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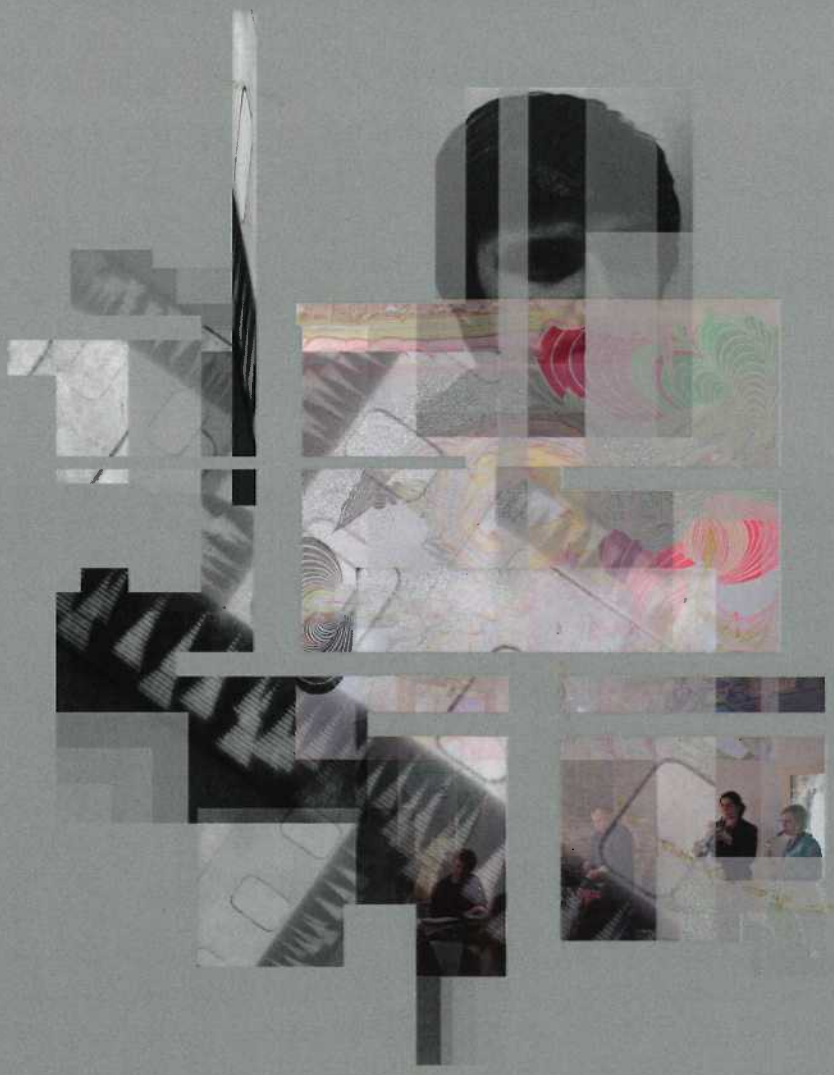

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From the Editor

In this issue, Bob Gluck takes us down memory lane in an interview with David Rosenboom. The interview is part of one of Gluck's larger projects centered on 1960s musical performance and focuses on Rosenboom's early career between the late 1960s and early 1970s. Rosenboom talks about his college days at the University of Illinois, Urbana-Champaign and his involvement in rock bands and the contemporary concert music scene. He relocates to New York City (NYC) in the late 1960s and begins to work closely with Morton Subotnick and engages in various projects including *Electric Circus*. His interests in computers, the human brain, intelligent instruments, algorithmic composition, and biofeedback for musical applications take him to various places including York University in Toronto, Mills College in the 1980s, and California Institute of the Arts (CalArts) in the 1990s, a school that was co-founded by Morton Subotnick who now teaches at New York University.

We have a number of articles related to musical performance in our current issue including an article by Mara Helmtuh et al. entitled *Waterbirds: Compositional Collaboration with Clarinets, Wireless Sensors, and RTcmix*; Peter Leonard's *HOOLA: A Circular Digital Musical Interface*; and an essay by Ivica Bukvic et al. which focuses on open-source solutions and Linux-based laptop orchestras. Helmuth's paper details an interactive and collaborative compositional project with clarinetist Rebecca Danard where the notion of the performer as a significant contributor to the composition, is highlighted. Leonard presents a novel musical controller that embraces "circularity" as a framework for performance, instrument design, composition, and aesthetic direction. The final article related to musical performance is Ivica Bukvic's *L^2Ork* project. Bukvic details how he and his team utilize notebook computers, Nintendo Wii Remote controllers, hemispherical speaker systems, Linux operating system, and a custom Pure-Data real-time graphical programming environment. One of outcomes of project has resulted in partnerships with K-12 initiatives, including the design and development of a satellite laptop orchestra for 5th graders. The project's primary aim was to encourage learning by cross-pollinating music with the *Science, Technology, Engineering, and Mathematics* (STEM) initiative utilizing tools from the area of music technology.

In the Reviews Section, we include extensive concert reviews from the 2011 SEAMUS National Conference held in Miami, Florida; Craig Dongoski's *Realms of the Right Brain*; the 2011 *Kyma International Sound Symposium* (KISS); and the second edition of *Matrix Perspectives of Live-Electronics*.

In the penultimate Section, Yuri Spitsyn, who is a native of Russia and currently lives in the United States, contributes a book review of *Sound in Z: Experiments in Sound and Electronic Music in Early 20th-Century Russia*. This book, authored by Andrei Smirnov, sheds light on Russian electronic music from the early 20th century and goes far beyond the topics of well-known Leon Theremin. A number of historic examples covered in the book include early studies and extermination in graphic sound, bio-mechanics, 48-note scales, as well as insights into the political situation and Stalin's negative influence on Russian electronic music.

Tae Hong Park, Editor

Water Birds: Compositional Collaboration with Clarinets, Wireless Sensors, and RTcmix

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Water Birds (2010) is an interactive composition for bass clarinet, B-flat clarinet, and computer, by Mara Helmuth and Rebecca Danard using a wireless sensor system. A wireless sensor network with infrared sensors responds to the clarinetist's movements, and sends data into Max/MSP for signal processing control. The wireless sensor configuration was developed by Jung Hyun Jun, Talmai Oliveira, Amitabh Mishra, Ahmad Mostafa and Dharma Agrawal, and extended for this project in collaboration with Helmuth. Max/MSP Mxj Java objects were created to receive data from the programmed low-powered wireless Tmote sensors. Helmuth's score consists of four sound-generating ideas. Her Max patch and RTcmix scripts process the clarinet sound with spectral delays through the rtcmix~ plugin for Max 5. Danard created a working score solidifying her decisions about materials played and order of events. Helmuth and Danard's interactive compositional process allowed the piece to evolve organically into a work commenting on the interaction of people, nature, and technology.

Introduction

Interactivity

Water Birds for bass clarinet, B-flat clarinet, computer, and wireless sensor network is an interactive composition in which the electronic part consists entirely of processed live clarinet performance, which in turn is controlled by the performer through a wireless sensor network. Infrared sensors react to movement by the clarinetist, and transmit data back to the computer to control signal processing modules. The work was composed in 2010 by Mara Helmuth and Rebecca Danard, and has been performed at the College-Conservatory of Music (CCM) on a Sonic Explorations concert, on the Performance and Time Arts Series at College Hill Town Hall, and at the 2011 SEAMUS National Conference at the University of Miami. The compositional process involved discussion and choices made by both Helmuth and Danard.

Compositional Collaboration

Compositional collaboration has many benefits. A composer may leave decisions to a performer that a specialist on the instrument could make best in order to highlight the performer's special abilities. Instead of allowing a performer's contributions to a collaborative composition be unacknowledged and subsumed into a composer's composition, which often happens, we preferred to credit the decisions made by Danard as contributive to the resulting musical work. It is not uncommon in computer music performance that the roles of composer, performer and audience become less rigidly defined (Lansky 1990). Recorded material of a performer can work its way into a composition, and the composer may have to be actively engaged on the computer to realize a successful performance. In our case the compositional work included programming, designing the interactive system and creating a score of sound-generating ideas, contributed by Helmuth. The collaborative work also included creating clarinet sounds, improvising on score fragments, choosing timings of events, creating a working score, and assisting with the system design strategy, which was contributed by Danard.

Conception of the Collaboration

Rebecca Danard took a class from Mara Helmuth involving composer and performer collaborations in the spring of 2009. Danard had previously worked with composers on new music projects at Midwest Composers Symposia, Bang on a Can, and as president of the Ottawa New Music Creators. This course was one of her first experiences with electronic music, however. She approached Helmuth about collaborating on a piece. Helmuth had extensively collaborated before both compositionally and with performers since 1995, and was interested in how Danard's clarinet playing would work with various signal processing algorithms. Having studied and performed with the Cincinnati Real Time Composers, Danard is an excellent improvisor and skilled in extended techniques; therefore an improvisational, interactive piece involving sensors was conceived. Danard's studies in biology, her interest in acoustic ecology and particularly her experience at Murray Schafer's "Wolf Project" also informed her contributions to this collaborative work. Several of Helmuth's previous works, including *Abandoned Lake in Maine* (1997) based on loon sounds, were motivated by her concern for wildlife and the environment.

Wireless Sensor Network Projects

Helmuth had also previously collaborated with Jun, Oliveira, Mostafa and Mishra, students of Dharma Agrawal, in several projects involving wireless sensor networks and music (Helmuth 2010). In several cases, music was generated from dancer's movements (Mostafa et al 2008), and in an installation, sound was affected by audience movements. These projects made use of light, received signal strength indicator (RSSI), pressure, and accelerometer sensors. Helmuth's interest in computer music performance took new directions aurally and interactively with each sensor project. This project explored the use of a performer-controlled wireless sensor network.

The Sensors and Processing

Stage Layout

Four sensors are placed on a small square table, one facing in each direction of the square's sides. Each Tmote Sky wireless sensor has an additional infrared sensor attached, which measures the presence of the clarinetist when she stands in front of it, and transmits data to a base station sensor. A microphone is in front of the table and picks up the clarinet sounds. Danard moves from offstage, around the table, and finally offstage again at the end of the piece. The base station sensor receives data from the four sensors on the table and is attached to Helmuth's computer, which performs signal processing tasks at the side of the stage.

The Wireless Sensor Network

Five Tmote Sky sensors are used. Four have infrared sensors attached and are programmed to send data to the fifth Tmote (the base station), which is connected via USB to the computer. Tinyos2.x light operating system was used for sensor programming and serial data forwarding to Max/MSP. Java objects in Max 5 received the serial data and made it available to the Max patch. Four streams of data, one for each sensor, were used to control signal processing modules. The software was originally implemented on OS X 10.4, was ported to 10.5 and is currently running on 10.6 with slight modifications.

RTcmix Spectral Delays and Clarinet

The RTcmix music programming language (Garton and Topper 1997) is available as a Max plugin, rtcmix~ [1] , facilitating the use of its powerful collection of instruments with scripting capabilities. The RTcmix SPECTACLE() instrument, programmed by John Gibson, was used to process the sound of the clarinet by altering its spectral timing characteristics. This technique works most effectively on sound sources with a large frequency range, so the decision was made to use the bass clarinet as well as the B-flat clarinet. Helmuth created four different parameter settings for the delays, each

[1] www.rtcmix.org/rtcmix~

paired with a sensor. This strategy allowed Danard to know what to expect from each sensor, and to choose sounds for each type of processing that would be most effective.

Max patch

Helmuth's patch performs signal processing on input audio signals in response to sensor data. There are four components to the patch, one for each sensor. In each component the sensor data controls whether audio is being recorded or not, and whether live sound or sound from a recorded buffer is being processed and heard. The patch was constructed to make the sensor activities transparent to the performer. Since there are some reliability issues when sounds are triggered or whether they stay on, it is helpful for the performer to visually monitor what state each sensor/signal processing component is in. Three large lights display whether each sensor/signal processing component is recording, playing or playing from a buffer of recorded sound. The computer should be placed where the performer can clearly see the screen, or the screen can be projected.

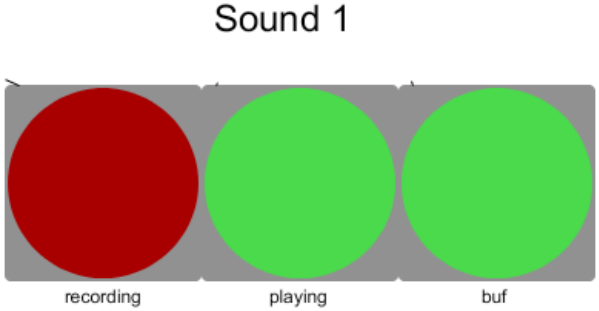

Figure 1. Three LED indicators for sound component 1, all in the off state. The first indicator highlights when the record state is enabled, the second when live sound is being processed, and the third when sound is played from a buffer recorded earlier.

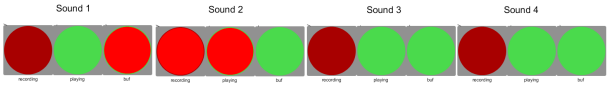

Figure 2. The display in this Max patch indicates that the recorded buffer is playing from sound component 1, after the performer left sensor 1, while sound component 2 is currently recording and playing, as sensor 2 is reacting to the performer's presence. Sensors 3 and 4 are inactive, neither playing nor recording.

Collaborative Process

Initial Work

One of the first steps was a recording session to provide Helmuth with material to work with in creating the processing strategy. Extended techniques and improvisations were part of the recording session, and were a great resource in creating the Max patch and RTcmix scripts. None of this recorded material was used in performing the piece. From an array of possible sensors the composers decided to focus on the infrared sensors. Helmuth chose the spectral delay processing technique, which worked well with the clarinet sounds.

Processing Strategy

After Helmuth created a spectral delay patch, Danard began to experiment with the DSP module using clarinet sounds. Hearing the sounds of the processing greatly influenced decisions on how to use the sensors. Because the delay-based processing had long-lasting and complex repercussions for every sound played, most of Danard's first improvisations quickly turned to a wash of sound. She discovered that it was best to play very simple motives to set up a clear sound world, turn off the processing following the set up phase, and, finally, improvise on top of the processed motives. We found it best to allow the performer to set each of the four sensor/processing components to one of four states: (1) recording and processing, (2) playing with processing, (3) only playing the recorded buffer with processing, and (4) not playing at all. Helmuth programmed this functionality and fine-tuned the timings and spectral delay parameters of the RTcmix instrument to avoid overloading the CPU.

Stage Layout

We originally had four microphones, each paired with a sensor, at different parts of the stage. This setup was cumbersome, however, as the presence of the microphone cables could potentially obstruct the performer's movements and increase the likelihood of inadvertently moving the sensors. A solution to this problem was to use a single microphone and a small square table with the four sensors facing outward. This reduced accidental triggerings and

gave Danard freedom and more space to move during performance of the piece.

The Score

As the collaborative process evolved, the first compositional decisions were pertinent to sound processing issues and creating the sonic and physical environment of the piece. The score was one of the last parts of the piece to be created. Helmuth felt that a score representing sound-generating ideas would be less rigid and more likely to encourage intense listening compared to a fully notated piece. Also, because Danard's improvisational skills are excellent, she could be trusted to create an interesting listening experience. The sound-generating ideas include notated fragments that can be transformed by the performer. Figure 3 below shows one of the sound-generating ideas: a long tone going into a half-step trill followed by flutter-tonguing of only the middle portion.

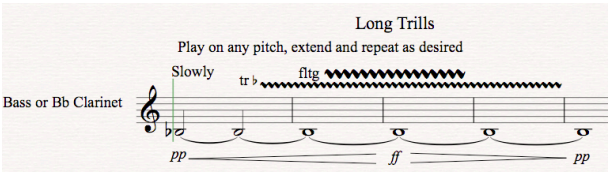

Figure 3. "Long Trills" sound-generating idea

On the Nondependence of Mind

Water birds
going and coming
their traces disappear
but they never
forget their path.

Figure 4. Poem by Dogen Zenji

Helmuth also selected the above poem (Tanahashi 1997) by Zen Master Dogen Zenji to be one of the sound-generating ideas. Experience with Zen meditation, Tai Chi Chuan, collaborations with other performer-composers, and Pauline Oliveros's Deep Listening® [2] retreats have influenced Helmuth to rely on the intuition of the performer to create a successful performance. The score also draws its inspiration from nature (in the poem's imagery, as well as the "like a butterfly" direction in one of the sound-generating ideas) and the timbral aspect of the sounds. The importance of the natural environment is one of the themes of the piece. As the Deepwater Horizon Gulf of Mexico oil spill of September 2010 increased our awareness of the presence and extreme vulnerability of water birds, the poem became particularly meaningful. Instead of the original wonder one feels at the birds' intelligence and skillfulness in navigating their environment, the poem now seems to hint at "traces" that may soon disappear completely, making one question whether we still live in a world where "they never forget their path."

Interpretation

A Structure from the Score

For Danard, the poem by Dogen was an inspiration on a macro-level, whereas the notated musical fragments were stimulations at the micro-level. The idea of *Water Birds* brings to mind an aural soundscape representing the birds' habitat – the call of a loon, the cry of the seagull, the flapping of a duck's wings, the splash of a kingfisher, the ocean's waves, and the rushing river. These are the sounds that Danard wanted to evoke with the clarinet. With the microphone and infrared sensors in a central location onstage, she moved toward or away from them to control the sound. Thus the "going and coming" refers not only to the performer's movement on stage, but also reflects the sounds of the piece. "Their traces disappear but they never forget their path" is a metaphor for how this piece works. Because it is improvised, each performance is unique and ephemeral; its traces disappear as soon as they are created. On the other hand, the "path" of this piece is highly structured and very consistent, both literally and figuratively. Each iteration of the piece has the same form; the same sounds are created in the same order using the same sensors. A fixed path within the performance space is traversed and improvisation occurs within this structure.

Initial Decisions

To work effectively with the electronics, several important decisions are made before the

[2] www.deeplistening.org

performance while other decisions are made during the performance itself. Danard's first step was to create a collection of sounds to draw on. At first it might appear that the musical fragments in the score are not much to form the basis of a piece. On the other hand, since there are two instruments (clarinet and bass clarinet), three fragments, and four different ways of processing sound, there are a combined total of 24 different sound possibilities even when applying the most literal interpretation of the music. After much experimentation, however, Danard developed eight sounds to use in this piece inspired by the idea of water birds and by melodic fragments found in the score. Although the fragments are not conventionally notated, these eight sounds are distinct from one another and relatively consistent from performance to performance. In addition to musical parameters such as pitch, rhythm and timbre, each sound is associated with one of the four sensors. Having created these eight sounds, the next step was to sequence them and layer them. Although these choices were mostly made to give a musical shape to the piece, there were also practical considerations due to the inherent limitations of the system. For example, it is not possible to have two sounds produced by the same sensor play simultaneously. It was necessary to minimize the need to switch instruments and to reduce movements that were likely to accidentally trigger sensors. There are also sections when Danard deliberately moves away from the sensors to improvise over the sounds she has created as well as instances when she turns off all the sounds allowing moments of silence. The complete outline of the piece is shown in Figure 5. This was used by Danard to plan and memorize her movements in the performance space. Each time a sound is initiated or terminated, the performer needs to move in proximity to the appropriate sensor to start the signal processing.

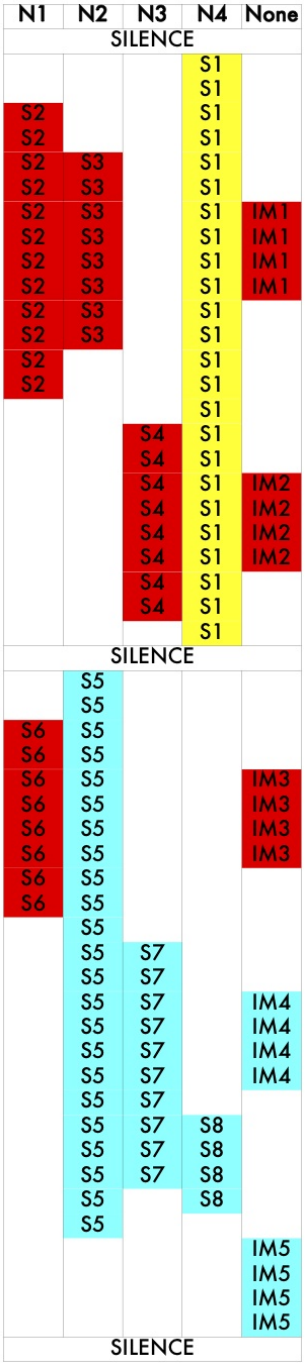

Figure 5. Outline of the form of Danard's interpretation of "Water Birds". Time moves from top to bottom. N1-4 are the seNsors. S1-8 are the Sounds. IM1-5 are unprocessed IMprovisations. Red highlighting is clarinet; cyan highlighting is bass clarinet; yellow highlighting is key clicks.

Sonic Realization

The harmonic basis for Danard's version of *Water Birds* are the four long tones comprised of C, Bb, Ab, and G which make up the third sound generating idea. To keep this harmonic structure, she rarely plays any other pitches while the clarinet sound is being processed. While there is more freedom during the improvised sections when the processing is off, the music is still centered on these primary pitch classes. Rich sonic variety is created by changing registers, dynamics, and articulations as well as by using different processing techniques associated with each sensor, while coherency and unity is achieved by limiting the pitch content.

Movement is an integral part of *Water Birds* and as such begins the moment the clarinetist physically enters the performance space. With the sensors in the center of the stage, however, the sound processing does not begin until she is within range of the infrared sensors. The piece starts with key clicks on the bass clarinet (Sound 1). The key clicks begin sparsely, but turn more densely textured as the piece progresses, thus allowing for a smooth transition from the unprocessed acoustic sound to DSP processed electronically modulated sound. On the bass clarinet, it is possible to get a variety of sounds, with key noise ranging from purely percussive to clearly pitched sounds. In keeping with the harmonic framework, Danard uses single clicks on C and G and a repeated click on Ab before moving to more highly transient, percussive sounds. The processed key click sounds create the effect of beating wings, rain, and ocean swells, which form the backdrop for the first part of the piece. Having begun very subtly, Sound 2 introduces the clarinet sound gradually with a single pitch – the low G on the clarinet. Some flutter tonguing and microtonal trills, inspired by Part 4 of the score, add to the texture, blending the acoustic sounds into the ocean sounds. Sound 3 introduces the full harmonic content of the piece for the first time by means of long tones over the entire range of the clarinet. In this section, the challenge is to get as many different pitches into the buffer without seeming to rush the long notes. Once all of the notes are in play, the clarinet sound and the processed sound become harmonically complex due to the possibilities of seconds and sevenths in addition to more consonant intervals (thirds, sixths, fourths and fifths). In fact, the only interval not in the set is the tritone. Depending on the order of the pitches and the time between them, Sound 3 creates a shifting cloud of consonance and dissonance. Sounds 1, 2, and 3 create the environment for the first improvised section.

Sound 4 was developed very early in the compositional experimentation process, and was directly inspired by the "butterfly" section of the score, which specifies that harmonics above a fundamental be performed. It is also the only sound that deviates from the core pitch classes, as any fundamental may be chosen. For this reason, Danard felt that only Sound 1, which is essentially unpitched, should overlap with Sound 4. What makes this sound special is the interaction of the signal processing with the acoustic properties of the clarinet — the signal processing associated with Sensor 3 brings out the overtones of the sound that is being processed. Unlike most wind instruments, the clarinet overblows at the 12^{th} harmonic rather than the octave resulting in the prominence of the odd harmonics. When short staccato notes played in the low register of the clarinet are processed by Sensor 3, the 3^{rd} and 5^{th} harmonics begin to emerge from the texture. Danard begins Sound 4 on C4, which produces the overtones G5 and E6 – a major triad. She then adds G4 produce the overtones D5 and B6. These pitch classes (C, E, G, B, D) form the set (01358) and the core pitches (C, G, Ab, Bb) form the set (0135). Although the pitch classes are different, the sets they make up are strikingly similar. It is important to note that pitches for Sound 4 were arrived at entirely intuitively and aurally, not by analysis of the sets involved.

The second half of the piece begins from silence and is dominated by the bass clarinet. As in the first section, sounds are created, layered, and used as the basis for improvisation by the clarinetist. The piece concludes after Danard turns off all the sounds. As the buffers continue to play and decrescendo, Danard exits the stage, decreasing the volume and intensity of her playing to fade out with the processing..

Indeterminacy in Performance

Despite this careful planning there are still many decisions that are made during the performance.

The first 30 seconds after turning on the sensor are the most important because this is the material that is recorded and stored in the buffer. Anything that is not stored in the buffer will stop playing after the performer moves away from the sensor. Another consideration is the length of each segment. This is partly a practical consideration determined by how long it takes the performer to move around the stage. It is also an artistic consideration, since some segments have inherently more musical interest than others, and therefore deserve more time in performance. Danard balances the form of each performance so that one section flows naturally into the next. Finally, despite our best efforts, sometimes things go wrong. An inadvertent movement can accidentally turn a sensor on or off, a glitch in the data can make a buffer not record, or sometimes sounds are produced unintentionally. These are the risks of any live and interactive performance. The key is to know the technical and musical characteristics of the system well enough to make the "mistake" sound deliberate and get back on the right track as seamlessly as possible.

Conclusion

The indeterminate nature of the score raises the question of how it would transfer to another performer. Danard says, "I think of what Mara has created in *Water Birds* as a beautiful playground. What is special about the piece is that, rather than telling me what I can and can't do, she has allowed me to create my own game. At first I explored, discovering all the features and attractions, but over the course of the project I discovered which ones were the most rewarding for me. Like a made up children's game, there are definitely rules, but I get to create them and change them to suit myself. With a video recording and some verbal explanation, I could teach another clarinetist the rules of my game and how to play my piece, but this is only a limited use of the *Water Bird* sound world. What I have chosen to do will never be as natural or comfortable for another performer as it is for me or as what they could come up with on their own. In working out my interpretation of the score, I had to engage much more intensely and creatively with the music than I would have if Mara had given me detailed instructions about how to play the piece. Because of this investment of time and energy, the piece is much more interesting, personal, and rewarding to play. I hope that future performers will not follow my disappearing traces, but follow their own path into *Water Birds*."

Acknowledgements

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Introduction

A Return to Performance

In the electro-acoustic music community, perhaps more than anywhere else, one encounters a prevailing respect for sound itself. This is typified by its music, which is often timbre-centric, frequently lacking elements of pitch/harmony and pulsating rhythmic idioms, and by the manner in which it is presented. At electro-acoustic and acousmatic music concerts, it is not uncommon to hear pieces for just the tape medium, often presented in dark, non-distracting spaces where sound alone becomes the focal point. A minor exception to this is the practice of live sound diffusion by which a composer or sound diffusionist controls the audio levels and spatialization of a multi-channel piece within a concert hall. Live diffusion is, however, usually performed off stage, at the mixing console, and not visually emphasized, so as not to disturb the pristine sound environment. As a result, for audiences who are not familiar with the performerless format, concerts that lack on-stage performers can be unexciting, if not confusing. Perhaps in response to this, or as a simple reflection of our culture's ever-increasing desire for multimedia stimulation, presentations of electro-acoustic music seem to feature more and more pieces which include live performers or, alternatively, works including some type of video element.

There are many categories of electro-acoustic music which feature live performance, including, but not limited to, works which include traditional acoustic or electric instruments, pieces for laptop orchestra, and compositions which highlight a novel device for live sound diffusion. For many, however, one of the ripest areas for investigation in music performance is the creation of new electronic musical interfaces, which meet needs not met by traditional instruments and which may offer opportunities for innovative performance synergies. The primary motivation behind developing HOOLA was to create a musical interface that would be visually engaging for an audience, while also investigating musical features that could potentially be desirable by composers and performers.

