computer, then the IP can be left blank.

Figure 8: ***Mad Scientist Machine*** **Software**

The second item is the Port. On the host computer this signals the first port number to be used. The software had problems receiving communication from multiple computers on the same port. Another benefit of using different port numbers for the other computers is that I was able to write a master control patch that made sure only the conductor that was currently supposed to be controlling the lights, had control. Otherwise a conductor just testing or setting up his/her system would control the lights during another conductor's performance. By default, the port numbers increase sequentially. So if the host port were set to 1200, the conductors would be 1200, 1201, 1202, and 1203.

This leads to the third item, that is, the conductor mode. There are two modes: Solo Conductor and Group Conduction. In the Solo mode the remote conductor has control of the entire ensemble. In Group Conduction the conductor only has control of one section. Port 1200 would control the choir, port 1201 the strings, port 1202 the rhythm section and port 1203 the horns.

The last item is the Control Group pull-down menu. There are two ways to select which lights you are controlling. One is to select and/or deselect a light by using the X check box next to a performer's name in the bottom left section. If there is no X you will not change the light. The X marks could be changed quickly by using the letter attached to each name. For instance Q would toggle Christine on and off.

The second possibility is to choose which group you are controlling from the Control Group pull down menu. If you had the Strings selected in this menu any light change commands would only apply to the string section. If *All* was selected you would control all checked members in the whole group. The numbers 1-5 could be used as a short cut to choose which group you are controlling.

On the left side is the main control section and player selection. As mentioned before, in the bottom left, is a list of all of the players with check boxes next to their names. Checking and un-checking these, allows you to choose which players to control. There is also a visual representation above each name, indicating the colour of what a player's physical light is set at.

