SCHOOL OF MUSIC
UNIVERSITY OF MINNESOTA

NOEL ZAHLER, director

2005 | THIRD ANNUAL

spark
festival of electronic music and art

featuring

a mix of the latest in **electronic** and **electroacoustic music**, **powered installation art**, **dance** and other interdisciplinary events.

Lectures, Performances and a Master Class with Keynote Artist Philippe Manoury

Special Performance by Guest Artist DJ Spooky

Panel Discussion and Paper Sessions

Experimental Performances and Concerts

February 16-20, 2005

The third annual Spark festival takes place in the University of Minnesota's West Bank Arts Quarter, Minneapolis Campus

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DJ Spooky Co-Sponsored by

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WELCOME:

Welcome to Spark 2005! Over the course of five days, Spark 2005 will feature audio/video pieces, concert works, and installations by over one hundred artists and composers from around the world. We're excited about the wealth of talent gathering for this year's festival, and hope you take the opportunity to experience the wide array of work we will present.

This year's featured keynote artist is Philippe Manoury, research scientist and professor of composition at the University of California, San Diego and at IRCAM, positions he has held, respectively, since July 2004 and since 1984. Mr. Manoury is known for his captivating work, which examines and explores the relationship between composition and perception. Mr. Manoury will give a master class to composers and the keynote lecture during the festival.

Also featured as a guest artist this year is DJ Spooky that Subliminal Kid. DJ Spooky, the constructed persona of conceptual artist, writer and musician Paul D. Miller, will present a lecture/demonstration titled Rhythm Science, a multi-media presentation of the history of digital art and media from the viewpoint of an artist who uses found objects and how DJ culture has evolved out of the same technologies that are used for digital media and art. DJ Spooky's lecture/demonstration will take place the first night of the festival, Wednesday, February 16, in the Coffman Memorial Union Theater. This event is co-sponsored by The Whole at Coffman Union.

SPECIAL THANKS:

The Spark Festival gives special thanks to Dr. Noel Zahler, Director of the University of Minnesota School of Music; Dr. Steven Rosenstone, Dean of the College of Liberal Arts; the Infotech Fees program of CLA; David Hill; the entire Spark staff and School of Music staff, for their tireless efforts; and all of the artists, composers, and performers who agreed to take part in this year's festival, for their creative vision.

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Schedule of Events

Wednesday, February 16

8:00–10:00pm
Coffman theater

"Rhythm Science" with DJ Spooky

Thursday, February 17

9:00–11:30am
Influx Auditorium,
Regis Center

Paper Session:

Michael Berkowski
Sound Organization and Spatialization with John Conway's *Game of Life*

Robert Hamilton
Rolling the jChing: A Java-Based Stochastic Compositional System

Scott Miller
Audible-Mobiles: An Application of Eco-Systemic Programming in Kyma

Kevin Baird
No Clergy: Real-Time Generation and Modification of Music Notation

Henrik Frisk
etherSound: an Interactive Sound Installation

11:30am–1:30pm
225 Ferguson Hall

Panel session:
The Polarized Composer: Addressing the Conflict of Musical Upbringings of Today's Young Composers

3:00–4:00pm
Weisman Art Museum

Lectures About Installations

4:00–5:30pm
Weisman Art Museum

Video and 60x60 Concert

7:00–9:00pm
The Whole, Coffman Memorial Union

Experimental Performances

9:30pm–1:00am
Town Hall Brewery
1430 Washington Ave. S

Experimental Performances

Friday, February 18

8:00–10:00am
90 Ferguson Hall

Paper Session:

Marcus Bittencourt
Acousmatics, Sound Objects and Instruments of Music

David Kim-Boyle
Spectral Delays with Frequency Domain Processing

Ronald Keith Parks
Real-Time Spectral Attenuation Based Analysis and Resynthesis, Spectral Modification, Spectral Accumulation, and Spectral Evaporation; Theory, Implementation, and Compositional Implications