Human Computer Interfaces for Music

Musical Instrument or Interface?

Throughout this article we will encounter the following descriptions used interchangeably: digital musical interface and digital/electronic musical instrument. They are not, however, entirely synonymous. Most digital musical interfaces, especially of the type discussed in this article, require multiple parts for their functionality, whereas traditional acoustic instruments can be played and produce sound without need of any additional parts; certain hardware-based electronic musical instruments fit this description as well. Digital musical interfaces, on the other hand, often include a primary object with which the performer interacts (the instrument that the audience sees), a microcontroller (to receive and transmit data from the instrument), and a computer to interpret that data and output sound using music software. It is clear from this description that the digital instrument an audience sees is, in fact, a multifaceted human-computer interface, quite dissimilar from a traditional instrument.

Many designers of novel electronic interfaces, nevertheless, often call their interfaces musical instruments – myself included. In my own case, this type of naming preference is adopted to help temper potential aversion by musicians who might consider a digital musical interface to be overly technical or unmusical. Furthermore, when a digital musical interface's development and implementation is complete it should feel and function like a traditional instrument – the performer need not be aware of the technical

hidden layers of the interface and should ideally be free to just perform.

Why Use Computers in Digital Musical Interfaces?

I discussed above what could be described somewhat as a paradigm shift in the field of electro-acoustic music - an increase in live performances using digital musical interfaces at electro-acoustic music concerts due to a shift in interest by the community. An additional factor, however, cannot be ignored. The increase in computer processing speed, availability of cheap microcontrollers, and affordable off-the-shelf electronic components/sensors, has in the last decade made it possible for "non-experts" to design and construct their own digital musical interfaces with relative ease.

Using readily available microcontrollers, such as an Arduino or Basic Stamp, along with popular commercial software, such as Max/MSP, many curious musical thinkers are now able to experiment with and build their own instruments, a reality that would have been impossible in the past for all but electrical engineers. The HOOLA system is such an interface.

Desired Features of Digital Musical Instruments

Electronic musical instruments, in general, can be sorted into two categories: analog and digital. The latter, not surprisingly, has become much more common in recent decades. A Digital Musical Instrument, abbreviated DMI (Casciato 2007), is comprised of a hardware component and a software component. The hardware is used as an interface for human-computer interaction and software takes the role of mapping the gestures to sound. One advantage of this arrangement is that the hardware interface is responsible only for sending gesture data to the computer. Once received, the data can be mapped to musical output in any number of ways. This type of system allows for flexibility in modifying the sound while keeping the interface the same, thus creating the potential for the creation of an immeasurable variety of sounds.

With this in mind, two questions arise: what features should a DMI possess and what gestures would one like to capture? The second question should be answered on an individual basis, suited to the needs of the particular musical idea. The first, however, has a more generalized answer: a DMI should be as flexible and precise as possible. Specifically, it should be capable of capturing continuous gestures while at the same time also capturing ON/OFF type gestures. In other words, DMIs should be versatile enough to function as "buttons" and "handles" (Verplank 2001). Furthermore, any instrument, whether electronic or acoustic, should consider ergonomic design issues allowing for natural, comfortable movements. This has not always been the case, even for such instruments as the violin or electric guitar. The awkward twisting of the wrist and pressing of the violin body against the neck are certainly not natural nor are they comfortable. Finally, one should consider how the physical gestures required by their instrument are representative of the resultant sound output. It can be advantageous for these gestures to be reflective of the musical conception which underlies the instrument's design; this may aid the listener's understanding of the music and will certainly add entertainment value to the performance.

What is HOOLA?

HOOLA is a hoop-shaped digital musical instrument on which one performs by moving a light-wand around and across its inner circumference. It allows for continual circular gestures, triggering of twenty-four independent points, tracking of speed and direction of circular gestures, and tracking of X/Y position when playing in the open space inside the hoop.

I have created numerous versions of the instrument to date. What is noteworthy, however, is that even the original version of the instrument was successful in resonating with my basic instrument design goals – creating an instrument that would be engaging to watch and allowing for continuous movement by a performer. With additional time and consideration, I have focused on improving the interface's ability to capture more subtle gestures and on making its appearance more appealing. Nevertheless, I feel that the most important factor in creating a new instrument is the strength and seminality of the core idea. In the case of HOOLA, that idea is circular motion.

About Digital Musical Instruments

Disadvantages of Novel DMIs

There seems to be a temptation among those who work with technology to believe that new is better, especially for artists whose works incorporate technology. Unfortunately, this is not always the case. As Milton Babbitt said, "nothing grows old faster than a new sound" (Warburton 2003). Considering a newly invented DMI, there are a number of common factors which often impede artistic and commercial success. As a matter of fact, it is probably fair to say that most new musical instruments are unsuccessful – at least if considering their acceptance and widespread use by the common musician.

Limited Availability

Novel instruments suffer from limited availability. In most cases it is impossible to purchase such an instrument. In many other cases, only one or two examples of such instruments exist. The inventor is the designer, builder, and sole performer of that instrument. A further difficulty that affects the issue of availability is the fact that many such "prototypes" are fragile and incapable of being performed on by anyone other than the inventor (Casciato 2007).

Mastery of an Instrument

Even for instruments which surpass these barriers, another issue that arises is the difficulty in truly mastering the instrument (D'Arcangelo 2002). Certainly, for traditional instruments, people spend countless years studying performance techniques to become virtuosos. Considering the issues broached in the previous paragraph, it becomes immediately evident why mastery of a novel instrument is unlikely in any broad sense. Perhaps in response to this transient nature of novel instruments many new instruments are created to be immediately playable but are, as a result, incapable of being truly mastered. Mastery implies a level of proficiency that simply is not attainable on an instrument which only allows a small set of pre-determined playing techniques; such instruments simply lack the nuance and robustness of traditional acoustic instruments. Some argue that this over-simplicity might make learning to play such an instrument unappealing for musicians (D'Arcangelo 2002).

Game Controller or Musical Instrument?

In part, what delineates many new electronic instruments from traditional acoustic instruments is the grossness of the gestures allowed by them and the limited number of parameters that these gestures are capable of controlling. The following question comes to mind: are such controllers capturing *musical* gestures or merely gestures? When one considers the number of timbral parameters that are modulated when a simple motif is played on a violin, it is difficult to imagine capturing such variety and detail using cheap sensor technology. Acknowledging this, it seems that contemporary electronic musical instruments may be more closely likened to video game controllers than to traditional musical instruments. In terms of materials of construction and use of sensor technology, this is certainly the case. In certain instances, musicians are turning to direct use of commercial video game controllers, such as the Wii remote, for electronic music performance.

Part of the appeal of game controllers is their lack of an imposing physical interface; one is able to gesticulate in space with freedom (despite perhaps holding a small wireless remote) and movements can be mapped to control a variety of different games. Many new electronic musical instruments follow this model. This scenario, which can be described as a lacking of force feedback, has been found however to be poorly suited for controlled musical performance. When playing music, it is essential that performers have feedback from their instrument including tactile, vibratory, and visual cues to reinforce what and where they are playing (Marshall 2006). By using interfaces that lack physical feedback, one runs the risk of waving one's hands in the air as if signaling for help.

Commercial Preferences

At this point in time, keyboards or keyboard-inspired button interfaces remain the most commercially popular form of electronic instrument. This may be due in part to the fact

that buttons offer clear feedback and precise, predictable results. More likely, however, it is because electronic keyboards fall under the DMI Classification of *instrument-like controller* (Casciato 2007). It appears that those electronic interfaces which resemble traditional instruments are easiest to market and most accepted by the public as musical instruments. In other words, most successful instruments need to be either instrument-like controllers or instrument-inspired controllers, the latter borrowing ideas from traditional acoustic instruments without seeking to emulate them (Casciato 2007). This is not surprising as many of the potentially negative issues associated with alternative, or experimental controllers do not plague instrument-inspired controllers. For instance, a pianist need not learn many new techniques in order to play an electronic keyboard. Development of alternative controllers, on the other hand, while not as immediately viable commercially, offers new possibilities for music composition, sound production, and performance that would be unimaginable if only commercially successful instruments were available to the public.

Are We Not Renaissance (Wo)Men?

In the area of music technology it is not uncommon to meet individuals who design, record and synthesize their own sounds, compose music using these sounds, and invent, engineer and build their own instruments for performance. Are these individuals *Renaissance* men and women, equally skilled in the arts and sciences, or is quality being compromised by not dividing the labor behind the artistic project? While there is no single correct answer to this question, the common answer is yes; quality is frequently compromised when one person does all the work.

Regardless of the musical output of novel electronic musical instruments, their success is often jeopardized by lack of skills in craftsmanship, technical knowledge, etc., on the part of many instrument concepteurs who are musicians before engineers. As a result, many instrument inventions are never brought to proper fruition in the form of a professional prototype. The opposite case plagues the field of music technology as well. Engineers dabble in the arts without necessarily having any particular artistic talent or training, which often results in conspicuously weak artistic output.

Of course, it would be foolhardy to believe that any musical interface designer, whether primarily a musician or engineer, purposefully avoids collaboration. Unfortunately, many simply do not have access to the personnel that their project requires. A few universities are now offering courses on the topic of musical interface design, for which they should be commended. A positive solution to the issue discussed here would be to cross-list such courses in the departments of music, art, and engineering and to actively encourage collaboration between these disciplines. This has been the case at Tulane University for the past 7 years to great effect.

In the case of HOOLA, many milestones in its development were reached solely as a result of collaboration and consultations. I was fortunate to have the input of students from various departments and to work directly with professors with Engineering backgrounds including Professor Tae Hong Park (who holds degrees in music composition, computer science and Electrical Engineering) and Dr. Cedric F. Walker of the Tulane Biomedical Engineering Department.

Advantages of Alternative DMIs

After reading the litany of shortcomings of novel DMIs it might be difficult to understand why one would attempt to create a new musical instrument at all. Ultimately, many have decided to invent instruments, and to create new music, because of a particular musical need that cannot be fulfilled using existing instruments. If one desires to hear new sounds and to hear them organized in unconventional ways, one will likely have to organize those sounds oneself. Inventing and building a novel musical instrument is perhaps one of the most straightforward ways to accomplish this.

Flexibility

In general, DMIs, whether commercially available or newly invented prototypes, offer certain advantages over their acoustic counterparts. First and foremost, they offer flexibility; the same interface can fulfill nearly

limitless roles such as controlling MIDI, controlling sample playback parameters including speed and pitch, or controlling synthesizer parameters such as waveform or filter characteristics. Second, the output of a DMI is not limited by the laws of the physical world; as electronic producers of sound, they may generate a near infinite variety of sounds. Third, most DMIs may be repurposed to control media other than sound, such as video or lighting.

Interactivity

It should be reiterated that DMIs frequently consist of separate hardware and software units. The software component is, in most cases, where the core of the musical idea is encapsulated. Here, especially, a composer has the flexibility to modify the musical output in ways that would be impossible with an acoustic instrument. For example, with a DMI there is the possibility of creating an instrument that is not merely slave to a performer but may respond interactively (Chabade 2002). With traditional acoustic instruments and trained performers there is nearly a one-to-one relationship between input (playing on the instrument) and output (resultant sound from the vibrating mechanical object); with a DMI, this need not be the case. It should be noted that unpredictability in a musical instrument could be off-putting for a traditionally trained musician. Level of interactivity, however, is just one parameter to be included in the design of a DMI to whatever degree one sees fit, adding another level of flexibility to a controller.

HOOLA: Evolution of the Interface

The Circular Güiro Predecessor

Three or four years ago, I recall sitting in my home listening to the album *Homogenic* by Björk (1997), which was already more than ten years old. Since the time of its release, I had been inspired by the inventive yet organic approach to rhythm and percussion presented on the album. It seemed that rather than strictly emphasizing pulse and rhythm through use of typical staccato drum sounds, there was an attempt to create percussion parts, or *beats*, with smooth, evolving amplitude envelopes. The artist herself stated that her intention for the album was to capture the rugged landscape of her native Iceland (Dibben 2009). The "mimetic" beats featured on the album, strongly distorted and filtered, are especially reflective of the volcanoes, glaciers, and hot rock which typify Icelandic terrain (Dibben 2009).

In attempting to create an acoustic instrument capable of creating a similar continuous percussive sound with crescendos and decrescendos, I inadvertently invented HOOLA. This nascent version of the instrument, though never completed to a level worthy of showcase, drew its inspiration primarily from a Latin-American percussion instrument called a *güiro*. A *güiro* is a rasp made of a serrated gourd which is played by scraping a stick along its surface. Typical strokes across the instrument are quick, creating the illusion of a single percussive sound which can include a crescendo or decrescendo. My goal was to augment the *güiro* in such a way that the scraping motion could be continued indefinitely. The obvious solution was to create an instrument that, rather than having a straight design of short fixed length, would be circular. The paired images below depict, respectively, a traditional *güiro* and a design for a circular rasp.

Figure a. Traditional Güiro

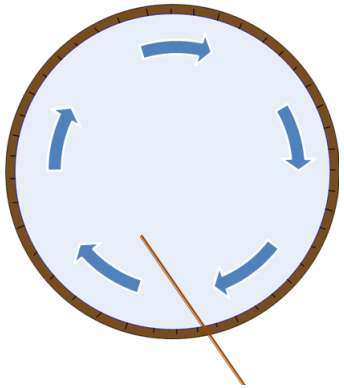

Figure b. Design for a Circular Rasp

HOOLA 1.0: A Piezo Interface

In the Fall of 2009, I composed a piece aptly entitled *HOOLA Etude No. 1* for which I constructed five circular instruments made of hula hoops, two of which are shown in performance in the image below. The concept behind the piece and its technical implementation were rather simplistic. I composed and recorded five musical parts each of which was allowed to briefly sound only when triggered by a corresponding hula-hoop controller.

Figure c. HOOLA 1.0 in Performance

The triggering was implemented in a rudimentary fashion, without the need for programming or elaborate musical patches. Each hoop was fitted with a set number of evenly spaced rivets (five, six, seven, eight, and nine) and a single piezo microphone. When the inner circumference of any hoop was scraped with a metal stick, impulses from making contact with the rivets would open a gate on a vocoder or side-chain compressor, allowing sound to pass to the audience. Musically, the piece was an exploration of polyrhythm and *polymicrotonality* (Reinhard 1997). Specifically, it showcased the potential relationship between metric divisions and frequency divisions (musical scales). Within the context of the piece, each hoop generated a specific polyrhythmic pulse and a related equal-tempered scale.

HOOLA 2.0: A Photoresistor Interface

It was not until the spring of 2010 that I began developing what could be considered a more mature prototype for the current interface. I collaborated with fellow graduate student David Hyman in continuing development of the interface as a final project for a class called Music Performance Systems, taught by Professor Tae Hong Park. I constructed a circular instrument featuring eight photoresistors controlled by a custom LED light wand, the design of which was recommended by Dr. Park. The conception for *HOOLA 2.0* was, in theory, to design an interface that would allow for independent triggering at eight positions while simultaneously accessing continuous control variables for each.

Data acquisition was managed using a Basic Stamp BS2 microcontroller and a MAXIM 1271 Analog-to-Digital-Converter (ADC) in order to obtain the values from the photoresistors in the form of MIDI messages to be mapped to musical output via Max/MSP. In practice, it was quite difficult to accomplish the goal of having the interface interpret both discrete and continuous gestures. Although it was initially decided upon to input the data in the form of MIDI Pitch Bend messages (because they offer higher bit resolution) ultimately high resolution was of little use for this version of the interface. Difficulties in successfully implementing triggering without crosstalk, the most basic requirement of the interface, created a scenario in which the available continuous data were rendered problematic. Ultimately, the data was scaled to a very narrow range (0 - 5) in order to simplify implementation of basic ON/OFF triggering.

The first factor influencing this situation was interference from ambient light which rendered the interface unusable in a lit room. Although performing in darkness may be entertaining at times, I felt it was not an option for a general purpose musical instrument. Second, the sensors themselves were mounted on the instrument in a manner which allowed for little adjustment of their positions, yielding disparate results from neighboring sensors. Finally, the custom LED light wand posed problems due to its uneven diffusion of light; triggering became unstable when moving the wand beyond medium speed.

Current Implementation

In the current version of the instrument, I sought to address all of the problematic issues listed

above while maintaining the general principle behind the instrument and improving functional features of earlier versions.

HOOLA 3.0: An Infrared Interface

HOOLA 3.0 is constructed out of a steel hoop, fitted with 24 height-adjustable infrared photodiode sensors, and is performed on using an 11 inch fluorescent light-wand.

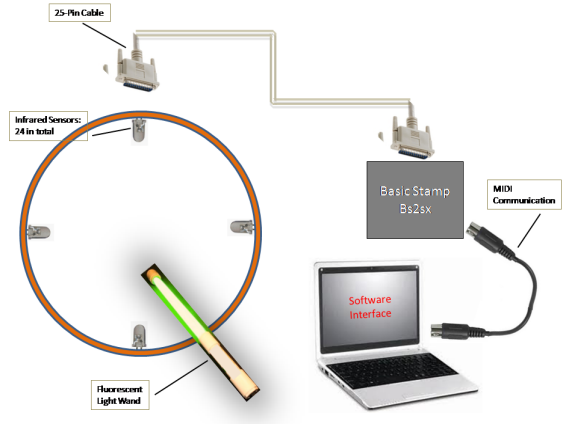

Figure 1. Diagram of Current Interface

Figure 1 provides an overall diagram of the current interface. The general architecture of the current version is quite similar to that of the previous, HOOLA 2.0; data acquisition is performed using a Basic Stamp BS2SX microcontroller and three MAXIM 1271 ADCs, and the data is processed and transmitted as MIDI to be mapped to sound output via Max/MSP. Below I will describe in detail each of the hardware and software components which comprise the musical interface.

Hardware: Height-Adjustable Photodiodes

In the current implementation of HOOLA, infrared photodiodes replace photosensors. Photosensors, being problematic for my purpose in a lit space, needed to be replaced by a light-based sensor that would, ideally, be unaffected by ambient light. The specific decision to use infrared photodiodes came as a result of receiving a recommendation from Dr. Cedric F. Walker from the Biomedical Engineering Department at Tulane. He explained that infrared photodiodes capture a significant amount of red visible light but are not overly affected by ambient light. The IR sensors did indeed greatly improve the ambient light issues.

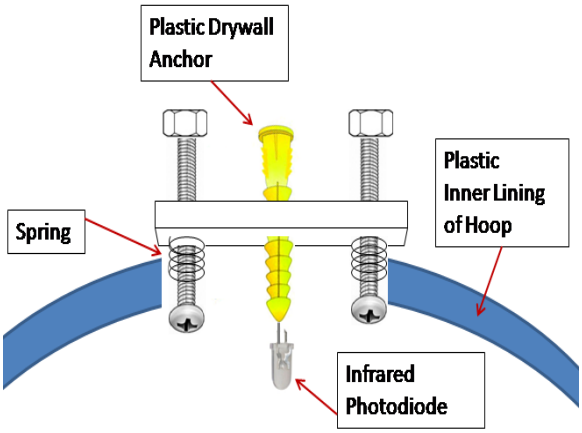

Figure 2. Adjustable Photodiode Mounting System

Based on my experience constructing HOOLA 2.0, of permanently embedding photoresistors into a solid hoop via small holes, I realized that being able to adjust the height and position of the sensors was critical for my particular application. I, therefore, designed an adjustable mounting system for the IR photodiode sensors used with HOOLA 3.0. Each sensor features its own spring-adjustable mounting system that is attached to the plastic inner-lining of the interface via two bolts. The main structure of each mounting system is made of a rectangular plastic piece; a plastic drywall anchor is attached to this out of which the tip of the sensor protrudes. Tightening of nuts on the bolts lowers the mounting system towards the playing surface. Springs provide mechanical resistance to maintain the sensor apparatus's height. Figure 2 provides an overall diagram of the adjustable mounting system.

Hardware: Fluorescent Light Wand

The original light wand used with HOOLA 3.0 was a byproduct from the previous version, an LED wand. It was made of a clear plastic tube, filled with numerous LEDs arranged in a spiral array with the intention of projecting light evenly in all directions. This, however, was not the result. Using the wand with HOOLA 3.0 yielded intermittent triggering due to unevenness in the light field.

The ultimate decision to use a broadband fluorescent light was reached after discovering that visible light from white LEDs has a

substantial effect on infrared sensors. This was unexpected. With this realization, the possibility of using a fluorescent light tube, due to its strong even distribution of light, became evident. Fortunately, in practice it worked well and it was found that brightness levels could be easily manipulated by altering the amount of voltage supplied to the fluorescent lamp.

Hardware: Microcontroller and Analog-to-Digital-Conversion

A Basic Stamp microcontroller board is used with HOOLA 3.0 for data acquisition and transmission of the digital control signals representative of the performance gestures. The Basic Stamp offers an affordable and relatively facile means of achieving data acquisition using a wide variety of sensors. They are programmable using Pbasic, a custom BASIC type language developed by Parallax. User code is downloaded onto the chip using the serial communication protocol.

In particular, I use the Basic Stamp BS2sx model for the current implementation due to its faster processing speed compared to the Basic Stamp 2 model (50 MHz vs. 20 MHz). The BS2sx features eighteen I/O pins, sixteen of which are used for data transfer between the computer and chip and two of which are dedicated to serial communication.

In addition, three MAXIM 1271 analog-to-digital converters are required to convert the analog signals from the twenty-four IR photodiodes for transmission via the BASIC Stamp. Each MAXIM 1271 ADC is capable of receiving up to eight channels of data. HOOLA 3.0, however, features twenty-four sensors and hence three ADCs are required.

Software: Overall Software Design in Max/MSP

I created the software portion of HOOLA 3.0 in Max/MSP, creating abstractions for the various functions the software required, finally streamlining them into a unified, user-friendly interface. Although it is my ultimate goal to program the objects directly in C++, Max/MSP offered a quick and easy system for testing and implementing algorithms. Currently the following features and synthesis algorithms have been included in the software: basic triggering of 24 independent sensors, detection of playing speed and direction, tracking of X/Y position using triangulation, melodic mode with portamento, Shepard Tones, and audio file scrubbing (control of speed and direction of audio samples). For more information about the various components of the software see (Leonard 2011).

Conclusion

According to Max Mathews, often referred to as the Father of Electronic Music, it takes at least a decade to fully test a new instrument, before its viability can truly be determined (Park 2009). This is likely more time than most novice instrument designers are willing or able to invest on a single project. Fortunately, the possibility of inventing one's own instrument becomes ever more feasible due to the availability of cheap and readily available technology. Nevertheless, instrument design has a steep learning curve and requires skills based in a number of distinct fields including engineering, music, ergonomics, and art/design. I advocate, whenever possible, that one consult or collaborate with others, as attempting to accomplish everything by oneself often leads to poor results, either technically or creatively. Successful examples of instrument design have, in nearly every case, been the product of collaboration between artists, engineers, and specialists in other fields. The composer John Appleton, for instance, collaborated with the cofounders of the New England Digital Corporation, engineers Cameron W. Jones and Sydney A. Alonso, in creating the Synclavier (Appleton 1989). Max Mathews, the engineer mentioned above, was known to continuously improve his electronic instruments based on the feedback of skilled musicians and other engineers (Casciato 2007). In the case of HOOLA, its progression as a DMI is largely indebted to the professors and engineers from whom I received consultation. A number of its current features simply would not exist without them. In my future work, I hope to collaborate with engineers with specific experience designing electronic musical instruments or gaming devices, who will likely help the interface to evolve in new directions.

With that said, my original intention for HOOLA remains. The instrument is the product of a personal creative pursuit with a specific

musical and performance purpose. It was initially created without consideration for commercial or popular applications. It has, nevertheless, evolved to a point where the potential for more wide-scale application is foreseeable. The instrument features a novel conception, an ergonomic design, and has been proven to be applicable for compositional and performance explorations. Although still a work in progress, I feel that HOOLA 3.0 offers a positive model for novel digital musical instruments, at the very least in its embodiment of the spirit of musical expansion and evolution.

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Interview with David Rosenboom on his Early Career: Late 1960s to Early 1970s

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Conducted by Bob Gluck, March 5, 2008

David Rosenboom is well known to readers of Journal SEAMUS as a pioneer in multiple spheres of musical and artistic endeavor. He has explored aspects of musical improvisation, form, and scoring, interactive multi-media, new instruments and live performance techniques including musical interfaces extending the human nervous system. Rosenboom has served as a core faculty member and administrator at several educational institutions, among them Mills College, York University, and the California Institute of the Arts (CalArts). This interview was conducted as part of my research about musical performance in the late 1960s New York contemporary music scene. A major focus was the impact of Morton Subotnick on new venues including The Electric Circus, a multimedia discotheque where David Rosenboom served as artistic coordinator. This interview addresses the broad trajectory of Rosenboom's early career beginning with his days as a rock musician and early experiences at Champaign-Urbana, Illinois; Buffalo, New York; and New York City.

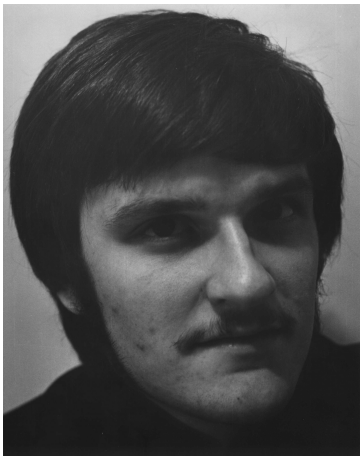

Figure 1. David Rosenboom (1968)

From Champaign-Urbana to Buffalo

David Rosenboom: I attended college at the University of Illinois, Urbana-Champaign, and I was basically minding my own business. The phone rang and it was Lukas Foss, who offered me a position on the spot in what was then the Center for Creative and Performing Arts at the State University of New York at Buffalo. He and Allen Sapp were running it. I took it immediately and went up there. That was 1967 - 68. I was pretty young, 20 years old. Morton Feldman was there, in and out; I'm not sure in exactly what capacity. There was a core of people hired for the year, composers and performers – a lot of them composer-performers – who made up the ensemble and whose works got played. And then there were people who came in for shorter periods of time.

I was still an undergraduate student, and I left the University of Illinois against the advice of a lot of my professors. I followed the advice of my main mentor Salvatore Martirano, who said "Oh you can't pass this up." So I did it and I'm very glad I did. So I went up there and that was an incredible year. Some of the other people there were La Monte Young, for part of the year, Terry Riley, Stuart Dempster, Jon Hassell; a ton of great musicians. There was something called the New Percussion Quartet at that time. Jan Williams and several others put that together and we had quite a year.

Now, at the time, I was off doing a lot of experiments that were crossing over into the contemporary concert music world with rock and roll; and I had a band, which had formed in Champaign-Urbana. I was the drummer [along with] three other members. One named Lynn Newton, who was a composer, a very talented composer at Champaign-Urbana, who decided that the right thing to do was to give up the abstract contemporary musical world and go into rock and roll. And a man named Tom McFaul –

I believe he was a musicology student who was also a singer and keyboard player. Lynn played bass. After we moved to Buffalo, we had picked up a guitar player and lutenist named Richard Stanley; he played early music as well, a very good player. Later, after the band moved to New York, Tom became a partner in a studio that did commercial work, and that's where I recorded a lot of the commercial work that I did in New York. Tom made his whole career in commercial work and was very successful. In New York, I went whole hog into the contemporary music world and dropped out of the band. The band continued for a little while after I left.