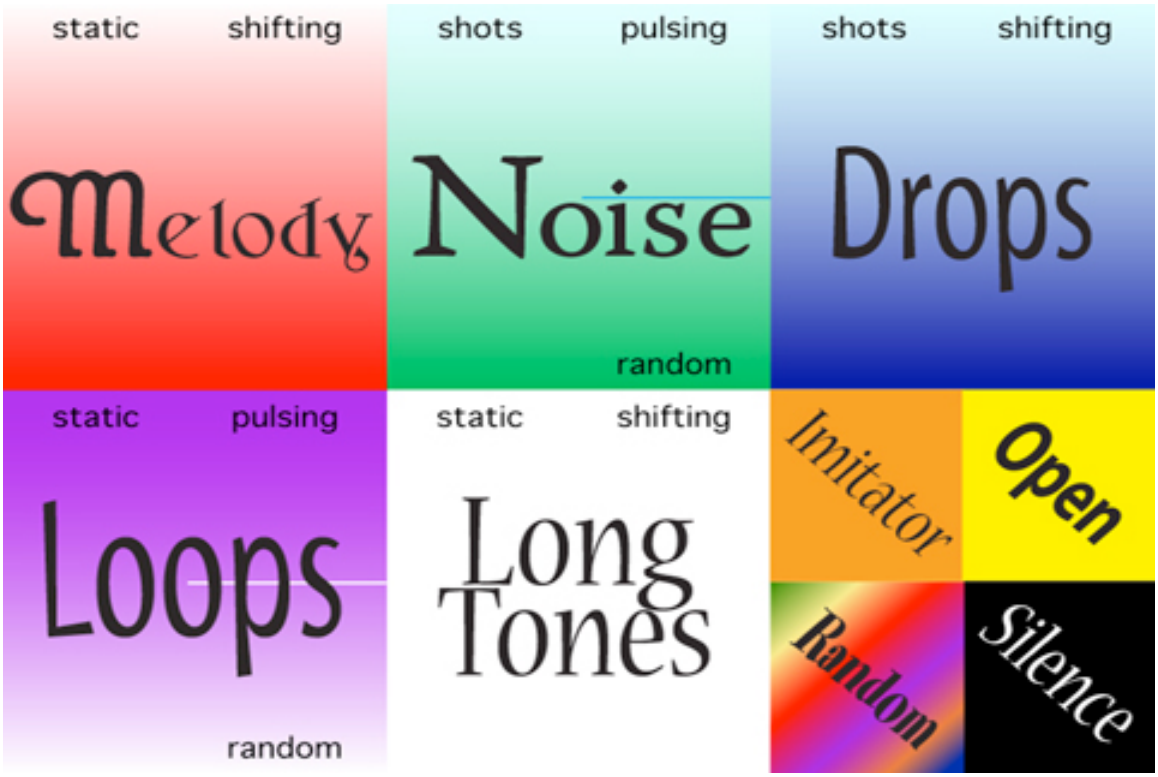

Figure 9: Main Control Section of the *Mad Scientist Machine*

The top left of the Mad Scientist software is the main control section. The software was originally designed for use on an iPod Touch, so the main control is the exact pixel dimension that you can fit on an iPod Touch. While the iPod Touch interface worked well there was no way to add the ability to select specific players on such a small screen. This is why I added the extra controls and transferred complete control back to the computer. An iPod Touch can still be used to select the colours if desired.

Clicking on the main control selection is very location specific. I will address *Melody* first. The first thing to note is that *Melody* is divided into two halves, *static* and *shifting*. (See Figure 9.) Clicking on the left side of *Melody* results in a static light cue. The intensity of the solid red light is controlled by the

y axis, specifically, how far from the bottom of the *Melody* zone you click. Clicking at the top of the screen produced the brightest red and thus would be interpreted as being the loudest sound. Clicking near the bottom of the *static* half of *Melody* would produce a dull red indicating the player should play a soft melody. Clicking on the right side of *Melody* has an entirely different result. As the text *shifting* on the interface indicates, clicking on the right side produced a shifting fading in and out of the red. The vertical location corresponds to speed instead of intensity. Near the top the red light would pulse quickly whereas at the bottom it would fade slowly in and out. In the areas indicated as shifting, such as in *Melody*, *Drops* and *Long Tones,* the fade in and fade out times are determined randomly. This means that if the string section were selected, and shifting long tones were chosen, the strings would not be in sync, instead each player would fade in and out individually.

Noise does not use *static,* instead it uses *shots*. *Shots* mean that the light is on only while the mouse button is held down. As soon as the mouse button is released the light goes out. With *static,* the light stays on after you release.

Noise and *Loops* are different from the others in that instead of *shifting*, both divide the right half of their button up into two sections, *pulsing* and *random*. *Random* is much like *shifting*, except with an on/off instead of a fade in/fade out. To choose *Random* you would click on the lower right quadrant. Again, distance from the top indicates speed. The top right quadrant is *pulsing*. This mean the light turns on and off at a constant tempo. All players that are selected to pulse

at one time will be in sync. This lets you set up a tempo for the *Loops* or blasts of noise if using the *Noise*.

The buttons for *Imitator*, *Open*, *Silence*, and *Random* only have one function, it does not matter where you click inside of them, thus there are no intensity or speed controls possible. The reason for this is that at lower light intensities it is difficult to tell yellow and orange apart so there is only one shade of yellow and one shade of orange possible. *Silence* is the absence of light so there is only one option: turn the light off. *Random* initially had a tempo associated with it but I found that randomly setting all the lights at a specified interval was not useful. Instead clicking on *Random* sends one blast of random to all the selected lights. If you want the lights to change randomly in time you need to click on it multiple times.

It is important to note that the addition of stochastically controlling the fade in and fade out of lights allows a conductor to create a compositional process without having to individually and continually specify the individual lights. For instance, a conductor could click on shifting *Drops* to create small drop sounds coming from random places in the orchestra. They would not have to choose and conduct each random drop; the software takes care of this. A conductor can then free his concentration to make other compositional choices such as choosing a soloist. This is using the computer to help composition in the best possible way. You still have meta-control but do not need to take care of the details unless you want to.

The main innovation in the *Mad Scientist Machine* is in the creation of an intuitive easy-to-use interface. The conductors all had to practice the system before they became more adept at it but after a few hours they were all able to get their ideas across.