George Brunner
Text Sound: Intermedia, Interlingua, Electronica

Brian Kane
L'Object Sonore Maintenant: Reflections on the Philosophical Origins of *Musique Concréte*

10:30am–noon
90 Ferguson Hall
Master Class with Philippe Manoury

2:00–3:30pm
Weisman Art Museum
Spark Cinema

4:30–6:00pm
In Flux Auditorium
"Audio Immersion" Concert

8:00–9:30pm
Lloyd Ultan Recital Hall
Electroacoustic Concert

10:00pm–1:00am
Town Hall Brewery
Experimental Performances

Saturday, February 19

8:00am–11:00am
225 Ferguson Hall

Paper Session:

David McIntire
Aspects of Flow: Structural Elements in Barry Truax's *Riverrun*

Christopher Bailey
Construction of Balladei, a Work for Piano and Computer

Ivica Ico Bukvic
The 0th Sound

John Gibson
RTcmix: Recent Developments

Craig A. Coburn and A. William Smith
Musical Landscapes Using Satellite Data

Robert Rowe
Personal Effects: Weaning Interactive Systems from MIDI

Saturday, February 19 (cont.)

11:15am–12:30pm NeXT Ens Concert
Lloyd Ultan Recital Hall

1:30pm–2:15pm SmartMusic Demonstration
225 Ferguson Hall

2:30–4:00pm Manoury Keynote Lecture
225 Ferguson Hall

4:30–6:00pm Shiau-uen Ding Concert
Lloyd Ultan Recital Hall

8:00pm–9:30pm Electroacoustic Concert
Ted Mann Concert Hall

10:00pm–1:00am Experimental/DJ Performances
Town Hall Brewery

Sunday, February 20

11:00am–noon Coffee Concert
In Flux Auditorium

12:30pm–3pm Symposium Fast Forward, Paper Session:
In Flux Auditorium

J. Anthony Allen
Jonathan Harvey, *Mortuos Plango, Vivos Voco*: An Analytical Method for Timbre Analysis and Notation

Matthew Peters Warne
The Voice as a Source of Gestural Control

John W. Lato
HumanInput: A Musical Interface to 3D Environments

Harry Smoak
Sites for media choreography: Where media perform bodies and bodies perform media

Jamie Allen
boomBox—a Bluetooth Interfaced Visceral Sound Buffer Controlling Digital Musical Instrument

Photo: Patricia Dietzi

Philippe Manoury

Born in Tulle, France, Philippe Manoury studied piano with Pierre Sancan, harmony and counterpoint at the Ecole Normale de Musique in Paris, and composition with Gerard Condé and Max Deutsch. He earned a first prize in analysis and in composition at the Conservatoire National Supérieur de Musique, Paris. The premiere of *Cryptophonos* by the pianist Claude Helffer in 1974 at the Festival of Metz brought him to public attention. In 1978, Manoury settled in Brazil to give courses and conferences on contemporary music in various universities (São Paulo, Brasilia, Rio de Janiero, El Salvador). In 1981, returning to France, he was invited to work at IRCAM. During this period, in collaboration with the mathematician Miller Puckette, he conducted research in the field of real-time interaction between acoustic instruments and new technologies related to musical data processing. In 1985, the Council of Europe commissioned his *Aleph* for the European Year of Music, which was premiered in Strasbourg the same year. The Théatre du Châtelet premiered his opera *60e Parallele* in 1997 and, more recently, he was invited composer of the Musica Festival in Strasbourg, where most of his *Suvres* was performed. His activity as a composer has taken him to many countries. In 1989 he took part in the European tour of IRCAM and the Ensemble Intercontemporain (Moscow, St. Petersburg, Berlin), and then in 1993 in Oslo, Amsterdam, Rotterdam, Utrecht, Vienna, Bratislava, Helsinki, and New York. He was invited to the Tokyo Summer Festival in 1994. His *Suvres* has been performed by principal orchestras (Orchestre de Paris, Chicago Symphony, Finnish Radio Symphony, Ensemble Intercontemporain, Radio France, London Sinfonietta, and others) and by prominent conductors (Pierre Boulez, David Robertson, Peter Eötvös).