When I arrived in Buffalo, they didn't realize when they hired me that I was going to show up with a band, but I did. We all came up there and so it was a pretty exciting, inventive, creative year. Actually, Lukas was really supportive. I have to thank him because he took a liking to my music and he programmed a lot of it. That was my launching pad into the scene. And it got programmed in New York as well as Buffalo. I got great write-ups from people like Donal Henahan in the New York Times. So I had a base that started to get built in New York at that time, having worked with some of the people I've mentioned. That was really terrific.

Also, Morton Subotnick had come in the Fall, when he had a piece played by the Buffalo Philharmonic. He was friends with Sal [Salvatore Martirano], and I introduced myself to him. Mort and I have been close friends ever since. David Behrman was there. David at that time was still working as a producer for Columbia Records, and there were many connections that developed. Morty Feldman, I also have to say, was a real booster. He was really encouraging to me as a young composer, and I took that very seriously. Feldman often came to hear my pieces, particularly in New York, and he always had nice things to say afterwards. That meant a lot to me.

I'm probably leaving out a lot. Of course that was the year we recorded *In C*, (1964) the original Columbia production. Lukas had worked a deal with Columbia to produce two recordings of the group from Buffalo, only one of which came out. The pieces that were chosen to be recorded, in addition to *In C*, were a piece of mine titled *Then We Wound Through An Aura Of Golden Yellow Gauze* (1967), a piece of Yuji Takahashi's, and a piece by an Argentinean composer named Carlos Alsina. My piece had a very large circular graphic score and texts, both original and from modern media, like advertising. These were deconstructed using techniques from information theory. All four of those pieces were recorded, but the only one that was released was *In C*. So it was. But still, it was a good experience and a good entrée into the scene there.

Computers, the Human Brain, and Intelligent Instrument Design

I had been very involved with new developments with computers and electronic instruments. Of course, the modular synthesizer developments were accelerating at that time. But that's not the direction I went. I had gotten involved with very exploratory electronic work with electronics and music at Illinois, and was influenced by being around Lejaren Hiller and early computer music.

During my early days at Illinois, from maybe 1964 onward, computers operated at very, very slow speeds and were not portable to say the least. But there was an enormous conceptual power that was being realized. I was absolutely convinced that it was eventually going to be possible to make that kind of compositional modeling real-time and resident inside instruments. I began calling these kinds of instruments "intelligent instruments." And so my approach immediately turned towards live performance. I did some tape pieces, but my main thing was figuring out how to get this kind of stuff live on stage. And so I studied a lot of electronics and computer science, and so on. I got to the point where I was building my own instruments. This started in Champaign-Urbana and I carried that through the Buffalo years and into New York.

This interest continued with my involvement with the brain. I had an avaricious appetite for studying brains. I began studying the brain partly in response to what was emerging as a sort of crisis in music theory of the mid-20th Century. This was that we had no analytical systems that were not stylistically bounded. I began to think that one of the ways around this

crisis was to start looking inside, to start understanding what was going on inside the brain. Then you could work yourself outward to the musical experience and outward to the ear. And so I was thinking about what kind of general language we could develop to approach the reception of music in that way. Later, I met Ted Coons, the guy who got me connected with people at NYU and at SUNY Stony Brook who were doing research in biofeedback. Then, I got immediately totally absorbed in it.

I was also very close to Hiller's work with algorithmic composition. I felt that it might be possible to embed processes of composition inside instruments in such a way that they would become part of the communication between the player and the instrument. As a result, you could think of musical states, so called descriptions of particular states, as particular relationships of the performer with the instrument. Compositional ideas could be spontaneously called up and used in the actions of live performance. My intensive, almost daily, conversations with Sal were also fuel for my thinking, as was my study of systems theory with Ken Gaburo, Champaign-Urbana in the mid 1960s was almost unparalleled as an environment for experimental music development in the world at that time.

Sal continued to develop these ideas, which eventually led to the SalMar Construction. I was doing it another way, building circuitry that I could use live on stage, and I started employing analog computer technology to make live processes. Of course you could think of a modular synthesizer as a special purpose analog computer, but I went back to the raw versions and started developing performance techniques with that kind of stuff. Since at the same time I was also an active violinist, pianist, percussionist, I was constantly playing. I am very much about the live experience of music, and being a performer was always a big driver for it.

It took a while before very evolved interfaces were developed. The possible input structures we had were pretty limited in those days. What we had were crude analysis of audio input or sensors, photocells and switches, things that you could trip [on and off]. So it's been a long process of developing more evolved input structures. But that's still one of the biggest areas of development in electronic music.

I brought thiskind of work to the Buffalo scene. There, I landed among this fantastically interesting group of musicians and composers of that year. I'm sure I'm leaving quite a few people out. John Cage was there part of the time. Lukas got Cage to agree to participate in a performance of one of my pieces, which was really fantastic, and we got to know each other pretty well. Bob Moog was just a couple hours' drive into the mountains, in Trumansburg, New York. I went to see him, and we had stimulating conversations. It was a really, really fertile situation.

Heading to New York City

And so at the end of that year, Lukas offered me another year there to stay in Buffalo, but I was too anxious to get to New York; I wanted to make a beeline to be in New York City. So I didn't accept the second year that he offered, and I moved to New York with no job or prospects. That's where I had some really great performances and met a lot of people. I wanted to be in New York because I had grown up in Illinois, was a Midwesterner kid. I went to the Interlochen summer program as a youngster, so I had real high-level professional experience in high school. But I wanted to get out of the cornfields and get to the big city. So Buffalo was a steppingstone for that. And there was a magnet around a lot of the real experimental work going on there and I met Nam June Paik, and I knew what he was doing there, and La Monte Young, Mort Subotnick, David Behrman, Yuji Takahashi, Terry Riley, John Cale, Morton Feldman, John Cage, and so many others. I met a lot of people through them. It was mostly, but not exclusively, the downtown scene that I was drawn to. And then I spent my time manipulating serial pitch structures, too, just like everybody else, you know, but I was moving in another direction.

Mort Subotnick's Studio, the Electric Circus, and Downtown composers

So I moved there, and there were a lot of fortuitous coincidences, and one of them was the opening of the Electric Circus [a psychedelic, multimedia discotheque on St. Marks Place,

New York City, 1967-1971] (Gluck 2012a). Another was the fact that Mort Subotnick and Tony Martin – whose work I had seen in San Francisco at the Fillmore West while I was still living in Illinois – had become [artist-in-residents in what had evolved into] the Intermedia Program at NYU (Gluck 2012b). Their studios were installed in a space that was above the then Bleecker Street Cinema. There were writers and theater people on some of the floors there, too. Mort's studio was its own sort of little hub of activity. I was hanging out in the electronic studio a lot, and other people would come in and work there, too.

Figure 2. The electric circus (1968)

Don Buchla would show up every once in a while. Ultra Violet [artist Isabelle Collin Dufresne, an associate of Andy Warhol] walked in one day. You know, all sorts of things like that happened. Having previously met Mort and having prior connections to other people I was encountering in New York was important. I had met Stuart Dempster and Pauline Oliveros on the West Coast before I went to New York. Being by that time a good friend of Terry Riley and Jon Hassell – who moved there at the same time – La Monte Young, and Mort was pivotal.

Mort was very generous in opening his studio to me, so I worked a lot in the Bleecker Street studio. And we got to be very close. We were building things and making pieces and so on. The studio and the Circus [for which Mort was founding artistic director] were just a few blocks apart from each other, so it was necessary, for some of the performances, to try out electronic ideas or systems before bringing them into the Circus. And I recall doing that a few times in the studio. They weren't so much for other people's work as for our own, like Mort's, Tony's or mine, and for the things we would do together. We would build and test them out there and then they would end up in a performance at the Electric Circus.

Working at the Electric Circus

And after the first year I lived in New York, I was totally freelance. I got into actually doing studio work doing commercials partly through my band. So I spent some time making a living partly through making music for television commercials and other studio work. I had this sort of wacky fantasy that because you could make a fair amount of money doing that, that you could do it a few days a month and then spend the rest of the time doing your own work. Well, I soon found that that was not the way it worked. To be in that business, you have to be like a doctor on call 24 hours a day; and you say no once or twice and you're out of it. So that didn't work, but I did do that for a while and I scraped by. And then, the Electric Ear [a new music series on Monday nights at the Electric Circus] started to develop, and I worked with Thais Lathem on that and took a role helping produce some of the events.

Eventually, after working at the Circus well over a few months, the Electric Circus opened a job for an artistic coordinator and they gave it to me. So I had a day job, which I kept for a little while, and it helped me pay my rent and do the creative things I was interested in. This was around 1968. I was working with the technology side, the coordinating and the organization of the Electric Circus itself with the artists who were coming in.

At the Circus, I was most closely working with Jerry Brant and Stan Freeman, the two owners. Jerry Brant, had come from the William Morris Agency and Stan Freeman had moved from Toronto, Canada to New York. The story is that Freeman was a producer of a band, I think they were called The Sparrows, from Toronto. He brought them to New York and to the William Morris Agency, where he met Jerry Brant. I think the band changed their name to Steppenwolf, and the rest is history. And then the two of them got together, and they had the idea of opening up a discotheque that would not serve alcohol, and they got a grant from the American Coffee Foundation – the number $350,000 sticks in my mind – to open this place, and they did. And then of course it took off. I wasn't there at that opening concert, but and I heard that Bobby Kennedy came to the opening.

In my production role at the Circus, performers would come in and we would figure out how they could use it. I wrote a User's Manual. A guide was needed because it was a kind of facility that didn't exist anywhere else. And people were encouraged to compose for the facility, to use this, for that time, massive projection and light capabilities, and do something interesting. We had, in addition to Stan and Jerry, another guy on staff named Robert Traynor. He was a manager, and I worked with him closely. He would book the bands, and sometimes I would participate in their selection and auditioning.

One of those bands was Sly and the Family Stone. He was recording in the same studio as I was. I remember when, after moving to New York, I participated in some recording sessions of Terry Riley's subsequent recordings, including *Poppy Nogood and the Phantom Band*, for the record *A Rainbow and Curved Air*. I'm not included on the record, but I played viola as part of the sessions. I also played drums on another record with Terry Riley and John Cale produced there called *The Church of Anthrax*. I remember being in the recording studios working with Terry on *Poppy Nogood and the Phantom Band*, and the session producer said, "come across the hall to this other studio and meet this guy, this new guy we're speculatively working with." And his name was Sly Stone. So we listened to some of what Sly was doing. He was friendly. We watched some of his session, and then eventually he came to play regularly at the Circus, and I was part of bringing him in there.

Tony Martin and Donald Buchla's roles in the Electric Circus

Tony had a great deal to do with the development of the whole visual environment of the Electric Circus. Tony had really developed much of that back in San Francisco at the Fillmore West [and the San Francisco Tape Music Center]. Tony Martin really invented an awful lot of what psychedelic slideshows were based on. And he's really kind of an unsung hero in that line of light art, time-based light art, what he used to call it. Tony brought a tremendous amount of that from San Francisco to New York when the whole thing happened. There was a staff at the Circus that included at last two photographers that I remember who were constantly taking pictures and building a big slide library. They would draw from that slide library to build slideshows. And they were making films and doing abstract things and experimental things you could do with overhead projectors. Of course the oil-and-water-watch-glass things [techniques core to 1960s rock concert light shows] that were there. The on-site production scene was wild. It was really amazing. I think there were like 64 slide projectors, and my numbers might be a little off, but something like that, and 16 film projectors and a whole bunch of overheads and things like that.

Additionally, Don Buchla was commissioned to make a sophisticated multimedia control system for the Circus, in addition to the Buchla 100 system already in use at the Circus. What distinguished it was its elaborate, amazingly flexible programmable system that would run the whole collection of projectors and a lot of the lights that were in the Electric Circus. He created this big console. It had big buttons on it that you could use to turn on and off all the projectors, fade them in an out, and program them. You could record a show, the control signals for a show. He used tape cartridges that had three tracks. Two tracks were for music – you could put stereo audio on it – the third track was for control signals that would run all the

lights and projectors. You could play it like an instrument or you could compose pre-programmed shows. So, you know, you could actually compose for the room as if it were an instrument. When I first got there, that system was not in place, and it was all done by hand, except for the Buchla 100 System already there.

A second control system that Don made was to be installed in the Toronto Electric Circus. Some of us, including me, went up there and had meetings to help with the idea of developing it. But I never really saw it in operation. When I eventually moved to Toronto in 1970, it was gone by then. It didn't really last that long. I think something happened that led to the sort of demise of the Circus or the financial disillusion of it in some way, the details of which I don't really know.

Electric Ear, Monday Nights of New Music at the Electric Circus

While the redesign of the Circus predated my arrival in New York, one thing led to another, and Ted Coons [Professor of Psychology at New York University] had become involved. In addition to being a brilliant scientist and perceptive musician, he is a "professional catalyst." He's constantly putting interesting people together to see what will happen. And he was doing it at that time, and he had a lot to do with fueling the connections that began to develop then. He somehow had met Thais Latham and then this all got brought together. And I was close to Mort and Tony at that time, and so I got into that situation as well [Mort had helped initiate the ideas that led to the Electric Ear].

There had been one or two events before I got there. My role was basically the on-the-scene producer and, you know, technical liaison with the artists. I think that the one who actually recruited the artists was Thais Lathem. She had some ideas to start with, but I know that Mort gave her a lot of [programmatic] ideas. I gave her ideas about people to include on the series. It very quickly became a kind of a collective with Thais [playing the] leading role in terms of the entrepreneurial part. I did some of my own shows there as part of that series too. Eventually we had a little touring group that included Tony Martin and I and some of the members of my band. Mort did a little bit with that. We did some shows out of town, most noticeably a series of events at the Wadsworth Athenaeum in Hartford [Connecticut]. And so things grew in this way.

Some of the programming had political connections. I remember one famous event where we had brought the Once Group [from Ann Arbor, Michigan], and they were doing a piece of Robert Ashley's called *The Trial of Anne Opie Wehrer and Unknown Accomplices for Crimes Against Humanity*, which was a talking piece with Anne Wehrer, filmmaker George Manupelli, and others. Anne had been in Andy Warhol films and was married to Joe Wehrer, at the time a famous architect at the University of Michigan. I recall five people on stage. I believe they were Mary Ashley, Cynthia Liddell, George Manupelli, and Joe Wehrer, Anne in the middle, flanked by two others on each side. They were all talking with Anne, who was a virtuoso talker. Talk, talk, talk, she's a brilliant, amazing person. And Bob would be in the booth. I was with him at that time doing the sound in interaction with this conversation on stage. It's a legendary piece, a great piece. But Thais had gotten involved in New York City politics, and Norman Mailer was running for mayor. And so Norman was brought in with his entourage prior to Bob's performance to make a sort of campaign appearance. And it didn't work out too well. Bob was not too pleased, as I recall. It detracted from his performance. Mailer took up a lot of space, and so it was pretty wild.

Another one of the shows we presented at the Circus was Sal Martirano's *L's. G. A.* (1968). It is a multi-film projection piece with electronic music and a single performer, a poet named Michael Holloway. [Note: this was a work, dated 1967-1968, for gas-masked politico, helium bomb, three 16mm movie projectors, 2-channel tape recorder and films by Ronald Nameth.] The electronic music, on tape had been produced in the studio at Illinois, I think. And the poet is reading an amazing restructured speech, a deconstruction or a transformation of Abraham Lincoln's Gettysburg Address. And the speaker does this choreography. In the score there is choreography that's all based on calisthenics, and he wears a white suit and a gas mask, and there is a second performer who sits on the side of the stage with a tank of helium

and every once in a while according to cues he turns on the helium and modulates the voice of Michael Holloway. It's a really powerful piece. People thought of it as an anti-war piece, and I think it would be very easy to see that right in the middle of the Vietnam era. It has very strong political over tones.

"… if Plymouth Rock had Landed on the Pilgrims" and work with Terry Riley, La Monte Young and others

This was a year or so before Woodstock, so it was a very vibrant electric scene. Meanwhile, I kept playing my other instruments and doing a lot of composing and writing for a lot of people, developing that way. I was doing quite a bit of my own music at The Circus. One thing that comes to mind was my piece from 1969 – I'm thinking of it because it's now being revived – *How Much better if Plymouth Rock had Landed on the Pilgrims* (1969-1971). And it was a very long – it could be played for days – work formulated as a structured auditory tradition, which I called a composition. I developed it for myself to play. Members of the band and other musicians worked on it with me for a number of years. The work developed as a whole, sort of what I'll call pre-Minimalist, but still, you know, somewhat post-Fluxus/pre-Minimalist piece. So I'll call it conceptual stuff. It was a piece that ended up with about a dozen sections that involved a lot of my invented electronic work, some very conceptual things, some pieces that blended cyclical styles with pre-heavy metal styles and some very meditative styles.

I developed a lot of this work around the time I was at the Electric Circus, and I played a bunch of it there. Some of it was multimedia in nature; this was just prior to when I became involved with biofeedback sensors. And then I was writing for people, not just people in New York, but other groups, too. I had a chance to send people pieces, too, and I was playing a lot with Terry Riley and with La Monte Young – Terry eventually moved back to California, but La Monte stayed in New York. I also played with Jon Hassell and various others. And I worked a lot in the studio with Mort.

Return to Champaign-Urbana

The next year I went back to Illinois for the summer of 1969. There was another round of funding from the Rockefeller Foundation to centers for new music, and Illinois got one of those grants. This was the time of the visionary funder, Howard Klein. Sal was directing the program at University of Illinois, maybe along with a couple of other people. I got hired to work in a summer program and it was a summer of continued experimentation. By then, we had already presented Sal at the Circus with *L's. G. A.* I spent a lot of time that summer working with Sal developing circuitry. He was studying electronic circuitry and digital logic, and I had built an instrument that was subsequently to become the basis of a little company [Neurona] I had for a short while. It was a very weird kind of thing based on chaotic voltage control frequency dividers. One of the ways that Sal learned about circuitry was by building a copy of my instrument. Then, we started developing homemade digital circuitry to control it. We built in combinatorial ideas that are a derivative of set theory, digital logic, to control pitch and other musical parameters.

Then Sal and I made a piece together. We called it *B.C.-A.D.* (1969-95). We performed it in a famous concert – at least it was then – that we did simultaneously with the 1969 moon landing. We had video monitors all around the hall showing Walter Cronkite announcing the moon landing, and we did pieces that either had something to do with the moon or some other new things we had developed. One of them was a new multimedia piece I wrote, called *She Loves Me, She Loves Me Not*, ….. (1968). Bill Wegman, the artist who was famous for the Weimaraner pieces, filled the hall with bizarre sort of "happening-like" events and things that the audience would encounter. He strung very fine, almost invisible threads all through the performance space, and the audience would get trapped in them like they had walked into a spider web. They would find things under their seats. It was a great event.

After that summer, Sal went on to continue developments that led towards the SalMar Construction and I went back to New York. This time I did not return to The Circus, although I did continue with the Electric Ear series, but I

didn't return to my former job. Instead, a friend named Bill Rouner and I decided we would open up an electronics company, Neurona Company, sort of a flirtation with artists' business concepts that people were playing with at that time. We built these instruments based on my bizarre designs for circuitry that go back to the roots of analog computing and some other ideas. There's an article that talks about that instrument that is online on my website. Joel Chadabe bought one. We built some things that were used by the Electric Circus tour group, and we built a synthesizer, although I quickly learned that I am [*sic*] not cut out to be a businessman. We ended up squeaking by, making a living by doing a lot of custom electronics – like building custom things that were needed for a museum show by an artist.

Biofeedback

My work with biofeedback happened the year I returned from my summer in Illinois, the year spent with the Neurona Company. During that same year, Ted Coons – we have been close friends ever since – was very instrumental in introducing me to influential people in the science world, particularly in brain science. He said that I had to go out and meet Les Fehmi, who was then at the State University of New York at Stony Brook. Fehmi had a highly developed brainwave feedback research setup. I spent a lot of time with Les Fehmi. I learned what he was doing. I was a subject for a lot of his experiments. And I got completely into it. I of course had known about early experiments that people like Alvin Lucier and Richard Teitelbaum had done. But my interests went in a different direction.

As I did more research, I found much earlier antecedents. There was a neurophysiologist named E.D. Adrian who had done experiments amplifying or translating alpha waves into audio, way back, decades ago, in 1934. Adrian and B. H. C. Matthews published a paper about experiencing the translation of human electroencephalogram into audio signals, and he tried to correlate the changes in the sound with a subjective impression of hearing the alpha come and go and the activity of looking or not looking with his eyes.

I ended up getting very deeply involved in the brain and biofeedback and this eventually led to spending a little bit of time at NYU doing some research and then building a lab at York in Toronto, where I continued to do quite a lot of work through most of the 1970s. I've written two books on the subject, *Biofeedback and the Arts* (Rosenboom 1976) and *Extended Musical Interface With The Human Nervous System* (Rosenboom 1990).

My interests brought me back to my thinking about correlating things regarding the perception of musical form with brain activity. In a way it was an almost neuro-physiological parallel that eventually developed with my other really close friend's theoretical work, and that was Jim Tenney. I was doing work with the brain that was almost paralleling his development of a theoretical framework with which to look at music. He and I had years and years of dialogue about that until he died [in 2006].

Afterward: Toronto and CalArts

After first moving to Toronto, Canada in 1970 and starting in my new position at York University, I visited CalArts. I was invited as a guest artist by Mort Subotnick right at the opening of the school. I came out and did several guest artists gigs between then and through the 1970s. But I went to Toronto in 1970. I didn't ever look for the job at York University, but I was just called by the founding department chair, Sterling Beckwith, and invited to be a part of a group of four people to start a music department. It was good timing because my work had gotten very experimental and I was involved with the brainwaves. And I thought, "Well, you know, maybe having an institution job like this would give me the base I needed to do my work and not have to worry about paying the rent from it." That led me into my subsequent life at these institutions. A couple of years later, I took a year off and went back to New York, but I basically spent the 1970s in Toronto. Then I went to Mills College. I spent the 1980s at Mills, and then came to CalArts in 1990.

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Moving Beyond Academia Through Open Source Solutions: Introducing L^{2}Ork, Virginia Tech's Linux Laptop Orchestra

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In recent years we have seen a growing number of laptop orchestra ensembles emerging across the world**.** In part due to the inherent cost and technological complexity, these incredibly diverse and innovative vehicles for artistic expression have been limited largely to the community in higher education. Founded in 2009, L^{2}Ork, Virginia Tech's Linux Laptop Orchestra builds upon the foundations established by Princeton University's Princeton Laptop Orchestra (PLOrk) and Stanford University's Stanford Laptop Orchestra (SLOrk), seeking maximum compatibility with existing ensembles while providing a predominantly gesture-driven alternative performance practice and integrated turnkey system with minimal cost overhead. L^{2}Ork utilizes MSI Wind notebooks in conjunction with Nintendo Wii Remote controllers, under-$250 hemispherical speaker systems, Linux operating system, and a custom Pure-Data real-time graphical programming environment. The aforementioned focus on an affordable turnkey solution has proven critical in spawning partnerships with K-12 initiatives, including most recently the design and development of a satellite 6-seat laptop orchestra for the Boys & Girls Club of Western Virginia. Targeting 5th graders, the project's goal was to encourage learning by cross-pollinating music with the Science, Technology, Engineering, and Mathematics (STEM) initiative through creative technologies. In this paper we would like to share milestones that have made the K-12 initiatives possible. By exposing features of L^{2}Ork's prototyping toolkit, supporting software, and growing documentation, our goal is to offer insights into the technical and creative foundations of our existing infrastructure. By doing so, we hope to encourage further collaboration with the computer music community and also extend an open invitation for contributions in the form of new works and software/hardware development.

Introduction

The laptop orchestra as a standardized ensemble is a relatively recent phenomenon. Starting with PLOrk (Trueman et. al., 2006) in 2005, they have garnered an unprecedented amount of interest, particularly in academic institutions. In 2010 alone five new laptop orchestras have been added, according to the International Association of Laptop Orchestras (IALO) ("IALO," 2011).

Driven by an exciting and innovative array of technology-driven opportunities, laptop orchestras fuse the traditional orchestra genre with the age of computing, energizing physical presence, performance practice, and perhaps most importantly placing human-to-human interaction at the very epicenter of the computer music genre. The fact that today one can easily wirelessly network an entire ensemble of computers in innovative and intuitive ways, affording its participants attainment of a heightened awareness of the overall group's activity on both the micro and macro-level, is just one of many new possibilities that begs further exploration. Similarly, the network framework can be utilized to cross-pollinate participants' (re)actions, often with unpredictable aural and structural results. Offering an entirely new set of research vectors that often elide with other disciplines, it comes as no surprise that the laptop orchestra genre has attracted so much attention.

Introducing L^{2}Ork

The very first mention of the Linux Laptop Orchestra or L^{2}Ork (pronounced as "l2ork") (Bukvic et. al., 2010; "Virginia Tech Department of Music L2Ork - Linux Laptop Orchestra," 2011) was in the fall of 2008 in a form of a white paper proposal to a select group of potential stakeholders**.** Its purpose was seeking adequate financial support for the fabrication and development of its infrastructure. Following a six-month campaign during which

the project attracted over a dozen initiatives across the Virginia Tech campus, secured grants as well as several corporate sponsors, L^{2}Ork was officially founded in May 2009.

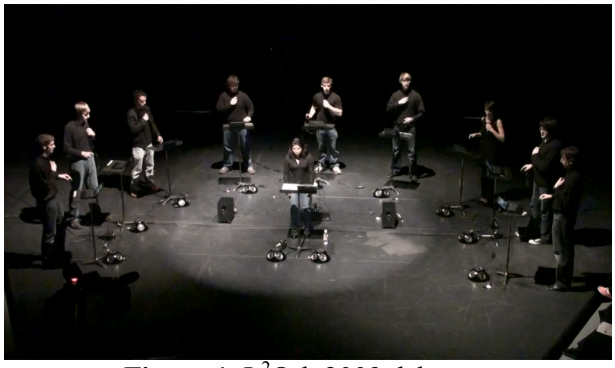

Figure 1. L^{2}Ork 2009 debut.

The L^{2}Ork Angle

While its very name reveals a fundamentally different platform than its precursors, its core philosophy is relatively similar to that of PLOrk (Trueman et. al., 2006) and consequently SLOrk (Wang et. al., 2009). More so, L^{2}Ork seeks to encourage maximum conceivable compatibility with other orchestras by supporting a near-identical array of DSP-oriented software packages, with the use of Pure-Data (Pd) (Puckette, 1996) instead of Max (Puckette et. al., 1990) being only notable exception.

One of the few original goals of a practical nature that continues to resonate with L^{2}Ork's current mission is producing an affordable infrastructure without sacrificing its overall quality. With the anticipated cost of $750 per station, L^{2}Ork's setup includes everything necessary for an out-of-the-box experience: a MSI Wind U100 ("MSI Notebook Official Website," 2011) notebook, a UA-1G Roland soundcard ("Roland U.S. - UA-1G: USB Audio Interface," 2011), a Nintendo Wii Remote (a.k.a. Wiimote) with Nunchuk and Wiimote Plus extensions ("Controllers at Nintendo :: Wii :: Console," 2011), a custom hemispherical speaker, supporting cables and accessories, a headset, and a carrying bag. This cost also includes partial amortization of a subwoofer that can be shared among up to five stations, as well as a wired network switch shared by the entire ensemble.