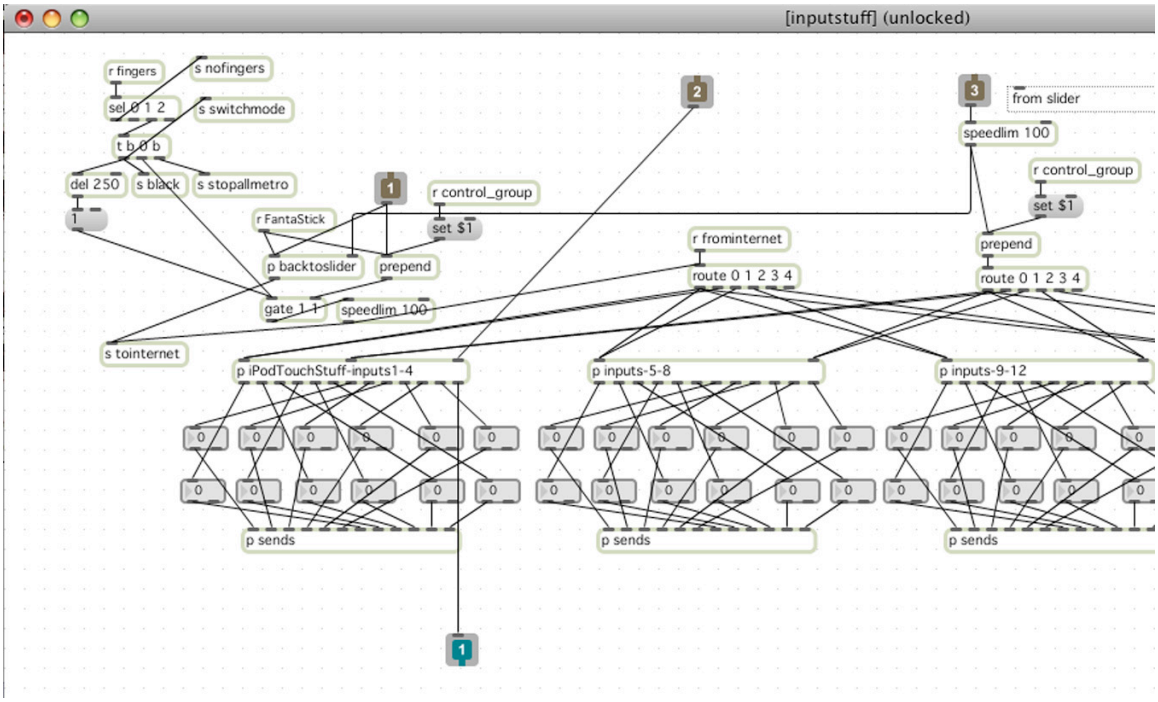

Figure 10: Max/MSP Code from the *Mad Scientist Machine*

From a programming perspective it was important to minimize data traffic across the Internet. To do this I sent three items. First the xy coordinate was sent in the main control window, so that I would know which colour and speed or intensity was chosen. Secondly, anytime the control group was changed, this data was sent as a separate message to make sure the correct lights would be controlled. The last was a list of which lights were selected and unselected anytime a change was made to the selection list. By separating these three items the traffic was highly efficient and dropouts were rare.

CHAPTER 4: REFLECTIONS

When examining the *Mad Scientist Machine* it is important to recognize that there are three major perspectives to consider: the conductor/composer, the performer, and the audience.

Conductor/Composer Perspective

I will begin by allowing the conductors to speak for themselves. First is an email from Paul Cram from the day after the show.

> "I also still really couldn't hear much, so flying deaf. The X's and 0's (the blank squares) are confusing and require a certain manual dexterity that only comes with practice. X to program and O steady as she goes is the mantra. Now that we (the conductors) are somewhat up to speed I hope you keep going with us on this project.
>
> There are many other possible parameters to be considered. I can even see it going in the other direction towards Halifax at some point. Practicing more with the software with some sort of random/pre-composed midi feedback would be something to work on.
>
> Dare I suggest the makings of a video game? I'm putting myself forward as a composer/programmer now just in case."

On the morning of the premiere I received this email from John Oswald about the rehearsal process so far.

> "i'm allowing myself to complain about only one thing and that would be the minuscule amount of information i was receiving from the event.

> i didn't hear any sound (or see any lights) until about fifteen minutes in when you rang/skyped and it was my turn to determine events.
>
> the mono skype sound was remarkably lo-fi. i could hear a drone but would never guess if it was strings or not. i could just barely distinguish my adding Christine to the drone, but couldn't tell if i was hearing the subsequent additions or not. this is of course partly due to the homogeneous character of my choice of orchestration.
>
> i can deal with the super lo-fi if necessary, and i can deal with the Exquisite Corpse nature of not hearing what has happened before, but i hope that the audience will be informed that that is the case."

John Oswald wrote this on March 23, 2010 after seeing a YouTube clip of the performance.