Manoury also continues teaching activity. From 1983 to 1987, he was responsible for pedagogy within the Ensemble Intercontemporain; from 1987 to 1997, he was professor of composition and computer music at the Sony Center of the Conservatoire National Supérieur of Lyon. In 1992, he was guest composer of the Acanthes center of Villeneuve-les-Avignon and the following year with the summer academy of IRCAM. He has given many composition seminars in various countries including Germany, Finland, Sweden, Norway, and the United States. Between 1998 and 2000, Manoury was music director of the Academie Europénne de Musique and musical adviser to the Festival of Alx-en-Provence, as well as composer in residence of the Orchestre de Paris from 1995 to 2000. In 1998, he received the Grand Prix de la Musique from the city of Paris. The French performing-rights organization, SACEM, awarded him its prize for chamber music in 1976, the prize for best musical performance for *Jupiter* in 1998, as well as the Grand Prix for symphonic music in 1999. For his opera *K...*, he received the Grand Prix of the Société des Auteurs et Compositeurs Dramatiques.

InstallationWorks

etherSound	Henrik Frisk
Leave-ings III	Diane Willow
Leave-ings IV	Diane Willow
Fly on the Wall	Christopher Baker
Traces of Silent Gifts	Andrew Lange & Katinka Galanos
Paper Bag	Katinka Galanos
60x60	Robert Voisey & Shimpei Takeda

Notes

etherSound

etherSound is an interactive instrument/sound installation in which the main intention is to create a vehicle for audience participation through the use of SMS (Short Message Service). etherSoundwas commissioned by the curator Miya Yoshida for her project The Invisible Landscapes and was realized for the first time in August 2003 at Malmö Art Museum in the city of Malmö, Sweden. The curatorial concept for The Invisible Landscapes project was the use of cellular phones in the context of experiencing and creating artistic expressions. The principle idea behind etherSound came to be an attempt at developing an instrument that can be played by any people who have knowledge about how to send an sms (Short Messages Service) from their cellular phones. The focus of my research project, of which etherSoundis a part, is interaction between computers and musicians as well as non-musicians. etherSoundis an investigation of some of the aspects of interaction between the listener, the sounds created and the musicians playing, and also of the formal and temporal distribution of the music that this interaction results in.

Leave-ings

Materials: bamboo, pear leaves, copper wire, sensors, microcontrollers, pager motors.

The Leave-ings installation series evolved from an impetus to create a responsive greeting for each person entering a space that generally rendered their comings and goings invisible and anonymous. Inspired by the tenacity of oak leaves rustling in the gusts of winter winds, I began to explore the medium of rustling leaves for interactive, improvisational sonic choreography. Two of these, including one created for the Festival, will be presented at Spark.

Leave-ings III, 2004

Whisker-like sensors reach into the space from suspended bamboo trusses that carry dangling, crisp leaves. As people wander under the leaves and around the whisker elements they activate vibrations that rustle the leaves. The visceral, enveloping quality of these sounds readily conjure memories that spark one's imagination towards places beyond.

Leave-ings IV, 2005

Out of a crowd and into the essence of wind and leaves, this installation offers a respite, counter point and antidote to swarming crowds in public spaces. The gesture of ducking into a sonic alcove actives a spiral rustling that is yours to play.

Fly on the Wall

Materials: Computer, Video Projector, Live Internet Connection, Custom software written in Max/MSP/Jitter and Java.

Fly On The Wall was the first experimental iteration of a larger study that seeks to develop new ways to more physically and visually represent network communications and online communities. This larger untitled study seeks to highlight the ways that popular modes of virtual communication (such as internet chatting and email) are transforming our more traditional face to face communication strategies.

Inspired by the text harvesting strategies of Mark Hansen and Ben Rubin, *Fly On The Wall* establishes a live connection with a large number of IRC chat rooms and subsequently displays the content of these public conversations on the wall of a public space.