To circumvent some of the rougher edges associated with optimizing Linux for audio work, L^{2}Ork has been conceived as a "turnkey" solution, offering a full hard drive image download with a completely preconfigured system**.** This approach also posits that the computers are treated more as a traditional instrument where their sole purpose is that of making music. Consequently, L^{2}Ork participants are provided with custom prebuilt machines instead of using their own laptops.

Ironically, a number of seemingly insignificant practical choices, including some of the ones mentioned above, have over time evolved to take on a much more important role, shaping the very aesthetics of the ensemble.

Practical vs. Aesthetic

The choice of a seemingly underpowered Intel Atom processor notebook (a.k.a. netbook), apart from the obvious cost-savings and a lower maintenance overhead (due to use of homogenous software and hardware environment), has resulted in a series of unexpected, yet profound changes to the ensemble's aesthetics, including:

Focusing on distributed computation for the purpose of producing complex textures, thus essentially compelling composers to factor this aspect into the very core of their creative process.

Shifting towards simpler DSP algorithms whose complexity is achieved through human control and human-to-human interaction.

Positioning each notebook onto a traditional music stand with spare room for controllers and accessories (see Figure 1).

Similarly, considering the notebooks lacked embedded accelerometers and were thus unable to fully emulate a PLOrk setup, we opted for complementing the notebooks with Nintendo Wiimotes and supporting accessories as standard issue for each station. We believe this choice of rugged hardware designed to withstand considerable physical stress has resulted in greater gestural freedom and control, and has in

turn resulted in greater on-stage presence and choreography.

In part due to braving a steep learning curve both technologically and aesthetically, the ensemble's early works have focused on timbral homogeneity, refashioning the orchestra as an electronic alternative to a traditional ensemble – e.g. a string orchestra. It has also relied predominantly upon soloists (vocalists, narrators, percussionists), which has allowed the ensemble to shift focus towards developing physical practice and presence. Unavoidably, the ensuing aesthetics quickly gravitated towards an emphasis on physical presence, full body gesture, and motion. It has also planted seeds towards exploration of coupling Martial Arts, choreography, and musical performance.

Some choices, while remaining primarily in the practical domain, have spawned secondary creative opportunities that may yet play a role in the shaping of the laptop orchestra's aesthetics. For instance, the ensemble moved to a wired network switch setup as we discovered that wireless solutions resulted in unpredictable amounts of latency, thus making them inadequate for time-critical musical cues. In turn, the newfound high-bandwidth setup has afforded us opportunities for streaming audio between the laptop stations while retaining the advantages of low latency signal transmission, which is one of the many exciting research vectors we look forward to pursuing in the near future.

pd-l2ork

In addition to ongoing hardware improvements, as of fall 2010, the L^{2}Ork team has put considerable effort into overhauling Pd to streamline user interface and supporting libraries. Due to significant changes to the Pd code base, and in part based on the feedback from the Pd community**,** L^{2}Ork has introduced and maintains its own iteration of Pd (pd-l2ork ("Virginia Tech Department of Music L2Ork - Linux Laptop Orchestra," 2011), offering numerous bug fixes, documentation and packaging improvements, new features that improve overall user experiences, and enhancements which streamline the building of a performance user interface. This exercise, which is perhaps not the most creative endeavor considering the availability of mature commercial alternatives such as Max (Puckette et. al., 1990), has surprisingly proven an invaluable complement to the research and educational potential of the project. Since its inception**,** the L^{2}Ork initiative has funded more than a dozen undergraduate student researchers, some of whom have maintained funding throughout the entire project and have made critical contributions to the Pd code base.

Figure 2. 5th graders from the Boys & Girls Club learning to control a laptop-based instrument.

L^{2}Ork in K12 EDucation

One of the unique opportunities of a laptop orchestra is that it offers a "level" playing field, allowing one to engage in real-time collaborative performance regardless of educational background. By contrast, the experience of collaborative real-time music making has been previously restricted to those participating in a traditional musical ensemble. This level playing field naturally offers great opportunities for linking higher-education programs with K-12 education**,** particularly in the wake of ongoing budget cuts and reforms that have all but decimated the Arts education (Brouillette, 2011). The ongoing struggle to reintegrate Arts with Science, Technology, Engineering, and Math (STEM) (Wallace et. al., 2010), coupled by the Commonwealth of Virginia's latest focus on strengthening K-12 education, has afforded us a unique angle in which a laptop orchestra would serve as a catalyst for linking STEM with the Arts. The laptop orchestra could provide a curricular

enrichment in the Arts domain while maintaining a tangible link with STEM, effectively addressing all four core areas in various capacities.

Figure 3. 5th graders from the Boys & Girls Club engage in fabrication of "ladybug" speakers.

Boys & Girls Club Pilot

L2Ork's official debut in the fall of 2009 was greeted with prevailing enthusiasm among student performers and audiences alike. After receiving unsolicited regional media coverage, an opportunity arose to explore potential collaborations with the Boys & Girls Club of Roanoke, VA. Funded by external grants secured through the Boys & Girls Club from 21st Century Federal Learning Grant and the Bank of America, the ensuing semester-long initiative took place in the spring of 2010. The funds were used to purchase infrastructure for a 6-seat satellite laptop orchestra (5 + 1 backup) as well as support for three students to fabricate the custom hardware. The grant also provided further support for weekly rehearsals with students in Roanoke which took place twice a week for an hour as an after school program for 10 inner city 5th graders**.** The program's ultimate goal was to stage a joint performance as part of the spring Digital Interactive Sound & Intermedia Studio (DISIS) ("Virginia Tech Department of Music DISIS - Digital Interactive Sound and Intermedia Studio," 2011) event at Virginia Tech.

We relied upon the experience obtained while fabricating the original 16 hemispherical speakers and applied it towards building improved iterations specifically for the Boys & Girls Club. The resulting speakers were colored red and dubbed "ladybugs." As part of the learning process, a visit to the Virginia Tech DISIS facility was organized to allow the participating 5th graders to engage in the fabrication of the "ladybug" speakers (Figure 3).

Spring 2010 Debut

Throughout the semester, we produced a series of exercises and adapted some of the existing works to Boys & Girls Club students' skill level. Their feedback has helped us identify optimal approaches that would build upon their familiarity with the Wiimote controller (attained through playing Wii video games) and cross-pollinate it with the uniquely collaborative nature of ensemble performance. The spring event featured two performances adapted for the satellite orchestra. First was a 5-part adaptation of a work originally written for L2Ork and solo soprano titled *Citadel*. This adaptation simplified some of the control mechanisms in order to achieve a balance between a stress-free co-performance with L2Ork and a level of challenge that retains the students' interest and attention. The second work was an adaptation of *Everybody Needs Somebody to Love* (1964) by Bert Berns, Solomon Burke, and Jerry Wexler for a 5-member Boys & Girls Club satellite laptop orchestra, saxophone, and percussion. The solo instruments were added as a last-minute improvisatory layer on top of the laptop orchestra part. Both works were performed as part of a special early evening program for children and parents which was repeated an hour later at a DISIS event. Proceeds from these events were donated to the Boys & Girls Club.

In *Everybody Needs Somebody to Love*, the 5th graders' parts consisted of both the theatric introduction and the actual performance. First, each performer was asked to sing any note of their choosing into the headset in front of the audience. After capturing the note, their voice was automatically pitch-shifted and adjusted to match a predetermined frequency. After all the performers generated their instruments on the spot, the performance began in which the students, led by a conductor**,** generated notes by shaking a Wiimote while pressing appropriate directional buttons on Wiimote's D-pad. The buttons in turn corresponded to a particular predetermined pitch. The ensuing texture was a

simplified version of *"Everybody Needs Somebody to Love's"* harmonic accompaniment.

Conclusion

Although no formal study has been conducted, the children participating in the pilot program have shown consistently high levels of engagement, with virtually no disciplinary issues. Likewise, feedback provided by a diverse audience attending the debut was overwhelmingly positive.

As we look forward to the Spring 2011 Project, whose scope will be in many ways similar to the one conducted the previous year, we are enthused by the support and encouragement we received both from the University and external sources. As the initiative matures, we are also hopeful that we will be able to quantify our contribution towards enhancing Arts education in K-12 settings. Another aspect we are keen on exploring within the K-12 context is a recent introduction of tai chi Martial Art into L^2Ork's performance practice and its potential benefits in improving focus and attention in a classroom setting.

As is the case with large-scale projects, many challenges remain. Some purely practical issues will simply require time (e.g. improving software infrastructure to the point where students can write their own pieces), while others, such as issues that are more philosophical in nature, offer a fertile ground for innovative research opportunities. For instance, while a networked laptop orchestra may allow for adaptive scaling of difficulty in order to engage individuals at various skill levels, such an adjustment may also fall short of expressing musicianship. This may lead to oversimplified gaming experiences akin to that of the early generations of Guitar Hero ("Guitar Hero," 2011). One might argue, however, that an adjustable difficulty may be better in terms of retaining an individual's interest by avoiding the pitfalls of an overwhelming learning curve, which can lead to disinterest. Consequently, adaptive difficulty can be seen both as an opportunity and a challenge that begs for further examination.

Call for Collaborators & Contributors

We would like to hereby extend an invitation to our fellow institutions to consider joining us in spawning similar initiatives across the United States and beyond. We are also openly seeking collaborators who will help us further improve upon our core infrastructure through collaboration and exchange.

Resources

L^2Ork's resources, including instructions on how to fabricate "sub-$250" hemispherical speakers, an enhanced distribution of Pd (a.k.a. pd-l2ork), as well as support mailing lists, are all available on the L^2Ork website ("Virginia Tech Department of Music L^2Ork - Linux Laptop Orchestra," 2011; "Virginia Tech Department of Music L2Ork » Software - Linux Laptop Orchestra," 2011).

Acknowledgements

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Events

SEAMUS National Conference 2011

Review by Charles Norman Mason (Part I)
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Late January is a beautiful time of year in Miami and I believe all the SEAMUS conference participants appreciated being able to spend some time at the University of Miami's Frost School of Music listening to electro-acoustic music, and eating and drinking with friends at the Ratskeller (I am sorry to say, the Ratskeller has since been torn down. It will rise again in a new guise in the new student center that is under construction).

The honored composer was Laurie Anderson. She and Lou Reed created quite a buzz and made an appearance at the celebration dinner. Having seen them perform at the Angel Orensanz Foundation in New York a few years ago, I was disappointed that my students were unable to experience a live performance, but given the logistics and cost of transporting all of the equipment required for such a performance, one can understand that it was not possible. However, her speech and repartee with Max Mathews were worth the price of the banquet ticket, which is not at all to criticize the Rusty Pelican. Unfortunately, we missed a performance that would have gone "viral." I don't know the details of the planned performance, but I do know that she ended up having to purchase some concoction to dissolve glue because, instead of gluing a piezo microphone to her tongue, she accidentally glued her tongue to the roof of her mouth. Encore!

There is a downside to living in Miami and that is the traffic. I knew that I would not be able to get to the opening concert before it started so I enlisted the help of Peter Leonard to review that concert as well as Concert 12. He also reviewed Concert 3 since my own composition was performed on that concert. I apologize to those composers who were presented in the Genelec Listening Rooms. I had intended on reviewing all of those works as well as the ones presented in concert, but I am afraid it was a larger task just to review the concerts than I had anticipated.

I also send out my apologies to any composer whose work I may have missed. There were some program changes made at the last minute. Neither Peter nor I realized we did not have sufficient information until well after the conference concluded. I assure you if you were left out of this review, it does not mean that we did not appreciate your piece. My approach to writing these reviews was to assume that each one of you had good reasons for doing what you did and it was my job to figure out what those reasons were. I probably misunderstood a lot, but for what it is worth these were my impressions.

Kudos to Colby Leider, Kristine Burns, and the Frost School of Music for an exceptionally well-run conference featuring multiple listening spaces with multiple speaker configurations, all outfitted with wonderful sounding Genelec loudspeakers. The technical crew and the organization of the conference were outstanding. Having put one of these things together myself in 1996, I was impressed with how well the conference unfolded and how calm Colby and Kristine remained throughout the ordeal. I also want to point out that every one of the performances was outstanding! This conference set the bar pretty high in that regard. Many of the performers travelled from out of state, and represented some of the very best in new music performance.

Before reviewing each piece, I would like to take a moment to discuss problems I observed when composers did not seemingly think through when considering multi-speaker configurations for their works. It has become a tradition at SEAMUS conferences (in fact, ever since the 1996 conference in Birmingham, Alabama) that multi-speaker configurations are provided to all of the composers. Many of the composers attempted to use the multi-speaker

configuration but very few did it well. I think that too often composers used it in an attempt to immerse the audience in a sea of sound and were perhaps not realizing that unless a listener is sitting in a very small sweet spot in the middle of the concert hall, the person will only hear what is coming out of the nearest speaker. It is a different case if the music has high frequency, dry, sounds that constantly move from channel to channel (or is diffused). Invariably, however, I heard composers place the entire sound file in all speakers at once. I also found it unusual that so many composers used the surround speakers when they had performers on stage where amplification was only utilized as sound reinforcement. While this is a slightly different issue, I have to ask why, if there is a performer on stage, would one want to hear the sound of that performer coming out the rear loudspeakers?

Concert 1

Most of the works presented in Concert 1 are discussed in Peter Leonard's review. However, there were some omissions because changes were made in the concert order and Peter's notes didn't match up to the works as listed in the program. I was able to attend the last segment of the concert and thus have attempted, using somewhat of a faulty memory, to reconstruct what I recall of one of those works. For the first six works see Peter's review.

Vivid Shadows by Timothy Harenda was wonderfully performed on alto flute by Emily VanDette. The sounds in this work were derived from flute samples of long duration intertwined and rang off the acoustic instrument's tones. I think the lead up to the climactic point could use some work, but the material that occurred at that point and after was quite beautiful.

Concert 2

Held in the Maurice Gusman Concert Hall, Concert 2 was a pre-lunch concert and thus had fewer pieces programmed than most of the other concerts.

Theo Lipfert's *Beneath the Surface* for video and interactive electronics began the concert. The sounds and the video resulted from a rather interesting process. The composer placed a Flip Video camera (made by Cisco) in an underwater housing and then threw it into the surf. The resulting music was a combination of the sounds of the water hitting the camera housing and a text read by a teenager recounting her dreams. However, it was not so much narrative in character as one might be led to believe because the recording was cut into sentence fragments and rearranged.

Deluge for computer playback by Halim Beere was a dynamic work that was also "pleasing" to listen to, which can be attributed to the careful attention given to detail and space, both temporally and acoustically.

The Piper's Son for piano and interactive electronics by Tom Lopez featured a fantastic performance by pianist Tom Rosenkranz from Bowling Green State University. I thought the piece was nicely composed, but then, much to my surprise, according to the program notes, I found out that it was actually created in collaboration between Lopez and Rosenkranz in such a way that allowed each "opportunities for improvisation and impromptu musical dialogue." This particular performance of the work was very sensitive and effective.

Apricot for computer playback by Christopher Cook was a highly complex arrangement of sophisticated alterations of samples, many of which were derived from using various types of materials to produce sound on a thumb piano. Speech was also included in the arrangement. Sound diffusion was minimal, but more attention to diffusion would have been welcome. The abrupt ending of the piece did not quite work for me, but others may have found it to be an effective surprise ending.

Christopher Cook's *The Blue Marble* presented a nice contrast to the other works by offering soft pillows of sound and a repetitive melodic figure straight out of Schenkerian theory, but with enough changes to reward the careful listener. Very low frequencies ended the work and I found my inner ear adding an upper melodic line matching what had been heard throughout the work. I was left wondering if someone who had not heard the entire piece would have heard the same pitches at the end.

The final piece of the concert, *The Frist Thing…* was performed and created by the PDMD ensemble featuring Nestor Prieto, Fred De Sena, Larry Moore, and Brian Del Toro. The

text for the piece was derived from a sequential presentation of lines of text that were provided by each player. Each member was aware of what texts the others were providing. The ensemble first read the text in its entirety and then manipulated their own lines of text, creating movements that overlapped, resulting in a dynamic work for electro-acoustic ensemble.

Concert 3
Please see Part II (Peter Leonard)

Concert 4
This evening concert had some of the best pieces of the conference. Particularly striking was Elainie Lillios' *Nostalgic Vision* performed by the phenomenal pianist Thomas Rosenkranz (who gave an impressive performance in Concert 2). The piece was a beautiful and effective combination of romantic gestures and sound based materials. Lillios created some amazingly beautiful sounds. Especially striking was how well her choices of timbre mixed with the piano.

Another piece in the concert that used piano was Sever Tipei's *HB with G&E*. It was clear that the letters HB stood for both Herbert Brün and for B-Bb. The piano part consisted of extended tertian harmonies morphing into clusters that would give way to sustained consonant chords ringing from strings that had their dampers raised. Quite interesting was the conflict between the tuning of the tape (multiples of 10.6) in contrast with the equal tempered tuning of the piano.

A work that stood out was Adrian Moore's *Sustain*. What was especially compelling about this piece was Moore's use of diffusion in the hall. *Sustain* was unique in that it had clarity without being simplistic. Careful attention to each sound was in evidence as was the transitions from one sound to another. "Sustain" was apparent in both the envelope of the sounds and in the artificial space that was created by the diffusion of the piece in the hall.

Some levity on the concert came from a really good performance by Butch Rovan and Lucky Leone in their highly entertaining work *Slim Jim Choker*. It featured a duet, reminiscent of Penn & Teller, between a person speaking from a lectern and a typist typing on a custom-built typewriter. The typewriter triggered various sounds including piano-type sounds, synthesizer pads, drones, record-scratching sounds, and "opening/closing–filtered" sounds.

Following this was *Oscillations* for handbells and computer playback with the student composer, Evan Boegehold, as performer. It consisted of pastel colors and hints of Arlen's *Somewhere Over the Rainbow*. An audience favorite was *Welcome to Medicare!* by Mark Wingate. It effectively evoked the nightmare world of the automated answering service one finds in the world of healthcare. It was witty, and went on a long time, accurately portraying an unending phone loop. On the other hand, Todd Kitchen's *Wreck, Wrecover* seemed surprisingly too brief (let's face it, a piece that seems too short at a SEAMUS conference is a bit of an anomaly). It used sounds recorded from aluminum cans in a sensitive manner that rewarded the listener who followed each sound to its completion. It was nicely done.

Two video works were also presented. Brian Evans' *arlequi* was all about mapping and decoding. Its sounds, which consisted mainly of sharp colored metallic timbres combined with flute and mallet sounds, were complimentary to the bright, digital synthesized images. As the program notes said, "Relax. Hear the colors. Listen with your eyes." The other video work, by Mark Zaki, was entitled *Absence Presence*. It consisted of various edited and manipulated images of dancers accompanied by sound with very subtle dynamic changes. The result was a quasi-virtual dance piece that created a dream-like atmosphere that could not have been achieved with live dancers on stage.

Meditations by Jeremy Van Buskirk used materials that sounded like recordings of prayer bowls. The piece appropriately did not try to be more than it needed to be and thus produced a sort of purity reminiscent of a meditative atmosphere.

Concert 5
Concert 5 was presented in Cosford Cinema, the UM movie theatre, and consisted of nine pieces, most of which included video. On one hand, it was a great venue for these works. Unfortunately, it began at 11:00 P.M., a time that was painful for this reviewer knowing that

he had to be at the 8:30 A.M. concert the next morning. For those of us who attended, however, the works featured on this concert made sticking it out past midnight rewarding.

Deterministic Chaos by Yemin Oh consisted of events that, despite their high level of organization appeared chaotic; or perhaps the events were chaotic and I put them together in a semblance of order. Many of the images recurred and I suspect that after multiple viewings a structure would be discerned. In stark contrast to the visuals was the economical use of a sonic palette that consisted predominantly of dry, crunchy sounds. *Err Prenne* by Brian Hernandez began with a striking image of a black screen for 30 seconds, followed by a sudden bright image giving the impression of traveling down railroad tracks. What I liked about this work was that it did not limit itself to sounds linked with visuals. There were times where the sounds foreshadowed or were in counterpoint to the visuals such that it went far beyond the typical color organ approach. Joshua Harris' *Grudge*, a two-channel fixed media work, consisted of long, heavily reverberated drones with interest created by a wide frequency range. The program notes refer to using everyday sounds that were slowed down. The sound sources appeared to be instrumental and sung.

A440 by Peter Bussigel is a work that one will either hate, or in the case of this reviewer, love. In a nutshell, it consisted of various images of a trumpet player appearing in many different locations (on a playground, in a subway tunnel, on a street, etc.) playing a long sustained 440 Hz note. Though the program notes somewhat dryly call it a "sound project for performer and documentation," this is a fun piece. After a few moments into the piece, it becomes evident that one is just going to hear a trumpet playing the same pitch, but the timing, the location of the performer, and the subtle timbre changes due to those different environments were not predictable. *Language* by Josh Goldman with video featuring Jennifer Jolley, presented a sound set derived from vocal sounds such as kisses, Donald Duck noises, breaths, slurps, and cheek pops. For the most part the sounds were presented with minimal alteration.

Economy of materials is appealing when it appears at a SEAMUS conference and thus it was rewarding to experience *Linear* by Jerod Sommerfeldt. It began with two horizontal parallel lines that gradually transformed in clarity and color. The visuals were accompanied aurally by sine tones that gradually became more complex waveforms.

Liza Seigido's *St. Vitus's Kyrie* consisted of images from the St. Vitus Cathedral in Prague juxtaposed with sounds from processed voice provided live by Seigido. The result was a meditative yet striking work. *Water Home to Water* by Greg Dixon was a patchwork of sounds derived from water drips with some very effective transitions that created changing sonic spaces. I would have liked to listen to this piece in a hall designed for diffusion but it was still successful, in part because the types of sounds used lent themselves to location aural cues .

Playground had a beautiful video component. The sounds were made from recordings of children being interviewed in their classrooms "talking … about their favorite school activities, subjects they excel at, and what jobs they want to have when they grow up." These samples were altered in a "vocoder-ish" manner, playing on the natural melodic inflections of the children's speech. I found it to be an interesting dichotomy between the digitally synthesized visual element and the sample-based aural component.

Concert 6

The sixth concert, beginning early Friday morning, seemed to have an overarching theme of innocence.

I am bothered by performances that feature someone on stage with no apparent reason for being on stage. Put a composer on stage clicking away on a computer with his or her back to the audience and I am dumbfounded. The composer's gestures have no apparent relationship to the resultant sound, the composer is often not comfortable on stage, and the audience usually cannot even see the computer screen. Is Apple providing sponsorship funds? Is it an attempt to cut down on cable lengths? Or is it simply an attempt to say, "hey, I am not simply playing back a sound file, I am actually doing something to the sound LIVE!" On the

other hand, when live electronics are used on stage and done in such way that there is a purpose for those performers being on stage, it can be a rewarding experience. So it should come to no one's surprise that I enjoyed *HOOLA* by Peter Leonard. Hula hoops! It was more than a gimmick. Not only did the gestures match the sound—there was an actual performance. The hula hoops were modified and fitted with evenly spaced rivets. Peter Leonard and David Hyman performed the piece by moving sticks in circular motions to cause pulses that triggered Max/MSP patches containing stored samples. As a result, there were direct correlations between the speed and the force of the arm motions of the performers and the resultant sound.

I thought of "naïve art" when I heard Fleisher's *Altra Alfresco*. Its primitivism came from the recording source (Tandberg stereo tape recorder), its recording environment (outside without a wind screen), its source materials (unaltered pots, pans, etc.), and its focus on rhythmic patterns. The danger of naïve art arises when the artist is self-consciously setting out to create such art. In this work, however, there was a certain level of innocence that could be felt. From the listener's point of view, there was no sense that the composer was attempting to create profundity through simplicity. Rather, he was an almost innocent bystander, observing what he created as a 17 year-old, asking the listener to not dig too deeply and to remember the joy of creating and recording sounds for the fun of it—something that probably led most of us into electro-acoustic music in the first place.

Nature Morte Alfresco for vibraphone, glockenspiel, crotales, and interactive electronics by Chapman Welch, demonstrated great sensitivity in its interaction of the acoustic and electronic sources. For example, a hit on the glockenspiel would seamlessly be taken up by the computer such that the only way one knew it was the computer was because the pitch would bend at the end. What made the piece especially exciting was the fantastic performance by percussionist Julie Licata.

Crosstalk, by Travis Garrison reminded me of the days when I worked on a Buchla with cords. Sometimes there would be occasions with a short click in it and I would find myself liking the sound better with the added crackling. The double meaning of crosstalk (electrical and conversational) was apparent. Sounds that one normally would try to ignore became the primary material and thus invited the listener to appreciate the beauty of the noise. I believe that Herbert Brün would have loved this piece.

A Short Stop for vibraphone and interactive electronics, by student composer Evan Combs, began with a vibraphone solo consisting of a short intervallic motive that gradually expanded. After about three minutes, the performer (Combs) repeated the opening pitch continuously while the tape entered. Following this was a section containing the opening motive played on the vibraphone while the computer emitted unrelated sounds. The piece ended with the opening motive, but on the second note of the motive.

LSU students Jeff Albert, Nick Hwang, and Corey Knoll performed an improvisation appropriately entitled *3 Computeers-Improvisation*. Albert mostly played the trombone, combining his sound with the altered recording of his performance. Knoll focused on percussive types of instruments, and Hwang reminded me of my son at a classical music concert (head buried in the iPad), which one could argue is an artistic statement in itself. Hwang would do a few things on the iPad (I was unable to discern what sounds were a result of his activity) then glance down, as if he was trying to decide whether or not to pick something up. This was followed by a decision resulting in a particular sound, picking up a percussion instrument, doing something to it, and then setting it back down. One could say the lack of stage presence was a profound statement concerning digital isolation.

This was a really tough concert to organize. The piece from LSU was quite complex to set up; but then to follow it with Roth Michaels and John Alexander's *Substantive Tale* must have been a nightmare for the stage crew as it featured vibes, computers, and monitors in a Punkte improvisation. Yet the crew was amazing and pulled off the complex arrangements without a glitch. Punkte Improvisation, not to be confused with Punkt Ensemble, is a collaborative project between Aylward and Michaels involving interactive and learned electronics (see http://punktemusic.com/). The

result was a performance that exhibited a wonderful musical sensitivity and ensemble awareness. The length was just right or maybe even too short. I wanted to hear more, which is saying a lot considering this was the last piece on the sixth concert of the conference!

Concert 7

Concert 7 was a pre-lunch concert in Gusman Concert Hall. Coincidentally, it had seven pieces programmed.

Natural Language with music by Lawrence Fritts and video by Sue Hettmansperger used the voice of mezzo-soprano Katherine Elerbe as the sound source. The composer employed an algorithm organized through a Markov chain. It was a remarkably beautiful work, where the structure was just under the surface, such that musical repetitions were always surprising and yet reassuring at the same time.

After Life by Orlando Garcia was performed by Paula Mattheson's FIU Laptop Orchestra (FLEA), which consists of Lina Borda, Carlos Dominguez, Paul Kinard, Jonatan Mendieta, Nayla Mehdi, Paul Poston, Nestor Prieto, Edrick Subervi, and Max Tfirn. The piece was an adaptation of a work originally written for cellist Madeleine Shapiro. FLEA's stage presence, presentation, and sonic results were quite impressive, and resulted in one of the better performances of pieces written for laptop orchestra I have heard. In addition to the ensemble performance, the work included a superb video created by Jacek Kolasinski. Director Mattheson avoided visual overload by placing the ensemble in a circle off to one side of the stage and had them dressed all in black. It was a beautiful experience.