> "interesting to see and hear a clearer glimpse of the event. i would almost say "you had to be there" but that would subvert the point of it all."

From Pauline Oliveros I have an email from the day after the show. As she has had the most experience with telematic performances she was quite aware of the limits of Skype and did not dwell on the quality of the transmitted audio.

> "Yes - these projects are a challenge and not "plug n Play" yet. So it is important to move things along and I think you did. I had a nice time performing as conductor (hard as I have tried to eliminate conducting from my own pieces!)"

From Lisle Ellis I have an email from October 19, 2009 immediately after our first trial run of the software. He was conducting from Romania as part of Sibiu Jazz Festival.

> "it was my idea to attempt this here in Romania and I realized it was going to be risky business ... but hey, to make progress in any field we must at times face some dangers, right? The infrastructure in Romania is always tenuous at best and considering the odds

> against getting this together here everything went pretty smoothly, or so I feel.
>
> What you are doing, and what we were all witnessing, is a very important step toward the future of how we will communicate our individual and collective artistic visions on a global scale. I felt like I was an assisting Marconi on his first transatlantic radio signal, a real privilege for me and I thank you for the invitation."

The main concern, for the most part, except from Oliveros, who is used to telematic work, was the quality of the video/audio transmission that they received of the performance. I believe that this is the single most important thing to improve in future performances. Unfortunately telecommunication software is not something I can program so I was at the mercy of the software that was available at the time for Internet video communication.

Cram voiced some concerns about the interface but suggested that practice would help make it work more efficiently. Some of the complexity in the system was there because of the group conduction section. As I most likely will not do group conductions in the future, I will be able to streamline the interface and make it easier to use. It would also be possible to program a sample simulator to aid in practicing the system.

From the conversations via email and phone I had the sense that all of the composers were satisfied with the system for the most part. Oswald was the least satisfied and the only one to not explicitly state that he was interested in further iterations of the project. He was particularly unsatisfied by the limitations of the technology to monitor and experience what was happening in Vancouver.

The original intent was to create a system that was able to communicate the ideas of the conductors. This is what was most important to me and I felt that this aspect worked well. Ideas were translated into light cues and the performers created interesting coherent music from the cues. Even though the conductors did not have the luxury of accurately hearing what they were doing, their ideas were compelling and thus resulted in good music.

When a conductor is using the *Mad Scientist Machine* they are essentially working as a composer in real-time. Of utmost importance as a real-time composer is that the system can quickly and accurately communicate an idea to the performers. The Internet limited speed, but as mentioned before the roundtrip latency to Finland was less than half a second. The reaction time of the musicians to respond to a lighting cue was equal or greater than the transmission speed.

There are two ways to accurately communicate ideas in the *Mad Scientist Machine*. The first is that a cueing signal is sent to the correct player when you want it sent to them. This is a simple technical and interface problem and was fairly easy to accomplish. The addition of keyboard short cuts and practice made the transmission of the lighting cues very accurate. The second more interesting aspect of accurate communication is that the system has a large enough vocabulary of musical ideas that a conductor's compositional ideas can be expressed.

One measure of success was that the aesthetic decisions by each conductor resulted in very different music. The sections did not sound the same

and some of the personality of the conductor was imparted to each section. Oliveros played with space and listening, Ellis allowed grooves to build and was more jazz oriented. Oswald went with a very conceptual maximalist/minimalist approach sticking with long tones in most of the ensemble while Cram took a more open jazz approach with lots of open solo spaces for players.

I created the *Mad Scientist Machine* with an emphasis on the composer perspective. I was interested in how external structures could be created and manipulated in real-time. In many ways I think it is the conductor/composer who finds this system the most satisfying.

Performer Perspective

The performers seemed to enjoy the possibility of interacting with some of the leading improvising musicians around the world. The novelty and feeling of connection with each of the conductors was quite exciting for the players. After the initial novelty two problems arose. I was using an ensemble made up mostly of players from the free jazz scene in Vancouver and after a while the imposed decisions of others did not suit everyone. A large part of the free jazz spirit is very anathema to being tightly controlled. They started asking how much liberty they had in ignoring the lights. It seemed that some of them did not like the decisions being imposed upon them and that they thought they could make more musical choices themselves.