Chester Udell was the first prize recipient from last year's SEAMUS Commission award and *Wakdjunkaga: The Trickster* was the commissioned piece. Written for saxophone and interactive electronics, it featured a gradual progression of saxophone sounds converging with coyote vocalizations until somewhat of a merging takes place. The performance, by soprano saxophonist Susan Fancher, was spectacular. The overall effect suffered from poor sound diffusion and the use of exact repetitions of certain sounds, but the piece was engaging nonetheless.

Paul Leary's *Number Stations* was for alto saxophone and computer playback. After an introduction, there was a section that began with a woman speaking numbers, and saxophones playing steady, repetitive rhythms. This was followed by a contrasting B section based on the saxophone motive (but without the repetitive rhythm). The material of the first section returned afterwards. The work concluded with another non-rhythmic section with altered saxophone sounds. It was an effective piece with just the right roughness and mostly foreground sound materials. And perhaps it needed to be played as loudly as it was, but I doubt I would have enjoyed the piece as much if I had not had a pair of earplugs on hand. I was also puzzled over the reason for placing the sound predominantly in the rear speakers.

Man Qua Man by Andrew Grathwohl for violin and interactive electronics was a joy to listen to. It consisted of parallel lines between the violin and the computer, where the violin duplicated the digital sounds with slight delays. My description doesn't do it justice, as many pieces could be described similarly, but this was an example of the composer going beyond the interactive gimmick to produce a sensitive and beautiful work. I did wonder why the composer was on stage with his back to the audience, however, and thought that it could have been due to inadequate cable length.

Mons Montis (A Gentle Rock) by Da Jeong Choi featured Pedro Javier Fernandez on percussion. The performance was somewhat marred by having the loudspeakers in front of the percussionist, resulting in a balance issue at the beginning of the piece. Nevertheless, Fernandez gave a superb performance of a work that featured several motives that were alternated at first and then built to a climax predominantly using the first theme.

The FLEA Ensemble performed the final piece, *Iathyrus* by Paula Matthusen (and which was commissioned by the Berlin Laptop Orchestra). The work featured improvisation, where various paths and endings are possible based on choices made by the ensemble. According to the program notes, "the performers self-organize, interrupting the navigation of the score, until agreeing upon a path." In this performance, the ensemble created a beautiful

work that began with a woodwind type sound that gradually thickened in texture with environmental sounds (voices and automobiles). It was fun to watch as various performers used hand signals to communicate information.

Concert 8

Concert 8 took place in Clarke Recital Hall on Friday afternoon. The program was to begin with *E-Space*, a joint effort by Pengilly and Rhodes. The piece, however, was rescheduled for Concert 14. Instead, *Janaka Blast* for drum kit and interactive electronics by Anthony Cornicello began the concert. It was given a great performance by percussionist Peter Jarvis. The piece was largely based around a 7/8 rhythmic idea with a very nice middle section consisting of a recurring rhythmic idea with repeating lower notes from the computer.

The next work, with music by Alexander Sigman and video by Colin Elliott, was entitled *detritus II.* According to the program notes this was an "after-image of detritus I" and concludes the composer's "Nominal and Noumenal cycles." The program notes further state that the title of the composition was "inscribed onto the spectrogram representations of the surface-materials, such that each character functions as a uniquely shaped band-reject filter." This resulted in sounds that were coarse and "industrial" in nature, and were in turn synchronized to visuals consisting of a number of different images, including sunsets, abstract images, and words (such as "silence only happens when one isn't listening" and "hear silence").

Erik Lund's *rehydrating fossils* made excellent use of spatial texture with careful attention to differing rates of reverberation and motion. The piece utilized sounds of "found objects" beautifully.

As a result of the dry acoustics of Clarke Recital Hall, Neil Flory's *The Trumpeter Dreams of Music* for trumpet, flugelhorn, and computer playback created an intriguing listening experience. The electronic part had a significant amount of reverberation such that it sounded as if it was in a different room than the live instrument. Perhaps that was the composer's intention, but I imagine it would be a completely different experience if the piece had been projected in a livelier room. Two really fine moments in the piece were when a mute was added to the instrument while the computer retained the sounds of the unmuted instrument, and a very long flugelhorn solo played magnificently by Mary Thornton.

Transitions II: JUOBE for computer playback by Andreas Levisianos used sounds derived from cello samples that were processed with filters and granular modulators and intricately layered to create a soft and subtle flow of sound events.

David Roberts' aptly named piece *Concertino for Viola and Electronics* featured an interesting mix between orchestra and electronic sounds. The title not only relates to the antiphonal nature of the concertino form but also to the reference to music of the past. The motive referenced a gesture one would expect to hear with music from the Romantic period and the amount of repetition evoked bygone composers; but the interplay between electronic and acoustic sounds created something new. I am not sure the dramatic ending was earned compositionally speaking, but violist Erin Rafferty gave a magnificent performance. Her string broke near the beginning of the piece forcing her to return later in the concert to perform the entire work. Rewording something I once heard from a certain figurehead at LSU, I turned to my neighbor and said, "that is the problem with ACOUSTIC instruments … something always goes wrong."

Anagoge by Andrew Babcock had engaging sounds that were beautifully built, and were presented in a well-constructed contrapuntal texture; yet the piece exhibited an economical use of materials. My review would have been less kind if I had not had earplugs, as the sound levels were so loud that I imagine most listeners were not able to focus on the beauty of the piece. I was also not entirely convinced by the ending, which concluded in sudden silence—I am not sure it actually worked in the context of the piece… or maybe I have heard that effect used one too many times (see Concert 2 above).

The final piece of the concert was *In the Shadow of Vulcan*, composed and performed by Cort Lippe and David Durant. Anyone who was at the 1996 SEAMUS conference knows where "the shadow of Vulcan" is and to what the name of the duo "The Red Mountain Boys" refers. But

I do not think it matters. The piece consisted of an improvised piano part (Durant) manipulated by an improvised computer part (Lippe). The piece was very convincing, with wonderful contrasts between loud and soft and aggressive and meditative sounds, and beautiful changes along the way. A cell phone was involved as well, but I am not sure if it was on a timer or if Lippe was texting Durant.

Concert 9

Concert 9 was held at 5:00 P.M. in Gusman Concert Hall and featured some fantastic works. *Are You Radioactive, Pal?*, by Eric Chasalow, was in three movements. Movement I had a kind of "funky" rhythm to it with great interaction between the live saxophone part and the digital audio counterpart. The second movement had a beautiful blending of long saxophone sounds and gorgeous sonic material, and at times powerful computer generated sounds. The third movement had an almost humorous but effective combination of computer vocal sounds interweaved with the saxophone. The title comes from one of John Berryman's poems found in the book *Dream Songs*. I did not really connect the poem with the first and third movements, but, and I may be interpreting too much into this, the second movement seemed to be quite profound in the context of knowing the background of Berryman. Regarding the third movement, the only words I could discern were those of the title of the piece (so I don't know if any more of the poem was actually included).

Dennis Miller's *Echoing Spaces* continued to showcase his work, featuring stunning graphics. This piece seemed to have more organic movement than some of his previous works that I have heard. The formal structure was engaging with its constant variations that never seemed to result in exact repetitions, but at the same time did not flood the viewer with unrelated images. It began with a dark screen that slowly became a "fauna" type image, gradually taking on an unreal and seemingly computer generated image without losing its organic nature. The computer-generated sounds were mostly long tones and presented in a multi-layered texture that fit perfectly with the visual elements.

The integration between the tenor saxophone, bassoon, and the computer was superb in Peter Van Zandt Lane's *Triptiek.* There was an ingenious interplay between the acoustic and digital sound sources that at times reminded me a little of Frank Zappa with its tight rhythmic unisons.

In John Gibson's *Blue Traces*, a rising pitch theme with piano tones producing voice-like sonorities with some wonderful surprises along the way, created a captivating work. This opening section gradually gave way to a highly repetitive, looping background rhythm accompanied by quick gestures in the piano that brought the work to a close.

A video of driving through New Mexico was the source of the visuals of *Horizon* by Rodney Washka III and Tlatko Cosic. At times one could see the entire view, but most of the time the viewer was presented with incomplete, smaller square and rectangular windows of the scene which seemed to be dancing in synchrony with the music. The music consisted of marimba-like percussion sounds playing a rhythmic pulse with periodic pad-like drones. *And Death…* for computer playback by Jason Bolte began with a loud, machine-like, rolling and metallic screeching gesture that gradually diminished into a mixture of cymbals, low drones, and sea gulls. The dramatic opening gesture gradually returned but went against expectations—the piece ended before the opening figure completely recurred in its entirety.

Installation by Sarah Porter was actually not an installation but was a piece for computer playback that effectively used samples of a bicycle. According to the program notes, the work was "…inspired by the artistic use of space in the design of an art gallery."

Kyel Maxwell-Doerty performed on the gyil in Robert McClure's *Intergrated Elements No. 3 "Divide by Five"*. The gyil is an instrument from Northern Ghana that consists of 14 wooden bars over gourds stuffed with paper, which produces a buzzing sound. The piece began with random bursts of sounds from the instrument and the computer, which was followed by a more steady rhythmic section that also included a person stating numbers "five, four, one, five, three…"

Strike Zone by Arthur Kreiger was a fantastic piece with virtuosic interplay between the

percussion part, performed magnificently by Peter Jarvis, and the computer playback part.

Concert 10

The third day of the conference began bright and early with *CONFINED-10-01-2* featuring sound by Paul Botelho and video by Russell Chartier. The visuals consisted of New York City scenes altered through various effects. The music, although created through the "use of a granular sampler developed in the ChucK programming language" had a very soft, "analog-ish" timbre. It was presented in a rhythmic repetitive gesture that recalled the opening music of television news programs from the 1980s. If one did not read the program notes, one could easily believe that there was careful collaboration between the video and sound artists. In actuality, however, neither the composer nor the video artist had knowledge of each other's part. Yet I noticed that some planning was involved in the abstract formal considerations, as both the video and the music reversed about halfway through the piece (i.e., video and music were played backwards).

Bicycle idioms were used as both the sound source and as a guide for the formal structure (a circular shape) in Landon Ashby's *Bicycle*. The work was an unassuming piece that sounded more mature than one would expect for a "first serious step into the electronic music world." My first thought when I saw the title, *Moments* was of Moment form in the tradition of Stockhausen. However, Eli Stine created a piece that was actually, in a sense, teleological with very graceful and subtle transitions from one sound to another.

Electro-acoustic music from Champaign-Urbana has a certain sound to it; therefore I was not surprised to read that *Drift* was realized at the University of Illinois Experimental Studios. *Drift*, composed by Ed Martin, exploited wide dynamic and frequency ranges and had a sonic clarity that allowed one to hear vividly the beautiful manner in which the sounds transitioned.

scape II by Robert Seaback was for amplified guitar (performed by Seaback) and computer playback. . The composer found just the right type of computer sounds that, while sounding electronic, mixed well with the acoustic sounds of the guitar. The first half of the piece used silence effectively; in fact, the performance was so tight (even though the entrances were unpredictable) that I was sure it was an interactive piece. On the other hand, Patrick McMinn's *The Middle Place* for trumpet, Yamaha Disklavier piano, and computer playback (running Max/MSP and Ableton Live), *was* an interactive piece. It began with consonant chords in the piano and a long drone triggered by the trumpet. In the beginning of the piece, however, the natural trumpet sound was not heard. Gradually, as the computer-generated piano chords entered and the level of activity increased, the trumpet became audible. As the dynamic level continued to rise, the piece reached a sudden dynamic drop and returned to a, sonic space similar to the opening of the piece, but this time with the trumpet remaining audible.

Beginning with a sigh, *Albtraum*, for computer playback, by Philip Hermans, explored human vocal sounds in an economical manner, effectively depicting a nightmare. The manipulation of the sounds was sophisticated, but I was disappointed in the lack of spatial placement and panning. *The Audible Phylogeny of Lemurs* by Chris Mercer can be best described as being an audio documentation of lemur vocalizations. We heard part 1 of 2, which, according to the program notes, focused on "primarily… affiliative calls and a few mild agonistic call and group alerts." Despite the copious program notes, one did not need to know the background to appreciate the piece on an aesthetic level. I found the work to be quite engaging, in particular due to the extraordinarily high attention to sound placement and thoughtfulness to formal design.

Concert 11

Although not entirely about youth, it was clear that the organizers, Kristine and Colby, carefully designed this concert to provide an element of interest for all ages. The audience, dominated by the young and their parents, brought an atmosphere of excitement and wonder that is often missing in conference concert settings. The concert was supported by a grant from Coral Gables as a Young Peoples Guide to Electro-acoustic Music.

The opening work, *The Beautiful Don't Lack the Wound,* was impressively performed by the inestimable Esther Lamneck on the tárogató, a type of clarinet played by gypsies. There was also an interactive electronics part that was fed material from four microphones surrounding Lamneck. All four audio signals were independently transposed by the computer to produce different pitch relationships with the live element. The first half of the piece is a lament in which the tárogató is not really accompanied by the electronics, but is instead augmented by the sounds, like shadows. The instrumental part gradually becomes more frenetic; but then towards the end of the piece, a lyrical melodic line appears which is then embellished by the performer.

The water moves is a delightful work by Kristine H. Burns for miniature trampolines, children jumping on them, and interactive electronics (executed by Colby Leider). The children from Atala Montessori School gave an absolutely exceptional performance. The piece poignantly produced the mood of a sudden downpour one might experience in the Everglades.

Unstrung was a truly multimedia work with live violin performed by Michelle Yeunhae Lie, dancing by Krissy Jones, and music and video by Jeffery Hass. It could have devolved into an over-the-top mish-mash, but instead resulted in a real synthesis of art forms thanks in part to the excellent choreography of Elizabeth Shea, the sensitive playing by the violinist, and the minimalist (in the visual art sense) approach to the video. I hesitate to assign programmatic ideas to a piece but given the title and the choreography, my take on it was that the piece traced a trajectory of severe limitations to freedom of expression.

Where Are We was an interesting title considering that the program listed the piece as being for piano and fixed media. Instead of a pianist, however, out walked a violinist to perform the work. Presumably the violinist was the composer, David Price. The sounds consisted of heavy reverberated drones against a lyrical violin part.

Balance featured the composer, Rex Allan Maze II, performing on a Wii balance board and alto saxophone with interactive electronics. The result was a work in arch form that was a fun piece to listen to and watch, especially given the clear and direct relationship of physical motion and sound.

Hotbird, performed and composed by electric guitarist Mike Frengel, had some great moments, especially the beginning where the guitar itself was not heard but used as a triggering device. I appreciated the later portions less, where typical guitar "licks" appeared.

The final piece of the concert featured the Greater Miami Youth Symphony conducted by Huifang Chen performing Scott Miller's *Engines of...* The electronic portion of this piece consisted in large part of recordings Miller made on a visit to the Maple Grove Senior High School. He used a Kyma system to manipulate sounds produced by the school's orchestra. The resultant composition did not patronize or condescend to the orchestra but instead asked for various techniques including *non-vibrato, snap pizzicato,* and *col legno battuto*. It is no easy task to create a serious work of art that is both interesting and feasible for young musicians to perform. Miller, however, was successful in this endeavor.

Concert 12

Please see Part II (Peter Leonard)

Concert 14

Concert 14, the final concert, took place in the Maurice Gusman Concert Hall. Perhaps because this was the last concert and composers had learned from earlier concerts how to best approach sound placement at Gusman, composers on this concert seemed to do a much better job with dispersion and use (or non-use) of the multiple speaker configuration.

The concert began with *Quicksilver* for video playback by Chikashi Miyami. The piece was a study of opposites and consisted of a beautiful black and white video of liquid and non-processed vocal sounds. The "liquid" was apparently created using the free open source 3D content creation suite called Blender. There was an elegant counterpoint between the visual and aural components. On one hand, the synchronized events were few and far between, and on the other hand, the interplay of each allowed for enough space that they didn't

compete for our attention – both could be experienced simultaneously. It had a lovely ending where a simple, vocal G/E-flat motive recurred unexpectedly, yet once heard, seemed totally expected.

E-Space, by Sylvia Pengilly and Michael Rhoades, was not listed in the program as it had been moved from Concert 8. I have watched Pengilly develop over many years. She has always been on the cutting edge of new technologies, including the use of lasers, interactive video, and exploiting brainwave interaction technologies. She continues to do great work and I believe her new piece, one in a series of works in which she does the video and Rhoades does the sound, is her best yet. Watching the video, I was reminded of the delight one has viewing mirrored images through a kaleidoscope. The industrial-in-nature sounds created by Michael were equally engaging and well designed. I saw in my notes that I had written the word "Tardis" thinking the title related to Dr. Who, but later reading the program notes I found that it referred instead to the visual world of M. C. Escher; however, I wasn't that far off as both refer to the idea of alternative spaces.

In the case of *Romance is a Phaser*, I think the extensive program notes best describe this piece: "Violin and piano through phaser filters performed by composers." The composers? Max Mathews and Jon Appleton. I wrote in my notes at the time "What a treat to hear these pioneers who still after so many years continue to create for the joy of doing so." Little did I know that Max's passing would occur so soon after this conference. I am sure that anyone who attended this concert feels fortunate to have been able to share in this moment. The piece consisted of beautifully soft, subtle sounds. I couldn't help but conclude that there was a direct correlation between the sound choices and the gentle souls of these two men.

Nina C. Young's wonderful work for two pianos and computer playback, *Kolokol*, was performed by two exceptional Julliard pianists, Yuxi Quin and Devon Joiner. The work begins with a single note from one of the pianos that gradually builds with added bell derived sounds (specifically Danilov Bell replicas that hang in the tower of Lowell House at Harvard University). Surprisingly, microtones were introduced, but the synthesis and presentation (with composer at the mixing board) was done so well that it resulted in a seamless transition. With this work I appreciated Young's attention to detail and textural interest, as well as how the piece unfolded. The work flowed smoothly through the four movements.

Shahida by Kala Pierson consisted of very large gestures full of carefully controlled textures comprised of a beautiful mixture of various levels of reverberated and dry sounds derived largely from piano and vocal sounds. The remarkable violinist Maja Cerar performed Douglas Geers *Inanna's Descent* with conviction. The quiet sections were especially attractive, with a subtle interchange of extended violin sounds and computer-altered sounds. I believe the piece would have been even better in a more intimate setting, as much of the detail was lost in the large concert hall.

Continuing with great performances, Hye Kyung Lee performed *MarimBella* for piano, video (Christian Faur), and computer playback. *MarimBella* is part of her "water series" and I believe it is a new direction for her. The music was enchanting, both meditative and seductive in its use of its *ostinato* figures in the piano and tremolos with marimba type sounds in the electronics and the elegance with which those sounds slowly faded in and out from each other. Nostalgic Moog-ish sounds, combined with a wonderful performance by Timothy Vallier, Margaret Schedel, Daniel Weymouth, Travis Ellrott, and Elad Shniderman on iPhones and iPod Touches, made Vallier's *Sloide* enjoyable and a delight to hear and see. It was really well done.

Following intermission was Scott Wyatt's *ComLinks*. Consisting of various phone sounds, including phone conversations, vibrating sounds, and ring tones, the piece enveloped the listener in a world of communications. Only a master at synthesis could pull this off, and Wyatt did with brilliance. The placement of sounds temporally was a composition in itself, but the placement of those sounds in the sonic space demonstrated attention to detail that few composers are willing to invest.

Alfrooz Family's *Tentations* consisted of Isaac Pastor-Chermak performing extended

techniques on a mechanized cello. However, the piece is more than a demonstration of the mechanized cello in that its genesis involves an interaction between the machine's causalities (such as magnets on the strings) and the cellist's responses to those events. From reading the program notes I discovered that the piece was informed by "spectral analyses of stress tests…" and meant to be a "'guided tour' of the full range of the instrument's acoustic vocabulary, exploring its furthest limits." The composer also participated in the performance, sitting on stage with a computer, presumably manipulating the sounds of the cello. However, it could have been that he was manipulating the magnets; I wasn't entirely sure.

The Empyrean by Taylor Horton was a computer playback piece that was a gentle, non-assuming loop or groove-based composition. The sounds, for the most part, consisted of various string type instruments plucked. *Can* is a great work of sound synthesis by Tom Williams. As one might suspect, its sounds were derived from cans — in this case a trash can and a soda can. However, the exceptional nature of this piece did not come from what sounds were created but by how those sounds were used. Williams held onto the sounds even as they became background, such that one was never disappointed in where the ear was led. Williams also did a masterful job in dispersing the sound.

Benjamin Broening's *radiance* was performed by one of the great clarinetists of our time, Arthur Campbell. It was worth staying through till the end of the conference to hear Campbell play this wonderful piece by Broening. *radiance* is based on the poem *City Limits* by A. R. Ammons. The design of the interactive electronics resulted in a near seamless interaction between the computer and the clarinet.

These concerts were only a part of the conference. A number of thought-provoking and informative paper sessions, several installations, two Genelec Listening Rooms, a laptop ensemble concert in the student pavilion, and visits to the beach created a fantastic and memorable experience for all. Thank you Kristine Burns and Colby Leider! Appreciation should also go out to Dean Shelly Berg, Julia Berg, Julia Lemus, the Frost School of Music, the technical crew under the leadership of Paul Griffith, and the various sponsors including ASCAP, Computer Music Journal, Coral Gables, Leonardo Music Journal, Smule, The MIT Press, Atala Montessori School, Sweetwater Music Instruments and Pro Audio, The Greater Miami Youth Symphony, Florida International University and the FLEA Ensemble, Culture Shock Miami, Dolby Laboratories, Ableton, and WVUM 90.5 FM for their support of SEAMUS 2011.

SEAMUS National Conference 2011

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Concert 1

The conference began bright and early at 8:00 AM on a beautiful January day as only Miami can produce. Concert I opened with an ambient nature-inspired piece for video playback, perhaps scheduled in consideration of those still in a dream-like state. The work, entitled *Akasa Vajrapani* (2010), was a collaboration by composer Kip Haaheim and video artist Nathan Hoffman. It began with projection of videos of the natural sky, augmented with digital snow-like particles that moved across the screen in various angular trajectories. The musical portion was created using samples of wind which were processed in a range of ways. Towards the middle of the piece, the sound developed with the inclusion of a somewhat mechanical rhythmic component, which ultimately evolved into an outright drum beat. All in all, the work presented a straightforward, tasteful example of multimedia collaboration.

The second piece of the concert, *Deluge* (2008) by Ronald Parks, was composed for computer playback and featured a wide array of intriguing electronic timbres, textures, and drum beats. Notably, the piece successfully blended styles and timbres from popular music with those of electro-acoustic music. It seems that many composers would like to break down this unspoken boundary between popular and art music, but do not have the skills or tools to do so. In general, the dividing line seems to lie

around the use of *beats*; any piece, however well composed, if inclusive of *beats* will never be considered "serious music" by certain traditionalists. *Deluge*, however, with its fluid modulations between break-beat and pure electro-acoustic textures, provides a potential model for how these two worlds may be successfully fused.

The three pieces that followed each featured parts for live performers. The first, *The Spark of Opposites* (2009) by Christopher Chandler for cello and computer playback, exhibited a number of extended and contemporary techniques including bowing on the bridge, *sul ponticello*, *glissando*, and harmonics, all of which were expertly performed by cellist Madeleine Shapiro. For such contemporary pieces, we are at times apt to make judgments based on the variety of timbres included rather than on their organization. Perhaps this is due to over-stimulation. Approaching the review process with this in mind, however, I found *The Spark of Opposites,* nevertheless, to be a compositional success; it was not merely a showcase of playing techniques and timbres. The electronic part, furthermore, being pre-composed as opposed to interactive, showed considerable independence from the cello part. This is often not the case for interactive electronic systems, which rely on delaying of the live audio signal, thereby often creating a predictable output.

The next piece in the concert, *Insert Coin Here* (2010) by Zackery Wilson, featured the composer on piano accompanied by a pre-recorded electronic part. This piece stood out especially at the conference for inclusion of theatrical elements, including acting and "stage props." The work was intended to reflect a typical video game narrative, featuring increasingly difficult *stages* that a player may or may not succeed in completing. Musically, these stages were reflected through increases in tempo and rhythmic complexity. In addition, the tape accompaniment featured sounds reminiscent of early video games, created using 8-bit synthesis techniques. Preceding the climactic section of the piece, the performer/game player drank a glowing green potion to revive himself in order to complete the *game*. This theatricality, which helped fulfill the narrative of the piece, rather than coming across as a gimmick, left the audience feeling entertained yet musically fulfilled.

The next piece in the concert, *Seven on the 25th, 1986* by April Mok (2010), was composed for computer playback alone. The composer described the piece as being expressive of the dichotomy between the technological and the human. This was conveyed via juxtaposition of common technological sounds (both sampled and synthesized), such as that of a fax machine, and inclusion of processed vocal and voice-like sounds. The piece presented a variety of traditional musical elements as well, such as motives, counterpoint, and harmony, played using synthesized sounds and sine waves. The mid-section of the piece, through inclusion of long vocal 'pads', may be stylistically associated with the new age and ambient music genres, though not in a distasteful way. All things considered, the piece was quite impressive for its bringing together of a wide array of timbres and allusion to various virtual acoustic spaces.

The piece that followed, *Silounds* (2009) by Benjamin Taylor, featured the composer on percussion instruments with interactive electronics. The piece was named for its featuring of *pianissimo* percussive sounds, which are not typically associated with percussive instruments. Through amplification and live processing, including looping and delay, these sounds were brought into focus. Quiet sounds, however, were not the only ones featured in the piece; *fortissimo* sounds were placed in juxtaposition to the predominant *piano* sounds. In general, exploration of extremes in dynamics seemed to be the theme of this work, one that turned out to be quite compelling.

For a review of the rest of the pieces presented on this concert, and any other concerts not reviewed in this article, please see Charles Norman Mason's SEAMUS 2011 review included in this volume of the Journal SEAMUS.

Concert 3

Concert 3 exhibited a delicate balance between fixed media pieces and works that included live performance or video. The concert opened with a work by Maurice Wright entitled *Darwiniana* (2011), for video playback and fixed-media

electro-acoustic music. As alluded to by the title, the work is an homage to Charles Darwin, commemorating the 200th anniversary of his birth. The video itself was comprised of moving geometrical patterns (at times reflective of Nordic Runes) and virtual landscapes (reminiscent of aerially photographed wetlands). According to the artist, these images were synthesized using three techniques: audio visualization, projection of Darwin's two-dimensional sketches in three-dimensions, and the employment of genetic algorithms. Musically, Wright worked with a palette of classic electro-acoustic sounds including filtered noise, tone clusters, and glass-like timbres, using chords tuned to just intonation and unusual melodic movement to support the curious digital world projected on the screen. Notably, Wright, also a music historian, was a presenter at the Sound and Image paper session where he provided a historical account of an early 20th century color organ. With this in mind, *Darwiniana* may be appreciated as much as a work of art as for its historical references.

The second piece in the concert, *The Ends of Histories* (2011) by Christopher Biggs, also featured live video playback and fixed media audio but with the addition of live piano, which was commissioned and performed by Kari Johnson. The piano part stood out as being sophisticated yet emotionally captivating. According to the composer, the work was intended to represent various historical and contemporary versions of how history could end. In line with this purpose, the musical portion featured a blend of historical compositional techniques, including a number of atonal procedures, strict serialism, along with more contemporary techniques, evoking a feeling of early modernism while remaining innovative by current standards. The video component most memorably included symbols of Mayan origin, mandalas that rotated entrancingly on the screen. *The Ends of Histories* stood out as an ambitious multimedia work that successfully presented great contrast in context and mood.

The next three pieces all featured live string soloists. The first, Heather Stebbins' *The Forgotten Dialect of Autumn* (2009) for violin and interactive electronics, adhered to a traditional model of drawing on the seasons as a source of artistic inspiration. The composer described that her compositional purpose was to express a personal, perhaps private, experience of autumn. The violin, which melded quite naturally with the electronics, often played noise-based sounds while the electronic part, at times, generated high frequency tones reflective of string harmonics. The piece ended quite intriguingly with the performer playing solely on the neck of the instrument with one hand; the resultant sound of this process was sampled and played back electronically.

The next piece performed, Juraj Kojs' *The Wetland* (2010), featured Madeleine Shapiro on cello and the composer controlling interactive electronics. The piece was one of the most compositionally abstract works in the concert and appeared to be somewhat aleatoric in nature. Nevertheless, it was evident that the compositional structure behind the piece was meticulously planned, consisting of an exposition of extended techniques for the cello separated into seven movements. The cellist interpreted the piece with great sensitivity and executed the extended techniques gracefully – blending and shifting between them with great ease, giving the impression that she and the composer were a unified entity.

The piece that followed, Dorothy Hindman's *Fantasia for Karen Alone* (2010) for violin and computer playback, sounded in strong contrast to the previous piece. It contained slowly evolving phrases often restricted within the range of a major second, with prominently displayed microtones. The influence of techniques from the "spectral school" could clearly be heard and the use of electronics was not ostentatious; predominantly, the electronic part was supportive or imitative of the violin part. In general, the intensity of the work increased gradually as the piece progressed, due to shortening of the delay time between the live violin and imitative electronic part. Near the end of the piece, the composer included a brief triadic motif which sounded in stark contrast to the generally chromatic/atonal material presented throughout the piece. The inclusion of this motif exposed the source material for the spectral analysis from which the other material was derived.

The concert also included three works for computer playback, which were interspersed between live performance pieces. The first of these, *Cleaner* (2009) by Bruno Ruviaro, featured a broad range of sounds that gradually evolved throughout its duration. The piece drew upon many timbres and textures representative of contemporary electro-acoustic music including noise-based sounds like that of a machine blowing out exhaust, pulsing and clicking sounds, low frequency drones, and quasi-random frequency patterns. All of these were created using short audio samples from pre-existing music by other composers. Within the context of the concert, it stood out as being provocative in terms of sheer volume and choice of abrasive timbres.

The second piece for computer playback, *Understatements (mvmnt i)* (2010) by Ilya Rostovtsev, was also emblematic of contemporary electro-acoustic music in its predominant use of *concrète* sounds rather than traditional musical timbres. These were organized into discontinuous mechanical rhythms, often supported by rumbling sub-bass drones. It transcended style-based expectations, however, through its communication of an elusive narrative and projection of an inescapable ambience (an underground world of tunnels and subway trains), placing it squarely in the realm of cinema for the ear. Rostovtsev's comfortable blending of multiple electronic music styles, including soundscape, *musique concrète*, and electro-acoustic composition, proved him to be a gifted composer well versed in the traditions of electronic music.

The third and final fixed media piece was entitled *Unhinged* (2010), due to its featuring of two representative sound samples: a squeaking door hinge and a slamming door. These were the only source material used by composer Stephen David Beck. Although the sound of a squeaking hinge has often been sampled, Beck placed the sound in new contexts and modulated it in novel ways such that the piece did not feel retrospective whatsoever. According to the composer, the piece was created in the presence of his students at LSU in order to provide them with a model for approaching electro-acoustic music composition using sound samples and resynthesis methods. Putting aside the piece's educational purpose, *Unhinged* came across as an effective musical work that expressed a wide range of musical ideas using a small amount of source material – a goal that many electro-acoustic music composers attempt but often fail to achieve.

The remaining pieces of the concert all featured live performance parts. Derek Sherron's *Doppelgänger* (2010) featured the composer controlling interactive electronics with parts for two B-flat clarinets performed by Danielle Woolery and Orlando Martin Scalia. For some audience members, the piece likely provided a welcome sonic departure. The clarinets, in general, played the lead role in the piece with electronics somewhat taking a secondarily role. The composer also included a pre-composed percussive background track inclusive of timbres and rhythms reminiscent of traditional Afro-Caribbean percussion. Melodically, one heard hints of *Roma* (or gypsy) influence. Technically, the composer used counterpoint and 20th century harmony techniques, both slightly uncommon in typical electro-acoustic pieces, all in all making the piece a standout in the concert.

DanceMad (2010), by Dan Hosken, was the second piece to feature cellist Madeleine Shapiro. The cello part included many extended techniques and projected a generally frantic ambience that was intensified by the composer's live processing of the sound. The sounds of countless short *glissandi*, bowing on the bridge, and striking of the cello's body sounded in ensemble, through combination of the live cello part and delayed processed versions of the signal. In this piece, more than any other in the concert, neither the live performance part nor the electronic part dominated (despite all of the sounds being created by the cello); it struck me that it takes courage to be willing to play a piece that does little to highlight one's virtuosity. This courage and flexibility was exemplified by Shapiro at the end of the piece at which point she ceased playing the cello entirely and shifted into a John-Cage-reminiscent mimed cello performance that evolved into a dance. The inclusion of this performance aspect was an artistically effective choice and also resulted in an entertaining program.

The final piece of Concert III, *Metaman* (2009) by Charles Norman Mason with video by

Sheri Wills, was commissioned and performed by violinist Karen Bentley Pollick. As a multimedia work, it showed sophistication and complexity in each of its three component parts. Conceptually, the work was intended to blend the human and the "digital machine" through the projection of the video onto the soloist, blending human motions with motion pictures, and through inclusion of both real sounds (live violin) and imagined sounds (synthetic timbres and samples of the violinist). Musically, the piece featured dynamic interplay between the live violin and the electronic part, with each at times taking the lead in call-and-response imitative phrases. In retrospect, more than any other performance piece on the concert, the virtuosity of the performer was truly highlighted by this piece through inclusion of a combination of traditional and extended techniques, both of which required great technique and artistry.

Concert 12

The opening work of Concert 12, Ted Coffey's *Blue Cycle: Noise* (2008) for video playback, explored meaning and lack of meaning (or noise) through the presentation of text-based video and related audio. According to the composer, "the work belongs to a cycle of tape-plus text-sound works;" this installment contained 13 individual vignettes, each of which explored a particular aesthetic or social topic. The sound portion consisted predominantly of effected and resynthesized speech samples – a wide variety of contemporary and classic techniques were employed to this end including vocoding, LPC, and DFT-based processes. Ultimately, this video work presented a very distinct ambiance despite consisting of only text.

The second piece of the concert, *Moosonnkita* (2009) by Dan Dickinson, was largely rhythmic in focus, especially in the context of a conference of electro-acoustic music. The piece featured sampled sounds, including the sounds of household objects, and various forms of traditional synthesis techniques. The piece opened with a polyrhythmic section, presenting simultaneous pulses seemingly not related by simple integer ratios. Also featured were a variety of sounds reflective of the music and wildlife of other cultures, such as a drone like that of a *didgeridoo* and bird-like sounds. At the end of the piece, bass frequency tones reminiscent of a detuned contrabass entered. In retrospect, through its strong use of rhythm and idiosyncratic sound samples, *Moosonnkita* may have filled a desired niche for concertgoers in need of a sonic diversion.

The next piece was *Ceaseless Cease* (2009) for B-flat clarinet and interactive electronics by Kyong Mee Choi. According to the composer the piece represented a comment on the human condition and the impossibility of thwarting human desire. The piece began and ended with the clarinetist, Esther Lamneck, blowing into her instrument without producing tones. Throughout the piece, one heard a number of 20th century influences in the clarinet part including Stravinsky-like motives, jazz-inspired themes, and various types of chromatic passages. The electronic part featured drones, noise-based timbres, and tones reflective of acoustic instruments, specifically the African *mbira* and wind chimes. The most noteworthy aspect of the work, however, was certainly the melodic variety presented in it.

In the piece that followed, *Metamorphoses* (2007) for cello and interactive electronics, Clifton Callender employed a rather common compositional process – delaying a live audio signal to create counterpoint, in this case a canon. Although the delayed version of the live cello part seemed to have been played back with little or no modulation, the piece did remain quite interesting throughout. Perhaps this can be partly attributed to the gradual diminishing of the delay duration throughout the piece, which allowed the repetitions to sound in new contexts. In retrospect, the success of the piece primarily lay in the strength of the initial cello part and in the fact that the process-based counterpart was well conceived in advance. The virtuosity of cellist Evan Jones greatly added to the success of the work as well. All things considered, this was a very energetic and musical work.

The next piece in the program was a work for computer playback entitled *redbird express* (2010) by James Paul Sain – a work that was 45 years in the making, according to Sain. The title refers to a defunct New York City subway line that the composer had experience with while growing up. Sonically, the theme of the piece was expressed through use of personally

recorded sounds including samples of trains, passenger speech, train announcements, traffic, and other forms of transportation. These *concrète* sounds were later interlaced with synthesized sounds, and played back using various filters, turning what could have been a pure soundscape piece into something artistically broader. The work, like many others that incorporate *concrète* sounds, conveyed a specific, emotionally charged aural landscape.

The following piece, Mara Helmuth and Rebecca Danard's *Water Birds* (2010) for bass clarinet, clarinet, and interactive electronics, was a theatrical piece that featured Danard on clarinets with live audio processing by Helmuth. The performance involved a complex interactive system including infrared sensing technology (used to detect the position of the performer), an interactive MaxMSP patch, and RTcmix scripts (to alter the clarinet sound via spectral delays), a score inclusive of five "sound-generating ideas," and extensive improvisation (Danard, Helmuth, 2011). Danard determined a prescribed sequence of events for the piece, but nevertheless the performance appeared to be quite "free" in nature. The piece was defined by the performer, who walked in slow, circular paths on the stage, thereby attaching a flowing and meditative aura to the work.

The next piece, *untitledededede* (2009) by Anthony Reimer, was composed for computer playback and comprised of samples of "small" sounds, "created by rubbing small pieces of wood, metal, and glass together" according to Reimer. A variety of textures were presented, including pulsing *crescendos* and sections with extreme fluctuations in dynamics. Additionally, a number of processes were applied to certain sounds including, perhaps, convolution and time-stretching. I found certain metallic, sword-like sounds in the work to be reminiscent of the sound design elements used in many martial arts films, a curious but compelling coincidence. Overall, the piece was most engaging for its use of sounds of long duration and creation of distinctive virtual spaces.

The next piece, *Vessels* (2010) by Timothy Dwight Edwards, was composed for wine glasses and live signal processing. It featured the composer as performer employing various types of articulations including rubbing and striking of the glasses. These sounds were then processed and diffused throughout the concert hall via custom software. The resultant timbres were at times evocative of the prototypical "crystal" patches found on many early synthesizers and keyboards. The final section of the piece featured classic synthesis timbres, ultimately lending the piece a 1950s science fiction quality – always a source of enjoyment for this reviewer.

The work that followed, *Driftwood* (2009) by Michael Olson, featured alto saxophone performed by Alex Sellers and computer playback. In general, the piece could be described as frenetic and dynamic. The saxophone part consisted of numerous atonal or chromatic passages with frequent *crescendos* and sudden stops. It also included moments of playing without breath, emphasizing the sound of playing on the keys alone. The electronic part also regularly featured sudden dynamic shifts and rests which seemed to have an effect of emphasizing the saxophone part. In general, the two sound sources were presented in contrast to one another with brief moments of imitation or reflection, making the piece challenging but rewarding to listen to.

The final piece presented in Concert XII, *Category 5 (Echoes)* (2010) by David Taddie, was a far-reaching work that referenced a broad range of musical influences. Composed for flute, violin, and electro-acoustic accompaniment, one heard hints of Romanticism, early 20th century impressionism, and of the modern avant-garde through use of techniques such as playing on the body of the violin. The piece offered a delicate balance between each of the instruments through inclusion of duets, solos, and ensemble playing (featuring flute, violin, and electronics). In the electronic part, there were moments that sounded imitative of the acoustic instruments' parts; the most interesting departure from this (and also the least able to be reproduced by an acoustic instrument) was the use of randomly generated tone patterns, which helped to expand the textural scope of the piece. As the final work in the concert, *Category 5 (Echoes)* was quite satisfying.

References
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Realms of the Right Brain: the graphic scores of Craig Dongoski

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Few people contemplate that the physical act of drawing upon a surface produces a sound. This transmutation of expression is the starting point for much of Craig Dongoski's artwork. In an ongoing project called *Drawing Voices* (2006) he invites guests to his lab to draw or write their signature on a tablet outfitted with contact microphones. These sensors pick up and amplify the subtle scraping and hitting of the pencil or pen on the solid surface. The resulting recordings often feel haunted, like abstract echoes from some ancient place. They are muffled communications and artful static from a hidden realm as much as they are aesthetic sound works.

In his latest body of work, Dongoski employs new procedures that occupy a similar territory between sound and unconscious mark-making. For WhiteSpace Gallery in Atlanta, Georgia, he made large audio-graphic drawings with the intention that they could be read as graphic scores. The title of the exhibition, "Attack/Decay/Sustain/Release," refers to the amplitude envelope of a tone commonly utilized in synthesizer keyboards. Literally, the fluctuating marcations of Dongoski's two-dimensional artworks relate directly to fundamental characteristics of sound dynamics.

Black and blue, or sometimes rainbow-colored lines bubble, bleed, and loop out over large wood panels and in one case they obfuscate an air-brushed scene of downtown Atlanta. These lines are very alive inside the compositions. It is not a far stretch to imagine they could demarcate something musical as well as metaphysical. The drawings dance and fluctuate and yet seem to have a chronology, albeit mischievous. One could think to read them like torqued musical staffs. But other readings of the imagery make viewers think of Maori tatoos, topographic maps or the gyrations of a pen that measures earthquakes.

As a demonstration of how to read these images as musical notations, Dongoski arranged a live performance in the gallery on March 29, 2011 – a small space with the remnants of its architectural history still intact. People filled the room in fold-up chairs on an unsteady floor of old "southern bricks." The audience waited in front of the musicians – percussionist Stuart Gerber, trumpeter Amanda Pepping, saxophonist Jan Berry Baker, and Dongoski playing a sampler – each with a copy of the graphic score. In a stunning psychological move, the first minute and half of the piece was confidently silent. Not even the tick of a metronome or clocking agent was there to acknowledge a beginning. The audience shifted and buzzed, somewhat unsure: had the work begun? Was there a technical problem? And this initial experience was an excellent primer for receiving the sound composition. Something happens when an audience sits in silence: anxiety mounts, expectations break to the surface and then adjust. The emptiness was just long enough for minds to let go and wander. In this way, the group was gently forced into a void or a moment of meditation out of which the austere sound work emerged. And this proved to be exactly the right setting in which to hear the piece. When the sound quietly broke through, the audience was in an absentminded mode. As if they had been sitting in the Rothko Chapel in Houston for a short while, they were ready to zone out for a pleasant 20 minutes of listening to a drawing.

When answering questions after the performance, Dongoski revealed the mystery surrounding this work. Over the graphic score he applied a systematized grid that the musicians were instructed to read from left to right. Through the graphic score, the performers were thus able to "generally" keep time, creating an improvisational response, which was at the same time somewhat measured. The top left part of

the drawing happened to be blank, thus no one played at first.

Somewhere between waking and sleeping, physical and invisible, conscious and unconscious is that gray area in which Dongoski plays. But it requires time and discipline to get beyond human control and into these "in-between" states. His drawings are produced very slowly. In Dongoski's words: "They connect themselves visually and conceptually to assimilating with geological time and sound waves. I have inverted my method, in that rather than responding to a sound that yields a pictorial result, I am responding to a visual [line] that yields a spectrographic result ... The drawings are built by repeatedly re-interpreting the previous line drawn." (Dongoski 2011) In this way, Dongoski has developed an impressive and original style that begins in the seemingly mundane and meaningless and erupts upon investment of time into the profound.

To make an initial line, perhaps, he picks up on the physical striations of the material's wooden surface; lines do seem to riff off the grain. From simple secular lines, created as if doodling absently while talking on the phone, he retraces and colors-in for hours. In the process, the artist's mind disengages and he is hypnotized. The drawing grows leisurely, perhaps even of its own accord and gives way to grand formations. As in the slow making of stalactites, imperfections eventually morph into small hiccups, hills and then upside-down volcanoes.

Dongoski's work somewhat aligns with traditions of automatic drawing. Well-known practitioners like Shaker Mother Ann Lee and occultist Austin Osman Spare both sought to access unused parts of our right brain through physical mark-making. But Dongoski's work wants to be considered more in the scientific realm. He wishes not to create a flashy hoax, or cash in on the drama that often accompanies investigations of the "mysterious" and therefore spiritual. His practice reads more like workings from the lab. However, it is interesting to consider what automatic drawing and its resulting sound will mean to a future population. The physicality of writing and drawing is fast becoming the lone domain of artists and other "edge people" – those who dwell at the edges of the shared beliefs and practices of society, like contemporary shamans – and not mainstream citizens. Our hands are no longer instrumental in our ability to communicate. The element of touch is being removed, which ironically makes Dongoski's work even more potentially esoteric as time moves forward.

KISS 2011

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The 3rd Kyma International Sound Symposium (KISS) took place September 15-18, 2011 at the Casa da Musica in Porto, Portugal, hosted by Eduardo Magalhães, and organized by Faculdade de Engenharia da Universidade do Porto and Symbolic Sound Corporation with support from Casa da Música and UT Austin | Portugal International Collaboratory for Emerging Technologies. The annual KISS symposia are dedicated to music, sound, and related topics that use Kyma X software and its accompanying hardware, the most current of which are the Pacarana and the Paca sound design engines. Kyma X is produced by Symbolic Sound Corporation, and is designed by Carla Scaletti. Kurt Hebel is the hardware developer. This year's symposium featured the theme "Explorando o espaço do som" (Exploring Sound Space). The schedule included information sessions, workshops, demonstrations, papers, and concerts. Organized lunches and dinners every day provided ample time for attendees to mingle, discuss, and socialize. Participants were eager to share ideas and connect with each other, and there was a general excitement regarding the quality of the event. This reviewer was pleased with the opportunity to reconnect with old friends and make new ones who share interests.

Casa da Música is a multiple-function music facility featuring concerts, tours, and educational programs. The symposium coincided with a multiple-day concert series presentation of

Jonathan Dove and Graham Vick's shortened chamber orchestra version of Richard Wagner's *Ring* cycle. The facility maintains a strong connection to electronic music, immediately evident by the presence of a public Macintosh-based computer lab located in the lobby, equipped with headphones, keyboards, and music software ranging from the obligatory GarageBand to a number of rather interesting in-house-developed applications.

Day one began with attendees meeting a security escort and being led to a freight elevator behind a hidden door. We would discover during the course of the symposium that being treated to a myriad of security people, mysterious elevators and escalators, and confusing routes to rooms would become the status quo.

Carla Scaletti's opening presentation was an introduction to Kyma X. She began by performing her setting of the poem *Lament* by Alice Thorne. Typical of Scaletti's work, it contains carefully crafted sounds, text painting, programmatic and extramusical elements, and an overall thoughtful pragmatism in the presentation of sound. The presentation continued with an overview of Kyma describing it as recombinant, having the ability to create infinite structures from a finite number of building blocks. In essence, it is a language. The Pacarana (as well as "Paca", the smaller version, and "Capybara", the previous version) sound design engine is a computer that is optimized for sound processing, allowing the host computer to be free to run the KYMA X graphic interface. This arrangement allows for the Pacarana to use computationally-heavy signal processing algorithms, resulting in extremely high-quality sound. Additionally, multiple Pacaranas can be combined to form "super" Pacaranas.

Scaletti went on to describe some basic sounds, tools, and configurations, providing helpful tips along the way. She demonstrated several interface options, including the Wacom tablet, iPad and the Kyma iPad app, OSC and Ethernet, OSCulator, and Delora's PacaConnect and Motormix emulator. In general, this session provided a large amount of information for beginners, while also providing useful reminders and some new ideas for experts.

Lunch was provided between 1:00 to 3:00 p.m., the customary time in Portugal. Each day saw a late lunch, late afternoon coffee, and dinner at 9:00 p.m. or later, often lasting well into the early morning hours. The afternoon session of the first day was set up as a workshop, with six stations placed around a room and several Kyma experts offering tips and solutions to the group. There was much interchange between attendees, and an atmosphere of excited playfulness began to emerge. Participants downloaded Kyma files, altered them, created new ones, and were provided with possible solutions to questions they asked. The entire group acted as a resource. Sounds wafted through the room.

The evening concert was in a reception area with drinks, appetizers, and a 5.1 sound system. The selection of food and drink was excellent. Lowell Pickett initiated the music for the evening with *Spatial Transformations* (2011), during which he used a homemade Open Sound Control (OSC) controller to trigger and spatialize industrial crane sounds.

The evening concluded with a three-part free improvisation by Eckard Vossas. The music was produced entirely in Kyma and controlled by Vossas using a myriad of controllers, including a Hakem Continuum, two iPads, a Keitar Minimix, a computer keyboard, and a number of foot pedals. The three parts ("expeditions") are titled *Kyma-tized Fred Frith Show*, *Across Seven Seas*, and *Cecil Ratledge Percussion Variations*. *Expedition One* was the least structured and controlled of the three and utilized harsh, complex sounds. Control of the sounds was clearly in human hands, with sounds exhibiting purposeful changes in parameters while evoking the soundworld of Fred Frith. *Expedition Two* featured the seamless control of sounds by both Kyma and the performer. The structure was clear and unified yet quite complex. Vossas displayed his virtuosity with the complex controller setup a number of times. He also made effective use of spatialization by placing this expedition in excellent counterpoint to the relatively still spatialization of the first piece. *Expedition Three* featured jazz samples from Cecil Taylor and Mike Ratledge. This expedition was the most pulse-oriented of the three, with Vossas creating related multiple beats and tempos through the careful use of

timing and delay. The contrast between acoustic and electronic sounds was well blended, mirroring the contrast between human and machine-controlled sounds in the first two expeditions. This expedition also made excellent use of cultural and other extramusical references, and exhibited the clearest and simplest form of the three movements.

Day two opened in a third room, the home of the remainder of the symposium, with a keynote address by Carla Scaletti. She began with a description and historical account of the astrolabe, a centuries-old navigation device, an image of which is the logo for this year's symposium. The astrolabe essentially converts time to longitude and vice versa, mapping time to space and providing Scaletti with a rich pallet of metaphors relating to the symposium's theme. Music occurs in time and space, and composers explore both of these elements. She continued with accounts of Magellan, Poincaré, and Einstein, all explorers in their own rights, shifting eventually to the exploration of possibilities in Kyma. It is this exploration that leads to a better understanding of our world. The address was rich in extramusical information, interesting, and ultimately inspiring, all presented with an understated and charming reserve.

The day continued with short presentations by Bruno Liberda and Jeffrey Stolet. Liberda explored methods of mining the upper reaches of frequency spectra for control signals that are not otherwise obvious. His technique is simple, useful, and inspired. Stolet introduced his new book, *Kyma and the SumOfSines Disco Club* (published 2012, lulu.com). The title is an inside joke so obscure that it borders on the painful, but the story he tells is worth asking. In summary, the book is intended for Kyma teachers, serving both as a compilation of scattered useful information that he has accrued in various resources over the years, and a source of tips and hints from Stolet, who is virtuosic in his knowledge and teaching of the software. The book includes fifty essential Kyma sound objects. Perhaps most importantly, it also maintains a stance as a book for teaching music philosophically and rhetorically, not simply focusing on technical software details.

Following lunch, André Perotta presented his restoration and redesign of Flo Menezes' *Mahler in Transgress* (2002 - 2003), a reimagining of the *Andante comodo* movement of Mahler's Symphony No.9 for two pianos and live electronics using Max/MSP. Currently the work cannot be performed with the new versions of Max/MSP and Macintosh computers with Intel processors. Of course, such a problem brings up the wider consideration of the preservation of any work requiring obsolete technology. Perotta got the chance to work directly with the composer to not only try to reconstruct sounds faithfully using Kyma and Max/MSP but also to assist the composer in actually redesigning and recomposing some of the electronic sounds.

Yannis Kyriakides presented the concept and technology behind his sound installation *Disco Debris* (2010) and the larger composition *Varosha* (2010) that grew out of it. The works deal with human interaction with audio and space, essentially defining a soundscape using human movement through a space. The concept stems from the abandoned northern Cyprus resort city of Famagusta, which was forcibly abandoned in 1974 and since occupied only by military personnel. Kyriakides also presented a fixed media version of *Disco Debris* for audio and video, a simple yet meaningful combination of sounds, video, spoken word, and written word. All elements combined beautifully into a distinct and symbolic atmosphere within the backdrop of fascinating subject matter.

The final presentation of the afternoon was Scott Miller's "Sonic Ecologies, Mobiles, and Orreries: Generating Interactive and Autonomous Behavior in Kyma." Essentially, Miller intended to demonstrate ways of creating sounds that affect themselves. He clearly communicated his concepts and their relation to Agostino di Scipio's work in audible ecosystems. Using the visual analog of Calder's mobile sculptures, he drew a parallel between the effect of physical input on connected objects being dependent on the structure of the interconnections, and the effect of audio input on a space being dependent on the structure of that space. Different programming approaches will emphasize different aspects of the sonic space at hand. His demonstrations were illustrated using sonic input to cause changes in spatialization. Although the technology was not

working properly for the demonstration portions of his presentation, the final concert of the symposium featured a piece by Miller that illustrated the concepts he discussed.

After a short break, many of us moved to the lobby and the public computer lab mentioned above. Filipe Lopes presented an information and demonstration session on the educational program Digitópia, available through the Casa da Música. It is a five-year-old program designed to offer opportunities in electronic music for school-age children. Students of Digitópia pay a very modest attendance fee or receive a waiver if they qualify. Employees of the program have developed a number of their own synthesis software applications that feature a range of rather interesting interfaces, including some for the physically disabled.

The Friday evening concert opened with Scaletti's *...odd kind of sympathy* (2011), featuring a hundred tiny bells of several different kinds rung on cue by the audience. The concepts behind the work include the use of physical modeling in Kyma to imitate the synchronization of pendulums on a free surface, and the slowing of time to make audible the rich timbres of the tiny bells. The work featured the projection of Kyma's virtual control surface to cue bell ringing by members of the audience. The musical effect was excellent, with controlled timbres, a rich texture of sounds possessing natural and physical rhythms moving in and out of sync with one another, and a clear form that drove the musical narrative forward. The audience seemed to enjoy being part of the performance, and I especially enjoyed distinguishing between timbres of different bells reproduced at a much slower speed and pitch than the live sounds.

Self portrait without self (2010), an extremely effective musical work by Bruno Liberda, was performed by the composer on what appeared to be a zither or similar instrument connected to Kyma. Its simple form, that of a steady *crescendo* from *pianissimo* to *fortissimo*, was effectively realized through the careful reservation of sounds, intensity of performance, and theatrical effects. Liberda's sounds are magnificent, ranging from delicate and touching to rich and satisfying, and to aggressive and complex. The performance was stunning, beginning with delicate, almost timid, touching of the zither that produced barely audible sounds, to anxious screaming into the instrument, to a sudden lifting and violent shaking of the instrument as marbles poured out of its sound hole, creating terrifying sounds that shook the room.