Part of this problem was caused by the quality of the video and audio feed to the conductors. As the conductors could not always accurately hear and see

what was happening, some of their decisions at times were a bit circumspect. It is likely that if they were present physically or had a better sense of the music being created, some choices would have been different. Another problem was that the software required practice for the conductors to use well. The only way for them to practice was with the ensemble so some of the early tests were less musically satisfying and more an exploration of how the system worked.

Performers that were from a more new music background did not have the same issues and were much more accurate in following the lights. In future performances it would be important that the performers felt that the creativity and power of the conductor organizing all of the performers as a whole was musically satisfying enough that it would be worth the loss of freedom in following the lights as accurately as possible.

One interesting concept that the trombonist Brad Muirhead brought up was treating the light cue as a container. This meant instead of always playing when the light was on – treating it as the possibility to play. When the light was off – it meant you definitely did not play. This small addition of autonomy of decision helped create a more musical interpretation and added some needed silence and space to the music.

Audience Perspective

After the performance many audience members commented on how much they enjoyed being included in the musical decisions that were being made by conductor and musicians. The lights made the compositional choices clearly

visible to both audience and performers alike. Often an improvised music concert is quite opaque to the audience. Unless you are a trained musician it is hard to know what is improvised and what is written. The choices made are also very hard for the audience to discern. The *Mad Scientist Machine* on the other hand with its colour coding of instructions makes the improvised impetus visible.

I provided a key to the colours in the program, and tried with my first section, to illustrate what the colours meant by creating a simple transparent composition. Still some audience members did not quite grasp the system. For future shows I will most likely be even more explicit in showing how the system works by speaking and demonstrating the system in a short intro piece to make the connections even more explicit between colours and instructions.

One of the most exciting aspects of the *Mad Scientist Machine* is that with a small amount of introduction, the audience is able to comprehend and experience in real-time what is happening. Making the cues visible as glowing plinths makes the compositional structures explicit to audience and player alike. The audience can then listen to how each player interprets a lighting cue and hear the individuality of each player response. For instance, comparing how two string players interpret the same instruction is very informative. It is also possible for the audience to experience radically different approaches to compositional structures by seeing how different conductors use the system.

The visibility of the structures also helps illuminate for the audience that what is happening is not random. It helps guide the audience through a piece

and understand some of the compositional thinking that is going on. It is quite fascinating to see how different conductors are thinking and using the system.

Things that can be Improved

The top priority for future performances is an improvement in the transmission of the video and audio back to the conductor. Recently, a new HD conferencing system was announced called Goober that looks very promising. It works similar to Skype but promises much better quality. As technology is always improving Skype is also likely to have an HD system in place soon as well.

The *Mad Scientist Machine* is an organic instrument and requires practice. This means more rehearsal time with the conductor having the band present to explore ideas. There are a huge number of possibilities with the system and practicing without the performers is not an effective means for determining the musical outcome of your actions.

The third section of the piece, the group conduction by all of the composers, was problematic. The main reason for this was that the conductors had such a low quality audio feed they really had no chance to hear what was happening. They had no visual feed either so they could not see what the other conductors where doing. As a result, musical interactions were limited.

While a better audio feed would have helped the individual conductions as well, what came across were the ideas of the composers/conductors. If they had good ideas then they were implemented well. With the group conduction there

was no plan between the four conductors and with no chance of a solid interaction the section was in my view the least successful.

I was happy with all of the cues with two exceptions. *Noise* should really be changed to texture so that more subtlety of interpretation is possible. While I did tell the musicians that they should think of *Noise* as texture, until the score is relabelled the change does not become ingrained. The other is that *Melody* was unclear. It did not really sound different from Open Solo. My current thought is to replace *Melody* with a new cue. I intend to add a projector aiming at the floor. When the red light comes on the players must follow the direction being projected on the floor. What is projected could be chosen from a pull-down menu of options or be an instruction typed on the fly by a conductor. This would be like chatting with the players. So if a composer wanted pizzicato in the strings they could choose pizz from the pull-down menu. If they wanted the singers to sing, "All hail the Mad Scientist Machine" they could type this and then select the appropriate singers with a red light. This would allow for more playfulness and a clear way of communicating complex ideas.

Future Possibilities

The *Mad Scientist Machine* is a cueing mechanism and there is no reason to limit it solely to music. It is an effective way to organize music, theatre, dance and the visual arts to interact in real-time. The cues might have a different meaning for each discipline. For instance the green light could signify texture for the musicians, whispering for the actors, moving only the torso for the dancers and using only horizontal lines for a visual artist.