The final work of the first half, *Galileo, One Night Only* (2011), by Theo Lipfert, featured the live, improvised manipulation of video using Resolume's VJ software Avenue interfaced with Kyma. The work explores the inaccuracies of memory, the life of Galileo, and the fictional experiences of an actor whose "day job" is that of a professional medical "guinea pig." Visual images created a sense of disorientation and an uneven, disjunct passage of time. Sounds were largely evocative of water, effectively spatialized, and simple enough not to interfere with the visual interest projected on the screen. The entire work masterfully juxtaposed water sounds, surreal video effects, concrète? audio and visual action, and distant voices from diverse sources. Lipfert's work will, without a doubt, result in an increase in the use of this kind of technology among experimental composers who wish to explore more meaningful visual elements in their own work.

The entire second half of the evening consisted of a single performance by Minibus Pimps, the free improvisation duo of Helge Sten and John Paul Jones. The duo initiated their performance with a theatrical entrance and dramatic lighting, approaching the stage from the audience while manipulating iPads. On stage, each performer had their own Kyma system, with access to several controllers including iPads, a guitar, an electric fiddle, and an electric bass. As is often the case with freely improvised music, form became evident slowly, and large-scale events unfolded over long periods of time. Transitions between large sections were handled deftly with some elements of timing approaching the virtuosic. Most of the performance was extremely loud and I think could be classified officially as an assault on the ears. For this reviewer the assault was extremely satisfying, with sounds that were highly complex yet easily distinguishable within the texture. The introduction of actual pitches from the electric fiddle toward the end blended perfectly with the

abstract sounds and noises that had been the norm until then. Although the sound was very loud, it was not painful, adding to the pleasure that this listener experienced.

Day three began with the Keynote on Musical Space by Laura Tedeschini-Lalli, Professor, School of Architecture, Università Roma Tre, Italy. She shared information regarding her interest, as a mathematician and musician, in the capacity for the human auditory system to gather and make sense of aural information. Tedeschini-Lalli is involved with studies that focus on the capability of humans to extract information about the space around them by assigning patterns to aural input (see "Matematici e musicisti, esploratori di pattern." *Journal of Science Communication*. January 2005). The process is both objective and subjective, and involves time as well as space. Musicians are very useful resources for her. Audio information is so complex, with so many variables, that it is still difficult, if not impossible, to construct accurate predictive models for all but the simplest of spaces.

Next was Scaletti's always-anticipated account of what is new in Kyma. She described a host of new features, ranging from color-coded syntax to new prototypes to faster processing speeds. As is evident year after year, Symbolic Sound is extremely responsive to input from, and the wishes of, Kyma users.

Following lunch, Pete Johnston provided information regarding fine-tuning spectral morphing capabilities in Kyma in his presentation "The Piece of Wire Between." Johnston eliminates audio distortion during spectral morphing by splitting frequency and amplitude information, and computing accurate formant structures during transitional periods, essentially mapping the first set of formants to the second and smoothly moving between the two. The result was dramatic, and in a demonstration, Johnston mimicked the voice of WALL·E from the 2008 Pixar motion picture, which was originally created in Kyma.

A question and answer session with Theo Lipfert, Bruno Liberda, Carla Scaletti, and Minibus Pimps' Helge Sten and John Paul Jones followed Johnston's session. Minibus Pimps explained the origin of their name and the basic improvisational operation behind their performance, among other information and anecdotes. Lipfert, Liberda, and Scaletti revealed "secrets" behind the musical works performed the previous evening.

The evening concert featured a single program: Franz Danksagmüller's live manipulation of Kyma to Fritz Lang's epic 1929 science fiction silent movie *Die Frau im Mond*. Danksagmüller's introduction shed light on his choices of sounds and use of Wii controllers to create what we were about to hear, including electronic recreations of Russolo's Intonorumori. Two hours and forty-five minutes later our minds had been filled with images of the film, a work of art in its own right, and sounds evocative of the industrialists and others of the early twentieth century, such as Russolo, Varese, and Ruggles. The combination of the two can only be described as a stunning and satisfying experience. Danksagmüller, because he was watching the movie while performing in real-time with Kyma, had the opportunity to react to the visual images as they happened. He restrained himself, choosing to react directly with the movie at select moments. The result was an effective pairing of deliberate and stylized visual editing with long-term unfolding of musical form. The music bound the expansive movie together in ways not possible through purely visual means.

Sunday, the last day of the Symposium, opened with two presentations about the sonification of data streams. Scaletti opened the topic by playing several simple examples, some of which she adjusted slightly and played back-to-back in order to illustrate aural possibilities inherent when seeking to emphasize different aspects of data streams. Kyma has an easy-to-use tool to import text-based data streams. She went on to describe current applications, including the use of Kyma by the European Organization for Nuclear Research (CERN) in its attempts to identify the Higgs Boson and its use by seismologists to sonify live data streams. The third part of her presentation dealt with interpretations of sonified data, including a new project, which can be accessed at www.symbolicsound.com/share/sonification.

Steve Everett continued on the subject with his presentation entitled "Sonifying Chemical Evolution," containing both information on data

streams from the Center for Chemical Evolution and a description of compositional processes that he is using during the composition of *First Life* for string quartet, live audio-video processing, surround sound diffusion, and audience interaction. The work is funded by a grant from the Center, and the premiere performance was scheduled for March of 2012 in Atlanta by the Vega Quartet.

Everett's data streams themselves are interesting because they come from the formation of self-organized polymers and oligomers, processes necessary during very early stages in the formation of life. Everett intends to apply ten to fifteen data streams to physical modeling techniques, while introducing stochastic elements from the performers and audience into the process. According to Everett, science says that what he is doing is composition, not sonification, which, of course, is true.

Robert Jarvis presented an account of his progress on a new musical composition on which he is currently working titled *aroundNorth*. The composition is intended to be a permanent sound installation for the city of Armagh in Northern Irelend. The work is inspired by images of the stars photographed by the Armagh Observatory. Jarvis is essentially using a time-lapse photographic series of the night sky, individual photographs taken at the same time of night for one year. Jarvis treats the resulting images, in which stars appear to travel in the reverse direction through the sky, as a kind of music box disc. His intentions are to map each star's brightness, size, distance, spectral signature, placement in the sky, and other features onto musical parameters. The disc will conceptually "spin" at a very slow rate, resulting in a long period of repetition. The examples that he played for the audience were lovely and rich with depth. I look forward to experiencing the finished piece in the near future.

Following lunch, Mark Nazemi shared research from the Transforming Pain Research Group in British Columbia, Canada. In their search for methods of managing chronic pain, they developed systems that control audio signals through biofeedback. The goal of these researchers is to use sounds to manage pain directly through listening and also to provide signals to subjects regarding the state of their bodies. The latter goal facilitates learning for subjects as it helps to control certain biological and emotional functions that naturally manage pain signals.

Of course, such attempts have direct applications to music composition and sound design. It is one thing to use sonified data streams from Electroencephalography (EEG) and other biofeedback instruments, but it is something entirely different to sonify such data in real-time and attempt to control it directly. In many ways, this is the “stuff” of science fiction. In fact, technology and programming exists where a properly trained human can draw real-time pictures of their mental images using just their mind.

Theo Lipfert's presentation "Using Kyma and Avenue to Create Live Cinema" expanded on techniques used in his video and audio composition *Galileo, One Night Only*, which he performed on the Friday evening concert. The term "live cinema" at one time meant the live accompaniment of cinema – the practice with silent films as in Danksagmuller's "accompaniment" of *Die Frau im Mond* from the Saturday evening concert. For Lipfert and others, however, it means the live creation and manipulation of audio and video. As stated above, I suspect that Lipfert's efforts will cause a small run on Allegro VJ software.

Lipfert, a video artist by training, continued with five video tips for composers and sound artists, which included an abundance of useful and practical information. I suspect the tips are actually pet peeves, albeit very useful ones when presented as "tips." Number one: Use the correct format for the correct stage, whether it is acquisition, editing, or playback. Number two: Do not use "group of pictures" (GOP) compression. Number three: Understand the camera format. Number four: Use MPEG Streamclip or a similar application for transcoding to an editable format. Number five: Render to the appropriate format for the continent or continents for which the work is intended. Lipfert continued with even more useful information, ranging from HD vs. SD to aspect ratios to recommended editing software.

The final presentation of the symposium was

by Christian Vogel, entitled "GenMov: a language based score generator." Vogel prefaced his session with an account of his search for a new path of artistic research for himself and how it brought him to the current project. GenMov has to do with expanding context-free grammar files into simple scores for simultaneous audio and movement generation. He demonstrated with an example work for video, audio, and dancer. The work was very effective, combining images (including written text), audio (including spoken text), and live dancer. While it was difficult to watch both the video and the dancer at the same time, the counterpoint between the dancer and other elements was beautifully executed. Additionally, the juxtaposition and treatment of both written and spoken texts was brilliant.

The final evening concert of the symposium on Sunday featured five works. Scott Miller's *Orrery for Casa da Música* (2011), as noted above, demonstrated concepts from his presentation on Thursday. While the presentation suffered from technological problems, the performance of the musical work did not. Effectively combining sonic objects in space with historical recordings from Apollo moon missions, it evoked a distinct feeling of outer space and weightlessness. Miller's work with sonic ecosystems and audible mobiles was expertly realized in this understated work with spatialization occurring naturally, organically, and in real-time. This phenomenon was not only conceptual but visceral as well, projecting a genuine sense of kinetic energy, a characteristic that is of utmost importance in this situation.

Jon Bellona performed his own *AUU (and Ah UM)* (2010) on a stand-mounted Wacom tablet. The music was emotional and purposeful with simple, with clear sounds, and very effective form. Visual aspects of Bellona's performance were remarkable with unambiguous, purposeful movement of the Wacom pen and body language suggestive of discipline and order. The overall effect was of virtuosic control of the tablet, resulting in a riveting performance.

Lukas Steiner's *Elements* (2011) is a programmatic work for Kyma and interactive dancer. The program takes the aesthetics from “B movie” science fiction cultures with pop dance music and transparent form. Costuming and makeup were excellent, as was the performance by the dancer. In a way, this work functioned as a welcome relief to the complex and abstract music of the past few evenings.

Hector Bravo Benard's original submission was canceled and his fixed media work Traces was substituted in its place. Sounds were rich and sustained and evoked motion. The second half of the work had the effect of a sustained explosion, extending for minutes on end with intermittent synthesized machine gun fire. The effect was terrifying, and toward the end this reviewer heard voices forming in the noise, which Benard assured me afterward were not there. Several listeners also reported hearing voices and even acoustic musical instruments, none of which were actually there.

The final work of the evening and of the symposium, *Beautiful Beasts: a generative digital Performance* (2009 - 2011) by Pascale Barret and Rudi Giot, is a four-"chapter" work for Kyma, video, dancer, and sensor-augmented giant Teddy bear. Each chapter presented a different stage or emotional state from a reimagined version of the *Beauty and the Beast* story. Both video and audio were manipulated through sensors on a giant Teddy bear. A dancer handled the bear, treating it with a range of physical emotions, from loving to violent. The animation in the video, while low-budget in appearance, used fascinating points of view and orientation, including from inside of the virtual character on screen. The visual and aural choices were thought-provoking, while the performance was effective, sometimes disturbing, but always interesting.

KISS 2011 was an unequivocal success. Congratulations to Eduardo Magalhães. Presentations, lectures, workshops, and concerts were universally of high quality. The Casa da Música, despite its idiosyncrasies, is a magnificent structure perfectly suited for this event. Having all four lunches and all four dinners as a group was a stroke of genius and resulted in a bond among attendees that one simply does not see at events like this. An e-mail flurry the following day confirmed that many who were there shared this sentiment.

Matrix10 Perspectives of Live-Electronics

Review by Felipe de Almeida Ribeiro and Max Murray
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During June 2010, the Experimentalstudio SWR (Freiburg, Germany) held the second edition of the "Matrix Perspectives of Live-Electronics" Academy, connecting composers, instrumentalists, sound designers, musicologists, and music students from nearly 25 different nations. Amongst the academy's faculty were composers Mark-André, Dániel Péter Biró, Vinko Globokar, Detlef Heusinger, Brice Pauset, and José María Sánchez Verdú; sound engineers/ computer programmers Michael Acker, Reinhold Braig, Joachim Haas, Thomas Hummel, Gregorio Karman, and André Richard; instrumentalists Reinhold Friedrich, Robin Hayward, Jean-Éric Soucy, Andreas Grau, Jürgen Ruck, and Götz Schumacher; and musicologists Jonathan Goldman, Stefan Jena, Stefan Litwin, Julia Spinola, Peter Weibel, Christina Weiss, and Margarete Zander.

The Experimentalstudio is widely known as one of the most important studios in the world today. An integrated part of the Sudwestfunk (the Southwest German Radio), the studio has existed for nearly 50 years as an institute devoted to the production and research of electroacoustic music, receiving much acclaim through fruitful collaborations on live-electronics projects with renowned composers such as Karlheinz Stockhausen, Luigi Nono, and Brian Ferneyhough, and more recently with Mark-André, Chaya Czernowin, and Georg Friedrich Haas. The studio also works with emerging composers in terms of "work-stay" projects, giving composers the opportunity to research and employ state of the art technology and equipment for creative projects. The Experimentalstudio is known for its role in the development of hardware, such as the ring modulators used in Stockhausen's Mantra and the halaphon used by Luigi Nono in Post-praeludium per Donau, both pieces performed in the Matrix10. It is with this historically conscious sensibility that the Experimentalstudio has developed the "Matrix Perspectives of Live-Electronics" festival.

The Matrix exists as a forum for the teaching and exploration of electroacoustic music, existing as a week-long set of courses, lectures, and masterclasses for a select group of students. The students learn and further develop skills and perspectives on electroacoustic music, benefiting from the vast expertise of the Experimentalstudio's team. However, the Matrix festival differentiates itself from other courses for electroacoustic music by emphasizing the aesthetic intertwinement between music composition and the techniques employing music technology. The academy is organized around concerts, lectures, workshops, masterclasses, private lessons (with both composition and performance instructors), roundtables, and film screenings. These activities serve to provide a better understanding of the technical and creative processes involved in contemporary electroacoustic composition. It became clear in the courses that the starting point and goal for the Experimentalstudio is to successfully convey the aesthetic idea within a new project, regardless of the technical implications.

Finally, the Matrix courses also present a democratic openness regarding the participants' profiles. While selective (only a percentage of all applicants were accepted), course participants do not have to have a complete fluency in the techniques of electroacoustic music, but rather have to be genuinely interesting composers, performers, musicologists, and researchers who can benefit from the high level of instruction.

The Matrix10 Academy began with a series of lectures, masterclasses, and workshops conducted by the Experimentalstudio team. Thomas Hummel, sound engineer and programmer at the studio, described the studio's facilities and the equipment available to composers who carry out projects at the Experimentalstudio. Hummel, who is also a composer of electroacoustic music, introduced not only standard, commercially available devices to the students but also unique hardware developed and manufactured by the studio's team, such as the Halaphon, AReC, and

MatrixMixer. One can obtain more information on the studio's website, where an interactive tour section provides details on each device[3].

André Richard, composer and former director of the Experimentalstudio, gave two remarkable lectures on the music of Luigi Nono and Karlheinz Stockhausen. As a composer and sound engineer who collaborated closely with Luigi Nono, André Richard talked about his experiences working with Nono, speaking of the composer's aesthetic choices during the creation of the work for tuba and live electronics Post-prae-ludium per Donau {year of composition?} André Richard eloquently discussed the techniques used to create the sonorities and processes of the piece. To exemplify these techniques, tubist Robin Hayward and Experimentalstudio team members Michael Acker and Reinhold Braig were available for a full performance of the piece. It was astonishing to hear such complex sonorities coming out of a simple electronic setup: microphone, halaphon, quadraphonic speakers, reverb, delay, and filtering. The second lecture by André Richard was on Stockhausen's composition Mantra (1970), for piano duo and ring modulators, performed by the Grau-Schumacher Piano Duo with members of the Experimentalstudio. According to André Richard, the loudspeaker placement is crucial for balancing the live and electronic sounds in this piece, to control problems of latency. André Richard was not only concerned with levels of volume but also with the problem of sound directionality, demonstrating how the sound of the instruments could be perceived prior to the electronic sounds. Within both lectures it was exciting for the participants to see and hear André Richard demonstrating the original analog equipment used by Stockhausen and Nono, as opposed to what is currently done by digital means.

Reinhold Braig, a longtime team member of the Experimentalstudio, gave another stimulating lecture. Braig discussed the role of the sound engineer, not only as technician but also, in the true sense of chamber music, as an instrumentalist. Braig, who is a well-known musician in the European Jazz scene, perceives sound engineers as performers. He argued that both instrumentalists and sound engineers need similar training (the Experimentalstudio requires the same kind of comprehensive musical training from its sound engineers, who all have proficiency in reading complex scores and amazing aural skills, not only in terms of pitch recognition but also terms of timbre perception). Braig presented one recent hardware development project of the Experimentalstudio that provides the sound designer with a better physical interface for musical expression: the development and creation of AReC. This unique instrument allows one to physically control most, if not all, parameters of a composition's electronic realization. The equipment was developed having in mind what had been emphasized by Braig, as the feasibility of a performance where the ability to read a score and simultaneously control electroacoustic processing is a necessity.

French composer Mark André presented his composition for ensemble and live electronics entitled üg (2008). For this piece, André attempted to "transport" sonorous elements of a city, namely Istanbul, into an electroacoustic concert hall setting. Together with Joachim Haas of the Experimantalstudio, Mark André recorded the resonance of the "Blue Mosque" in Istanbul. The acoustics of the empty space were then used as then impulse responses in the live performance, as they were fed into live instruments. André made recordings of various Christian, Muslim, and Jewish communities in Istanbul and these sounds were integrated into this remarkable piece, creating a true sense of geographical and theological resonance within an electroacoustic context.

Convolution was also a central part of José María Sánchez Verdú's Opera entitled Aura (2007-2009), which was the topic of his lecture presented in coordination with Joachim Haas of the Experimentalstudio. During the lecture, Sánchez Verdú and Haas presented a series of experiments with a tam-tam and convolution. In Aura, Sánchez Verdú was able to create a continuous feedback loop, using convolution in a multi-layered spatial setting with multiple ensembles.

In the lecture "Composing resonant spaces

[3] http://projects.aec.at/experimentalstudio/index.html

with ghost instruments," composer Dániel Péter Biró presented excerpts of recent compositions Simanim (Signs/Traces) and Hadavar (The Word) (2009-2010). In these pieces, loudspeakers and contact microphones are employed to excite acoustic instrument resonance (pianos, gongs and harps) and create feedback. Simultaneously, convolution reverb is employed within the given physical space, as unique impulse-response characteristics are incorporated into the live signal of instruments and projected into the concert hall. Allegorical implications of the works were touched on: resonance, decay, and instrumental resonance act as extended metaphors for historicized sound, and the composer raised a multitude of questions about the nature of musical memory in an electroacoustic context. In this project, Biró worked in collaboration with Reinhold Braig.

As a contrast to the composer and technicians' lectures, Stefan Jena was in charge of the first lecture given by the musicologists: "... like Webern on the Wurlitzer organ. On musicology's attitudes to electronic music". Jena, Professor for Musicology at the University of Vienna, criticized the deficiency that currently exists in academic institutions when it comes to research related to electroacoustic music. Jena presented data referring to the University of Vienna's library suggesting that music academics, in general, lack interest in live-electronic music, compared to the amount of research conducted in other areas. He also reflected on Stockhausen's paradoxical position, from the perspective of musicology, of at once connecting his electronic music with the canonical works of the earlier 20th century. Jena also spoke of the composer's delegitimizing the serious study of his electronic works by virtue of the flimsiness of his theoretical writings. Jena defended the Matrix Academy as a crucial vehicle of information not only for composers and technicians but also for musicologists and theorists.

In another fascinating talk, Canadian musicologist Jonathan Goldman presented a lecture on the relationship between Pierre Boulez and the French Spectral School. Goldman, who is currently writing a book on Boulez for Cambridge University Press, raised a fascinating discussion regarding the dynamics of Boulez's 'anxiety of influence', and the paradoxical creation and development by IRCAM, of the very technology so foundational to the developments of this 'opposing' aesthetic school.

During Matrix10, the faculty of composition led a series of masterclasses in which composition students had the opportunity to present their work and get feedback from professors and other students. Mark André, José María Sánchez Verdú, Brice Pauset, Detlef Heusinger, and Vinko Globokar all conducted masterclasses.

In the masterclass led by Detlef Heusinger, composer and director of the Experimentalstudio, Irish composer Ann Cleare presented her composition for accordion and spatialized electronics. This piece, entitled I am not a clock maker either (2009), is a series of variations on and permutations of the accordion, in terms of sound and instrumental production. The composer spoke of her wish to place the audience inside the bellows of an electronically augmented meta-instrument. Diffusion is a central part of the work's spatial and temporal form, as live and processed accordion sounds are violently re-forged in the course of the work. The piece left a lasting impression, and Heusinger's comments were both instructive and illuminating. Heusinger also presented a very insightful lecture entitled "Redundance and Recycling." He gave a critical overview of the short history of electroacoustic music and, following Adorno, provided a framework for critical reception of electroacoustic music.

In addition, a series of private composition lessons were available for active participants. Private tutoring was also made possible with other guests of the Experimentalstudio such as Dániel Péter Biró, Reinhold Friedrich, Robin Hayward, André Richard, and Jean-Éric Soucy. For instance, Canadian violist Molly Janz, who came from the University of Victoria, had the chance to work with Jean-Éric Soucy.

New to the Matrix Academy was the series of workshops in which students' pieces were played; this was an important addition to the courses. This unique opportunity gave students access not only to a highly qualified team but also to the studios facilities. For this second edition of Matrix, three students presented their

work in collaboration with performers and the Experimentalstudio team. Christian Billian, Theodor Schubach, and even one of the writers of this review, Felipe Ribeiro, had their pieces played in sessions with the aid of sound designers Joachim Haas, Thomas Hummel, and Gregorio Karman, as well as guitarist Jürgen Ruck and cellist Yen-Ting Liu.

The workshops were divided into three parts. These consisted of the composer's presentation of the piece, a group discussion, and performance of the given work. Each supervisor gave feedback not only on how to improve the electroacoustic realization but also on how to enhance future performances. For instance, Thomas Hummel gave a talk on how important it is to write complete documentation for the electronic part, so that future sound engineers, programmers, and musicians can realize future performances even if the composer is not available for consultation.

Besides the multitude of lectures, masterclasses, workshops, and private tutoring, Matrix10 presented roundtable discussions and several film screenings. On the last day of the festival, musicologist Jonathan Goldman led a round-table discussion on "Spatializing technology, technologizing space" with Dániel Péter Biró, Ludger Brümmer, head of the ZKM (Center for Art and Media in Karlsruhe, Germany), Joachim Haas, and the pianist Stefan Litwin as respondents. In addition, film-screenings were included in the weeklong program. These historic documentaries on Luigi Nono and Karlheinz Stockhausen proved to be very useful in terms of creating a historical context for the course participants.

In addition to the daytime activities, two concerts were planned. The first concert featured works by Gérard Grisey, Jonathan Harvey, and Luigi Nono, and the second featured works by Karlheinz Stockhausen and course participants. For the first concert the Experimentalstudio presented IRCAM's live-electronic version of Grisey's Prologue (1976-2001) for solo viola, along with Luigi Nono's composition, Post-prae-ludium per Donau (1987) for tuba and live electronics. After hearing the lecture by André Richard, it was intriguing to hear the performance of this piece, and one could sense that this was an "authentic" performance in the truest sense. The electroacoustic processing employed clear sonorities, which gave way to a transparent succession of polyphonic voices as opposed to creating chaotic textures by means of effect saturation. The Experimentalstudio along with the GrauSchumacher piano duo presented a magnificent performance of Karlheinz Stockhausen's Mantra (1970). In this performance, Reinhold Braig and Michael Acker chose to use analog ring modulators instead of digital processing. Since the musical nature of this piece requires a near-zero percent latency response, a digital setup results in explicit out-of-sync attacks. Lasting nearly one hour, this performance provided the public with a rare experience of perfect communication and interaction between the instrumental and electronic realms.

In terms of the overall quality of the academy, the immaculate organization of the academy (made possible by the director of the Experimentalstudio, Detlef Heusinger, and the Experimentalstudio's team members Stefanie Haupt and Constanze Stratz), it is hard to imagine how future editions of the Matrix Academy might be able to improve. The Experimentalstudio provides a rare opportunity for musicians to experience both the past and future of electroacoustic music. In this sense, course participants can learn from the faculty, lectures, and roundtable discussions, experience competent performances of important electroacoustic works, and learn about the latest high quality research that can be further applied to their own music. Heads-up for Matrix11!

Publications

Sound in *Z*: Experiments in Sound and Electronic Music in Early 20th-century Russia
by Andrei Smirnov

96 pages, Sound and Music, UK, 2013 (forthcoming), $38.

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Despite what the letter Z in the title might suggest, *Sound in Z* by Andrei Smirnov is not a DSP treatise on filter design dealing with z-transforms. Neither is it a text describing the acoustic behavior of the world's largest X-ray generator housed at one of the Lockheed Martin owned labs. Instead, this book is about the largely unknown history of sound-related inventions and theories that began emerging in Russia in the 1920s. During that period of time there was a spike of creative activity throughout Russian society, which resulted in innovative thinking and demiurgic ardor of the highest degree. Some of those inventions and inventors, like the musical instrument Theremin created by Leon Theremin, the Variophone by Evegeny Sholpo, or the Alexander Nikolayevich Scriabin (ANS) synthesizer by Evgeny Murzin, are not completely new to the Western reader. However, most of the other numerous inventions are hardly mentioned in publications or have never been discussed at all. It took Andrei Smirnov about three decades of painstaking investigations to unearth and put together materials from various private and institutional sources (sometimes found in an abandoned state) – piece by piece, character by character, and story by story. This book is a unique and valuable contribution to the "Russian chapter" of the known history of sound-related inventions.

Sound in Z is related to a series of archival exhibitions that were based on similar materials. At the onset there was an exhibition dedicated to Leon Theremin in Graz[4], where some parts of the archives had been made public for the first time. The second exhibition, titled the same as the book, took place between 2008 and 2009 at the Parisian museum for contemporary art, the Palais de Tokyo[5]. Since then, the project has gone through a number of installations in Russia and, as of this writing, the last presentation took place in Hungary in 2011. The name of the exhibit has been changed to *Generation Z*.

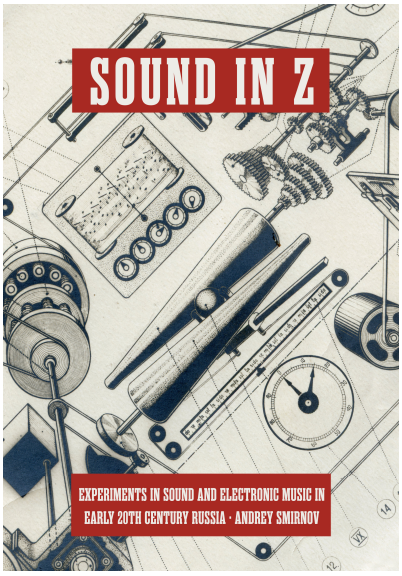

Figure 1. Sound in Z book cover

So, what does the **"**Z" in the title refer to? As Pchelkina describes in preface to the book: "The letter Z is in many ways emblematic of the period. Z is for zigzag, the spark; it is the symbol of energy, of radio transmissions, of electrical charges and of lightning. It became ubiquitous on book covers, posters, and in paintings during the 1920s. At the same time it is evocative of the anarchical, adventurous ideas and projects that went on during this period and that would have been inconceivable in other times – projects that were often anonymous and many of which have largely been forgotten."

Ostensibly, owing to its exhibitory roots, the structure of the book's narrative resembles a sequence of guided tours through chambers of various topics and characters. Sections are grouped into chapters, not unlike the manner in which exhibits are showcased in halls accompanied by short stories that denote their origins and meaning to visitors. Probably half of the book's material comes from documentary sources – letters, diaries, period articles, patents, inventor notes, and various kinds of reports. The same goes for the figures: there are over 200 examples of archival photographs, drawings, posters, score snippets, schematics, and diagrams. Eight chapters organize the space of

[4] *GRAZ MOCKBA GRAZ, Kunst und wissenschaft zwischen freiheit und terror*, dedicated to Leon Theremin, in DOM IM BERG, Graz, Austria, October 6 – November 4 2006 r., curated by Richard Kriesche.

[5] The *Sound in Z* materials were presented as a part of exhibition *From one Revolution to Another*, curated by Jeremy Deller.

that imaginary museum into topical spaces: (1) In the beginning was the Word; (2) Theremin; (3) New Trends and Institutions; (4) the Art of Movement; (5) The Revolutionary Sound Machines; (6) Sound vs. Image; (7) Graphical Sound; and (8) The Destruction of Utopia.

The author opens the book by stating that early Russian sound art mainly owes its advancement not to professionally trained academic composers, but rather to interdisciplinary art practitioners and autodidact polymaths. The opening chapter presents materials pointing to the innovative theoretical thought of the period. The book starts around 1910, and the first character to take the spotlight is painter and physician Nikolai Kulbin, whose seminal treatise *Free Music* (Kulbin, 1909) became an influential source for subsequent sound art theorizing and praxis. Based on neurological studies, his ideas called for the usage of micro-intervallic pitch distances. He became an evangelist for the liberation of music from the artificial limitations of academic tradition, pointing towards methodological developments based on continuities like those found in the sounds of nature. In the section "The Laboratory of Hearing" the narrative turns to Dziga Vertov**,** best known for his revolutionary filmmaking**.** The author, however, describes Vertov prior to his arrival at the world of moving images. Vertov's initial fascination with the world of sounds brought him to the concept of "organized hearing" and attempts to descriptively capture, in quite a "spectromorphological" manner, arbitrary streams of sound. Only after the failure of those experiments**,** due to phonetic and symbolic limitations of the language, he turned from onomatopoeia to filmmaking, looking for better ways of capturing fluctuations of the world. "Upcoming Science of Music" introduces writings by polymath theorist and practitioner of music Arseny Avraamov, who argued towards achieving a continuous timbral space and arbitrary sound-forms by using the technological means of the time – e.g. the phonograph. Elaborating on the microtonal ideas of Kulbin, he devised the "ultra-chromatic scale," a 48-tone microtonal tuning system created to bridge the gap between just intonation and equal temperament (Avraamov, 1919). Avraamov's contribution to the process of sound innovation in Russia was a substantial one, so time and again the reader finds his name in various chapters of the book. The next two sections, "The Enemy of Music" and "The Mechanical Orchestra," introduce a science fiction novel written in 1917 by inventor Sholpo. The novel was never published, but the manuscript survived in his daughter's personal archive. Sholpo, inspired by Avraamov's line of thought, describes a mechanical orchestra that eliminates the necessity of human performers, and the operating principles which predict many details found in the ANS synthesizer built some forty years later by Murzin. Chapter 1 concludes with the description of "The Leonardo da Vinci Society," a working group that gathered and operated in the belief that interdisciplinary research was the force needed to propel music into the future.

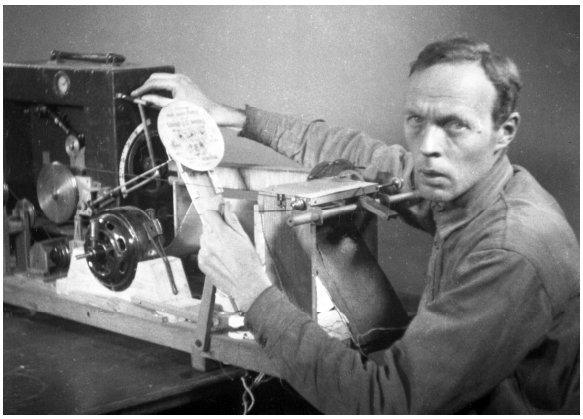

Figure 2. Photo of Sholpo from 1932

In Chapter 4 Smirnov delves deeper to the area of biomechanical research, presenting key figures that theorized about and shaped that process in various organizational forms. He introduces, among others, painter Solomon Nikritin, a now forgotten painter and theorist of Projectionism, and his "Projection Theatre," which found its home at CIT and became a demiurgic site for biomechanical training of human actors. The theatre featured a variety of courses following the Projectionist methodology. The material of spoken sound was analytically deconstructed into sub-lexical grain-trains of high density and rhythmic complexity. All kinds of improbable noises found their place and function within the rattling machine of the

projectionist sound. With their determination and zealotry**,** looking like members of a cult to the European eye of historian and journalist René Fülöp-Miller**,** the projectionists were redefining the philosophical grounds of theatrical media work (Fülöp-Miller, 1927). The author suggests that through its workshops and performances, the Projection Theatre pioneered a number of multimedia technologies of the late 20th Century.

The second chapter is unique, as it's the only chapter in the book dedicated to just one person. Not surprisingly, that person is Leon Theremin (Lev Termen in Russian spelling). Due to his unique historic trajectory that traversed the borders of Russia, Europe, and the United States, the knowledge of his inventions became accessible to the global community through the traces left by publications, interviews, video footage, and audio recordings. The chapter succinctly describes his life, and Smirnov points to the somewhat controversial position of Theremin within the context of musical innovation in Russia: despite his engineering genius and the appraisal by Avraamov, who called the Theremin "a social revolution in the art of music" (Avraamov, 1927), the inventor himself was interested mostly in traditional music and never participated in any "experimental" music projects. On the other hand, the author does notice the versatility and globalism of Theremin's engineering formulations, which went as far as looking for solutions to the problem of human mortality.

In the next chapter, the author describes institutions that, to a variable extent and capacity, provided an organizational context and resources for innovation during the period. Proletkult[6], founded in 1917, is characterized as a state-independent attempt to build a functional network of organizations based on the idea of exhaustive reevaluation of the arts through universal analysis and scientific knowledge. The objective of developing a new proletarian culture did not save it from being dismantled in 1932 when the state started eliminating organizations that showed the slightest hint of institutional independence. The Phonological Department of GINHUK[7] addressed the science of sound from perspectives of physics, speech, and music. GIMN[8] is presented as a frontier in musical science at this time in Russia, tying together research in "acoustics, musicology, psychology, physiology, the construction of new musical instruments, and ethnomusicology." It became an active volcano of research energy continuously erupting with theoretical and practical proposals. The description of its organizational structure is followed by examples of specific projects and inventions too numerous to mention here, but it is one of the most captivating sections of the chapter. The next institution discussed by the author is a little surprising because it seems to have little in common with music or the arts in general: CIT[9], which was established as a body of institutional research into the mechanization of the human worker – a Russian sibling of Taylorism. Nevertheless, the author argues, the organization can be seen as an interdisciplinary research powerhouse that delved into the understanding of man-machine interaction and produced a variety of devices for film, photography, as well as the biomechanical study of musical performance. The chapter concludes by elaborating the theme of cyborgs, with a short story of ANDROID {should this be in caps?}{Yes, this is the spelling of the system taken from the book}, a body-extending machine patented [10] around 1938 by space pioneer Ary Sternfeld.

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[6] Proletkult (Proletarskie Kulturno-prosvetitelnye organizacii) – Proletarian Cultural Educational organizations

[7] GINHUK (Gosudarstvenny INstitut HUdojestvennoj Kultury) – the State Institute for Arts Culture, existed in 1923-1926.

[8] GIMN (Gosudarstvenny Institut Muzykalnoj Kultury) – the State Institute for Musical Science

[9] CIT (Centralny Institut Truda) – the Central Institute of Labor

[10] USSR Copyright Certificate N 67162. Applied for 3.09.1938

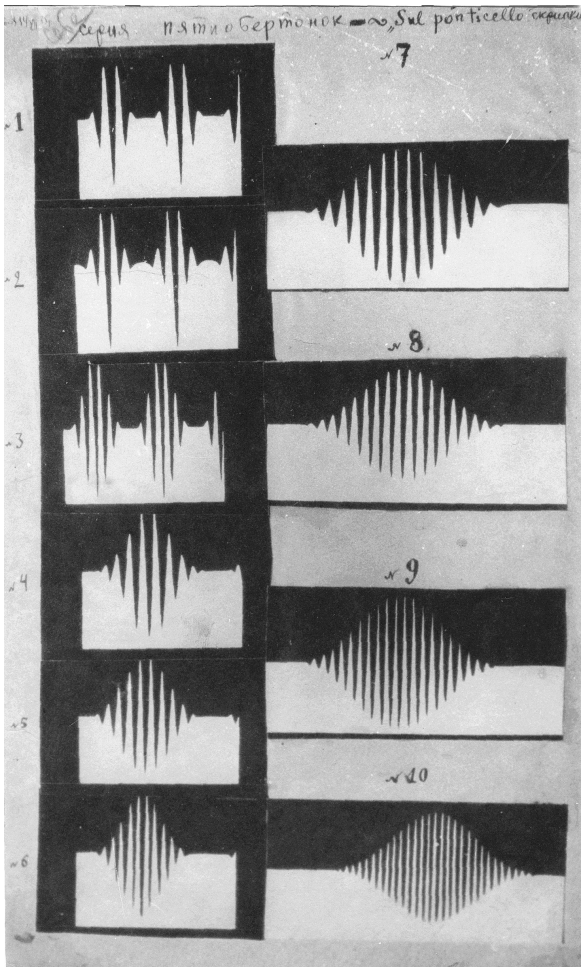

Figure 3. Yankovsky's penta overtones

Within the bounds of the subsequent chapter, the author focuses solely on sound and paints a panoramic view of cross-development between, as he suggests, two trends: the first inviting arbitrary sounds as compositional material, and the second inspired by the idea of the synthesis of speech and singing. The section entitled "Noise Orchestra" describes a new breed of sound practitioners called "shumoviks" – masters of noise-based sound mimesis. This was a predominantly grass-roots movement of the youth fascinated with "the chaos of life" and opposed to bourgeois individualism with the devices and instruments conjuring supra-human spirits of the era of electro-mechanical objects and processes. In "Talking Machines," Smirnov gives the reader a tour of the inventions based on technologies from this period, and provides a description of the concatenative approach to synthesis. In particular, this section outlines practical solutions for producing complex signals involving, among others, human speech and singing. The section "Various Sound Machines" extends the list of inventions with more examples, the operation of some of which resembles functionality of contemporary audio-visual tools. Chapter 5 concludes by describing the performance of *The Symphony of Sirens* (1922) – a grandiose project by Arseny Avraamov that called for a hyper-human scale instrumentation, consisting of sounds produced by military weapons and industrial objects.

Next, Smirnov turns to the beginning of the 1930s, when freshly born sound-on-film technologies had endowed editors with new ways of working with sound. Smirnov points out the profound difference between the aesthetic directions taken in Soviet era Russia: Soviet films adopted predominantly noise-based sound materials, while the Western world preferred traditionally performed musical materials. As the author shows, some early Soviet filmmakers, such as Sergei Eisenstein and Dziga Vertov, who proposed methodological decoupling of visual and aural semantics in films, created unique grounds not only for cinematography but also for making the soundtrack a work of art in its own right. Vertov, who was strongly opposed to the mimetic applications of sound practiced by shumoviks, developed an idea of treating sound according to its acoustic features. Smirnov suggests that many soundtracks were "aesthetically very close to the future Musique Concrète, invented by Pierre Schaeffer in France in 1948". Sound editing was so significant in early Soviet films that the sound and music credits might be longer than the cast listing.

Chapter 7, which is the longest in the book, contains materials related to "graphical sound" — sound synthesized from graphical sources using light and opto-electrical devices. The earliest sound-on-film systems, which were functionally and technologically diverse, started surfacing in Soviet Russia after 1926. The author marks 1929 as the beginning of graphical sound synthesis technologies invented in Soviet Russia. Parallel developments had been taking place in Germany in the work of Rudolf Pfenninger and Oscar Fischinger. Smirnov points to competitive practices and even secrecy that existed between international peers who

often, for public media presentations, showcased bogus presentation elements to mislead competitors about their actual technology. Such degree of demiurgic tension might have been tied to the profound ontological novelty of the method – it allowed composers to work directly at the level of specifying vibrations as opposed to traditional symbolic writing. Smirnov presents the ramifications that characterized the progression of this new technology in Soviet Russia: hand-drawn ornamental sound (Anonimuos, 1931), paper sound (Solev, 1935), automated paper sound (or the variophone[11]) and the syntones method (Yankovsky, 1935). Each method occupies its own section or two, describing corresponding inventions with ample references to archival sources. Presentations of the pre-1940s graphical sound inventions culminate in the depiction of work on synthetic acoustics conducted in early 1930s by Boris Yankovsky. Yankovsky's efforts were extraordinary in creating a comprehensive framework of cross-synthesis that aimed at achieving continuous timbral spaces via combinatorial applications of pre-configured spectral templates called syntones. His method of frame-based temporal splicing resembles granular sound synthesis, the theory of which was developed a few years later by physicist Dennis Gabor (Gabor, 1947). Smirnov further describes Yankovsky's vibroexponator, an invention that allowed to assemble spectral frames in any possible temporal combination. In various proposals, Yankovsky also addressed the problems of time stretching, as well as the separation of excitatory and resonating constituents of sound – a feature to allow independent control of pitch while preserving formant structures. From Yankovsky the narrative turns to Evgeny Murzin, the creator of the ANS optical synthesizer, a concept conceived in 1939 (two versions of the instrument were built much later in 1957 and 1964). Conceptually following Sholpo's mechanical orchestra and Yankovsky's focus on the spectral domain, Murzin developed an instrument that had 1/6 semitone pitch resolution and performed a dynamic optical score. Unlike most of its predecessors, the ANS synthesizer survived and was used by contemporary Russian composers such as Sophia Gubaidulina (Vivente, non vivente, 1970), Alfred Schnittke (Stream, 1969), Edison Denisov (Bird's Singing, 1969) and others. Smirnov concludes the chapter with a description of another invention by Murzin – a device for the visually impaired that provides aural version of a picture. The author calls it "artificial synaesthesia."

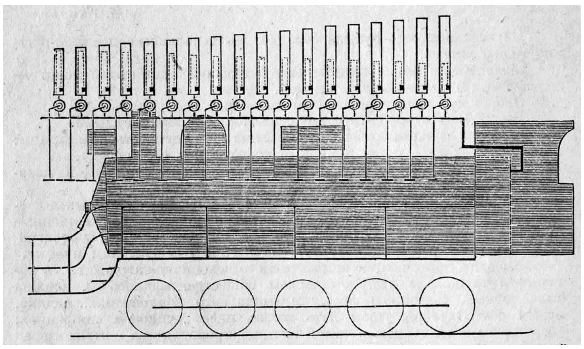

Figure 4. Avraamov's steam organ from ca. 1922

Sound in Z has no lack of examples with dates referring to events, personalities, organizations, and inventions. However, the reader may notice that typically those dates do not go much later than 1940 – be it a person, an organization, or an invention. In the last chapter the author depicts the socio-political catastrophe caused by totalitarianism in Soviet Russia, which started rapidly growing between 1925 and 1935 and eventually put an abrupt and undisputed end to truly revolutionary developments in the arts and related scientific research. The cornucopia of diverse and intrepid ideas was forcefully supplanted with the stasis of singular adherence to socialist realism, the only officially sanctioned paradigm of artistic expression. Smirnov shows how the utopia of the pioneers met its unfortunate demise and was thrown into the abyss of a historic void; people were arbitrarily accused and executed, organizations were dismantled, audio devices and recordings were destroyed, and archives and documentation were largely abandoned. Those archives that

[11] Copyright Certificate #22312 for the invention "Method and device for the production of the periodic sound track on film" by E. A. Sholpo, applied 19.05.1930 (application #69944)

survived did so because they were in someone's personal care. The author shows the degree of devastation that characterized the field of sonic research during the Soviet and post-Soviet era until the end of millennium.

Smirnov's book is a remarkable resource not only for the reader interested in the history of sound-related technology from Russia, but also for those interested in sound technology in general. Its body of evidence is constantly growing: initially the book was scheduled for publication in 2010 but as the amount of newly discovered material kept growing, the publication date was pushed further and further. According to the author, the material currently included in the book is four times the amount originally planned. As of this writing, the book is scheduled for publication in April 2012, but the final revisions are still being made to the manuscript due to new discoveries.

Another characteristic of this book is the distinct personal relationship of the author to his material. Being an inventor and musician himself, Smirnov tells his stories in a seemingly neutral voice, yet with great deal of empathy. He considers this work as merely a beginning; in his own words, taken from a private communication (Smirnov, 2012), the author says: "… the book's material is an attempt to put into common context the ideas and lives that haven't seemed connected before. It is an attempt to sketch out a roadmap for myself and future researchers because the theme hasn't been touched yet. This is a provocation for further research". Last but not least, I will end this review with a dedication from the book:

> "We dedicate this book to Mikhail Khodorkovsky, and all victims of the ongoing political reprisals in Russia, all those who are strong in spirit, who believe in the value of an open society, striving for democracy, knowledge, intellectual honesty and integrity, resisting dictatorship, lies, cynicism, violence, obscurantism and ignorance, even at the cost of their own freedom. Moscow, August 2012."

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MATLAB ® for Computer Music, Part II: More Action … and Control!

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In the last issue we briefly took a look at some of the basic MATLAB functionalities and various tips and tricks that could potentially be useful for computer music applications. We also showed a "quick" way to create animations using the pause and sound function but with limited control. In this issue, we will continue on the topic of visualization of audio data with a little bit more sophistication.

Animating Plots and Moving Cursor

A useful application of animation is in the context of visualizing "real-time" cursor movement in synchrony with audio playback. This type of scenario is, of course, a must in any DAW or audio file editor and is also quite easily implemented in MATLAB. In this issue, we will concentrate on this aspect – display an audio sample, play the audio file, have the cursor move along with the audio that is heard, and for good measure, overlay another "signal" (we will compute and display the RMS amplitude envelope).

As you may have guessed, we cannot use the sound function in this situation as there is no way to query sample playback-based status information or control the graphics while it is playing. With the sound function, as was used in our Part I, we need to wait until the end of the audio sample is reached before we can do anything else. To efficiently update graphic objects as they relate to the sound we hear, we need use the `get` command to obtain properties (and the set command to set properties) during audio playback: the get function can be used to continually set the location of the "cursor." To achieve this, we replace the sound function with `audioplayer` function. Before jumping into the implementation of this problem, however, let's look at the structure of the code that will make all of this happen:

a) Update the cursor *periodically* so that it follows the audio output

b) Move the cursor to the location of where the "current" sample is playing

c) Stop when we reach the end of the file

As far as the structure of the program is concerned, we can see that it is quite simple as we adhere to a structure similar to the one used in Part I of the MATLAB *Tips and Tricks* series in the previous issue. Now, going back to the `audioplayer` setup part, we see that this is also quite straightforward:

```
% load sample
load handel

% create audio player object with
signal and sampling frequency
player = audioplayer(y, Fs);
```

Code Example 1. Creating an `audioplayer`

The load function in the above example simply loads a pre-existing sample that comes with MATLAB. We could just as easily use the `wavread` or `auread` for to read wav and au files respectively. The load function, however, is a little different from the more standard `wavread/auread` function as it can store a number of different variables types. If you type whos in the MATLAB workspace, you will note that the command window will display all of the current variables in the workspace. Using save, we can store the entire workspace to a .mat file, or selectively save variables which can then be recalled using the load function as we did in our example. Think of it as an implementation of a sophisticated session-saving feature as commonly found in many software products as well as DAW systems. After we load the sample to our workspace, we initialize the audioplayer with two variables – y and Fs. Both variables

were saved by the MATLAB folks in the `handel.mat`.

```
% setup figure
figure(1)
clf
hPlot = ...
plot([0:length(y)-1], y, 'g');

axis tight;
ylim([-1 1])

% create "cursor"
hLine = line([0 0], [-1 1]);

title('Handel')
xlabel('Samples')
ylabel('Amplitude')
```

Code Example 2. Creating handles and plots

An instance of the `audioplayer` is then referenced by variable player. Next, we set up the figure before doing any updates so that the code runs efficiently – this is basically the same as what we did earlier in Part I (see Code Example 2.)

`figure(1)` creates a new figure with index 1. If figure 1 does exist, we will overwrite what is plotted with our waveform by resetting the figure with the `clf` (stands for clear figure) command. We then plot the waveform by setting the x-axis sample values (starting from 0) and the y-axis amplitude values stored in y. The handle to the plot is stored in `hPlot` and we also set the color of the waveform to green to make things clearer as our cursor will be in blue by default (more on this shortly). Next, we use the axis tight command to create a plot that leaves no empty space before and after the waveform in both x/y dimensions and use the `ylim` command to limit the y-axis min/max to `-1` and `+1`. Finally, before playing the waveform, we add the cursor using the line function – we could have used the `plot` function here as well, but line is easier to use in this situation. Note that we only have to set the starting and ending x-axis/y-axis values to create a line. In our example, the "line" is a vertical line representing the cursor which extends from –1 to +1 located initially at the 0 sample point. In order to have the cursor follow the audio that we hear, we need a handle to the line as shown above. We use the handle to update the line parameters.

The next segment of code shows how we play the waveform and update the cursor to give us an illusion of the cursor following the audio in real-time (note that "…" is used in MATLAB to continue writing code that spills over to the next line):

```
% play the waveform
play(player)

% update the figure's line object
while(isPlaying(player))
    currentSample = get(player, ...
'CurrentSample');

    set(hLine, 'XData', ...
       [currentSample,
currentSample]);

    pause(.01)
end
```

Code Example 3. Animating the cursor movement

We start playback using the play function and then enter the `while` loop where we update the line object. The `while` loop breaks when `isPlaying(player)` returns a Boolean 0, indicating that the player object has stopped outputting samples: i.e. reached the end of the waveform. The first line in the while loop "gets" the current sample that is being played by the `audioplayer`. We use the handle to the cursor (`hLine`) to only update the x coordinates by using the set function as shown above and replace the old x coordinates with the new ones now stored in `currentSample` (remember that we need both the start and end x coordinates for the line function). As before, we use the pause function to allow time for updating the figure and poll the next sample after around .01 seconds. The audio continues playing in the background.

The final segment of code as listed in Code Example 4, shows how we compute and plot a simple RMS (Root Mean Square) amplitude envelope as defined in Equation 2. `N` is the size of the window, `x` the input signal, and *n* the discrete time index.

$$RMS = \sqrt{\frac{1}{N}\sum_{n=0}^{N-1} x^2[n]} \qquad (2)$$

The beginning of RMS code sets the window size in samples in order to get the number of RMS frames. We then proceed to create a placeholder (allocate memory padded with zeros) for the RMS array by initializing memory with `numOfFrames` elements. Although manually allocating memory in MATLAB is not required, for efficiency, it is nevertheless important in situations when we want to update an array in a loop. Without initializing memory before entering the loop, `rms(i)` would dynamically allocate additional memory at every iteration of the loop. This spells disaster for large loops as it would create bottleneck problems and animation would stagger quite severely. Since we already know the size of the array, it is recommended to allocate memory beforehand as we have done here. The `for` loop itself is quite straightforward except perhaps for the ":" and "." operators. As before, the ":" operator is used to access a portion of an array as defined by the `startIdx` and `endIdx` variables we set before entering the loop – it is used to window the signal and traverses through the waveform. The "." operator is very useful and allows for "element by element" computation. For example, if the portion of array y included the following 3 samples: 3, 7, and 5, the `.^2` operator would simply square each of the numbers individually, which would result in a new array consisting of 9, 49, and 25. As you may have already anticipated, the mean function is a built-in MATLAB function that computes the arithmetic mean. Before we plot the RMS envelope, we need to make sure that it is scaled appropriately in the time-axis as we have fewer data points for the RMS envelope compared to waveform y. Once we compute the axis "hop" amount we plot the envelope while using the hold on command to keep what is already being displayed and *add* the RMS envelope.

```
% compute rms: Root Mean Square
windowSize  = 1000;
numOfFrames = ...
floor(length(y)/windowSize);

 % make placeholder for rms array
rms       = zeros(1,numOfFrames);

%initialize indexes
startIdx = 1;
endIdx   = windowSize;
```

```
for i=1:numOfFrames
    % compute rms for window
    rms(i) = ...
    mean(y(startIdx:endIdx).^2)^.5;

    % update indexes
    startIdx = startIdx + ...
               windowSize;
    endIdx   = endIdx + windowSize;
end

% compute x scaler: hop amount
xScaler = length(y)/length(rms);

hold on
hRMS =
plot([0:length(rms)]*xScaler,...
            [rms rms(end)], 'r');
```

Code Example 4. Computing the RMS

Extendibility

Adding other "objects" on the figure is quite straightforward as we can use similar techniques of handles and set functions to update the various objects on the plot. For example, if we wanted to add text with sample the current sample number or current time, we could use the `text(x, y, 'string')` function to accomplish this:

(1) add a "text" object to the plot; save its handle.
(2) use first two arguments to set its location.
(3) use the `num2str()` to display the time.
(4) use the set function in the loop to update y and the string.

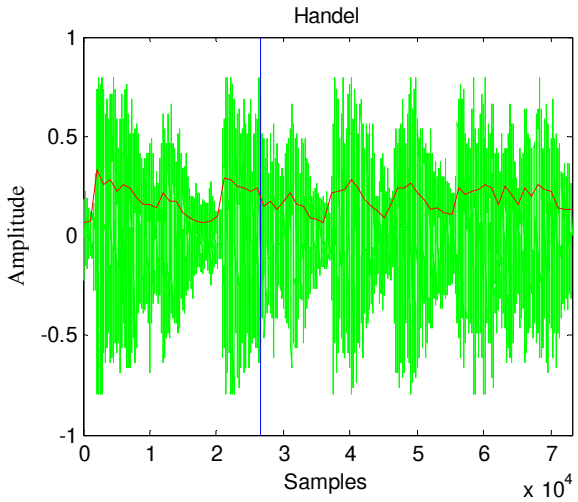

Figure 1. Waveform, cursor, and RMS envelope

Conclusion

In this article we gave an overview of some quick ways in creating animation while playing sound with control over the graphics. As far as the "DSP" side is concerned, engaging in more interesting experimentation such as amplitude modulation is now as easy as multiplying two sinusoids (see Code Example 4 in our Part I for creating a sine wave):

```
yAM = y1 .* y2;
```

Code Example 5. Simple amplitude modulation

And implementing FM synthesis will also be quite straightforward and will look something akin to Code Example 6:

```
yFM = sin(2*pi*f*[0:fs-1]/fs + ...
yMod);
```

Code Example 6. Simple FM synthesis

In Part I and Part II, we have presented some basic animation strategies that can be useful in situations where visualizing data in synchrony with audio is important. In a future *Tips and Tricks* article we will present topics pertinent to creating custom graphical user interfaces (GUI) in MATLAB using the GUI Design Environment (GUIDE) which allows for quick building of graphical user interfaces.

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SEAMUS seeks to provide a broad forum for those involved or interested in electronic music. Through its journal, newsletter, national meetings, and its national archive at the University of Texas, SEAMUS seeks to increase communication among the diverse constituency of the relatively new music medium.

The Society's objectives include:
To encourage the composition and performance of electro-acoustic music
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To attract a wide diversity of members and supporters
To advocate licensing and copyright concerns

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