Another exciting possibility is that the *Mad Scientist Machine* is easy for anyone to use that is interested in time-based structures. You do not need to have the skills of a conductor to conduct the music. One of the more interesting early pieces created with the *Mad Scientist Machine* was by Don Kugler, who is a dramaturge. He did many unexpected actions but as he is very aware of structure in time they were still very interesting and musical. The *Mad Scientist Machine* is thus an interesting way to allow choreographers, directors, and others from a variety of disciplines to create music.

Another strong possibility for the *Mad Scientist Machine* is to teach the value of structure to beginning improvisers. I used the system with an undergraduate performance class at SFU and was very pleased with how musical the results were. The players were introduced to the freedom of improvisation within a strong structure. The structure provided the framework that kept the students from being overwhelmed by the over abundance of choices that can occur when asking beginning players to improvise without a structure.

I will be using the system at the end of June 2010 with a group of children at the annual Sonic Playground event. The structures that the *Mad Scientist Machine* creates will help organize the chaos of a group of children playing, transforming the playfulness and freedom into coherent musical structures. I will change the composition to fit the needs of children, for example, using instructions such as stomp, snap your fingers, make animal sounds, and row row row your boat, could be possible additions.

Concluding Comments

The *Mad Scientist Machine* uses technology to allow connections between communities around the globe. By transmitting ideas across the Internet, latency issues are avoided and exciting new connections can be forged. Making improvised structures visible, it is exciting for composers, players and audiences alike. As an open-ended cueing system there are many possibilities for future uses of the system. It is an experiment that will keep developing over the years.

Already there are performances scheduled for the *Mad Scientist Machine* in June 2010 and March 2011 in Vancouver and in April 2011 for New York. I hope that the system continues to evolve and develop much like Morris' Conduction system. Every time it is used there is a flurry of new ideas to explore and implement into the system. The *Mad Scientist Machine* is a continuing experiment in combining communication, technology and improvisation.

APPENDIX

The DVD attached forms a part of this work.

The DVD can be viewed with a standard DVD player.

Video Files:
- Overview of how the *Mad Scientist Machine* works
- Concert footage excerpts of the premiere performance

The videos can also be viewed at http://tinyurl.com/madscientistmachine

BIBLIOGRAPHY

Allen, Clifford. Misha Mengelberg: More than Instant Composition. 2005 - Online at: http://www.allaboutjazz.com/php/article.php?id=17414

Bartlett, Andrew W. Cecil Taylor, Identity Energy, and the Avant-Garde African American Body. Perspectives of New Music, Volume 33. Number 1/2 1995 pp 274-293.

Brown, Earle. NOVARA (1962) Directions for Performance, Preliminary Notes. Editions Peters, 1962. Online at: http://earle-brown.org/media/Earle%20Brown%20open%20form%20general%20instructions.pdf

Borgo, David. Sync or Swarm: Improvising Music In A Complex Age. Continuum International Publishing Group, 2005.

Chadabe, Joel. Interactive Composing: An Overview. Computer Music Journal, Volume 8, Number 1, Spring 1984, pp 22-27

Chadabe, Joel. Electric Sound: The Past and Promise of Electronic Music. Prentice-Hall Inc., 1997.

Cox, Christopher & Warner, Daniel (Ed.) Audio Culture: Readings in Modern Music. Continuum International Publishing Group, 2004.

Deleuze, Gilles (Translated by Smith, Daniel W.). Francis Bacon: The Logic of Sensation. The University of Minnesota Press, 2003. pg 31-38, 71-80.

Duckworth, William. Talking Music. Simon & Schuster Macmillan, 1995.

Lewis, George. Gittin' to Know Y'all: Improvised Music, Interculturalism and the Racial Imagination. Critical Studies in Improvisation / Études critiques en improvisation [Online] 1:1 – 2005. http://quasar.lib.uoguelph.ca/index.php/csieci/article/view/6/14

Mathews , Max. CONDUCTOR PROGRAM. Available online at: http://www.csounds.com/mathews/manuals/ConductorManual.pdf (2000)

Mathews , Max. The Father of Computer Music. Online at: http://www.csounds.com/mathews/

Mathews , Max. RADIO-BATON INSTRUCTION MANUAL. Available online at: http://www.csounds.com/mathews/manuals/BatonManual.pdf (2000)

McKenna, Terence. The Archaic Revival. HarperCollins Publishers, 1991.

Morris, Lawrence D. “Butch” (edited by John Zorn). Arcana II, musicians on music. “The Science of Finding” Hips Road, 2007. pg 169-173.

Müller, Torsten. Interview for NOW Orchestra Podcast. 2007 - Online at: http://www.noworchestra.com/podcast

Nachmanovitch, Stephen. Free Play: The Power of Improvisation in Life and the Arts. G.P. Putnam’s Sons, 1990.

Sansom, Matthew. Interculturalism and the Racial Imagination. Critical Studies in Improvisation / Études critiques en improvisation [Online] 3:1. 2007 http://quasar.lib.uoguelph.ca/index.php/csieci/article/view/48/427

Schechner, Richard. Performance Theory. Routledge, 2003.

Shanken, Edward. A Telematic Embrace: A Love Story?, Roy Ascott's Theories of Telematic Art, 2001. Online at: http://telematic.walkerart.org/timeline/timeline_shanken.html

Stockhausen, Karlheinz. Stockhausen on Music: Lectures and Interviews Compiled by Robin Maconie. Marion Boyars, 1989.

Thompson, Walter. The History of Soundpainting. Online at: http://www.soundpainting.com/history.html

Whitehead, Kevin. ICP at 30: Everybody in the Pool. 1997 - Online at: http://www.icporchestra.com/

ENDNOTES

Chapter 1

[i] Bailey, D. from Audio Culture pg. 256
[ii] Lewis, G. Gittin' to Know Y'all
[iii] Lewis, G. Gittin' to Know Y'all
[iv] Bartlett, A. pg. 283
[v] Scheckner, R. pg. 202
[vi] Bartlett, A. pg. 281
[vii] Stockhausen, K. pg. 116
[viii] Stockhausen, K. pg. 116
[ix] Lewis, G. Gittin' to Know Y'all
[x] Toresten Müller – podcast interview from NOW Orchestra.com
[xi] Toresten Müller – podcast interview from NOW Orchestra.com
[xii] Sansom, M. Improvisation & Identity: a Qualitative Study.
[xiii] Borgo, D. pg. 142
[xiv] Borgo, D. pg. 143
[xv] Borgo, D. pg. 143 – citing Bonabeau et al. (1999:9-11)
[xvi] Nachmanovitch, S. pg. 104
[xvii] Whitehead, K. - from: http://www.icporchestra.com/
[xviii] Allen, C. – from http://www.allaboutjazz.com/php/article.php?id=17414
[xix] Morris, B. pg 169
[xx] Deleuze, G. pg 71
[xxi] Deleuze, G. pg 31
[xxii] Deleuze, G. pg 73
[xxiii] Morris, B. pg 170
[xxiv] Shanken, E. – from http://telematic.walkerart.org/timeline/timeline_shanken.html

Chapter 2

[xxv] Chadabe, J. pg 78
[xxvi] Chadabe, J. pg 77
[xxvii] Mathews, M – from http://www.csounds.com/mathews/
[xxviii] Chadabe, J. pg 161
[xxix] Chadabe, J. pg 163
[xxx] Mathews, M – from http://www.csounds.com/mathews/
[xxxi] Mathews, M – from http://www.csounds.com/mathews/manuals/BatonManual.pdf
[xxxii] Mathews, M – from http://www.csounds.com/mathews/manuals/ConductorManual.pdf
[xxxiii] Chadabe, J. pg 230-231
[xxxiv] Chadabe, J. pg 292-293
[xxxv] Chadabe, J. pg 22
[xxxvi] Chadabe, J. pg 22
[xxxvii] Chadabe, J. pg 23
[xxxviii] Brown, E. NOVARA (1962) Directions for Performance
[xxxix] Duckworth, W. pg 462
[xl] Duckworth, W. pg 463
[xli] Duckworth, W. pg 462

[xlii] Morris, B. pg 169-170
[xliii] Morris, B. pg 171
[xliv] Morris, B. pg 172
[xlv] Thompson, W. – from http://www.soundpainting.com/history.html

Chapter 3

[xlvi] McKenna, T. pg. 232
[xlvii] McKenna, T. pg. 232