Traces of Silent Gifts, 2004

Installation: 18 min., 2-channel video and performative objects 7' x 5' x 2'

100 screenprints - black lace on black butcher paper
100 castings - black wax tongues
100 actions - the wrapping documented on video

A long distance synchronicity happened the morning of November 22, 2004. It was the day that we had set aside to document the final stage of our collaborative work, which had begun only a little longer than a month before. We had agreed that it would be appropriate to wear all black – continuing our work's repetitive and monochromatic formal aesthetic. This is what led to each of us, separately, feeling the strangely orchestrated act of getting ready for a funeral. Somehow, on this morning, our collaboration seemed to span an eternity in the single and specific moment of getting dressed. The act of dressing, of wrapping our bodies in black, imprinted on us the notion of our *now* collective memory. This is the exact thing that a funeral sets out to do. It collects the body's memory and leaves behind its trace, wrapped up like a gift in its silence.

Our collaboration began as a transgression against the constant and relentless discussions of process. Within the mindful and physical act of simply making something, our work has come to draw out this transgression. The final piece is a mound of the performative remains of our actions, wrapped up in a shifting and fluid idea of *the trace*.

Paper Bag, 2003

Basswood, speakers, CD player, looped sound
("Help me Obi-Wan Kenobi, you're my only hope", Princess Leia from *Star Wars*)
12" x 6" x 17"

Coffman Theater ◦ Wednesday, 8:00pm – 10:00pm

“Rhythm Science” with DJ Spooky


Photo: Tobin Poppenberg

“Once you get into the flow of things,
you’re always haunted by the way that things
could have turned out.
This outcome, that conclusion. You get my drift.
The uncertainty is what holds the story together,
and that’s what I’m going to talk about.”

DJ Spooky that Subliminal Kid

DJ Spooky, the constructed persona of conceptual artist, writer and musician Paul D. Miller, presents a lecture/demonstration titled “Rhythm Science”, a multi-media presentation of the history of digital art and media from the viewpoint of an artist who uses found objects and how DJ culture has evolved out of the same technologies that are used for digital media and art.

DJ Spooky is an energetic and prolific performer whose outlook was shaped by his parents’ involvement in the civil rights movement—his father was a lawyer for the Black Panthers and his mother a leader in the Afro-Futurism fashion movement. DJ Spooky has recorded extensively and routinely exhibits his visual art, contributes articles to publications such as the *Village Voice* and *Vibe* and writes books on music theory, intellectual property and science fiction. His latest book *Rhythm Science*, published by MIT Press, has been lauded by critics and made a spot on the Books of the Year list in the UK *Guardian Observer*.

DJ Spooky Co-Sponsored by

whole music club

“In *Rhythm Science* Miller remixes sounds and ideas with equal dexterity. A new vibe for a new world.”
—John Akomfrah, film director

Thursday, 11:30am – 1:30pm ○ 225 Ferguson Hall

Panel Session

The Polarized Composer: Addressing the Conflict of Musical Upbringings of Today's Young Composers

Panelists:

J. Anthony Allen (Moderator), University of Minnesota (alle0434@umn.edu)

Per Bloland, Stanford University (bloland@stanford.edu)

Margaret Schedel, Cincinnati Conservatory of Music (gem@schedel.net)

Robert Hamilton, Centre de Création Musicale Iannis Xenakis (CCMIX) (robert_k-hamilton@yahoo.com)

Opening Statements:

J. Anthony Allen

In American academic music composition from the 1950s through 1970s, aesthetics of experimental modernism prevailed and composers whose work did not embody this aesthetic were often considered less "serious."

During the 1970s the growth of popularity of both postmodern and minimalist music opened the door for many composers to incorporate other stylistic techniques into their work. Both postmodernism and minimalism incorporate influences and materials from pop music. Since this time there has been a tension between composers who continue to follow modernism and those interested in incorporating materials from the popular world.

Meanwhile, through the onslaught of popular media, popular music is everywhere and most composers are raised on it. Popular music, because of its increasing ubiquity, has become a virtual *lingua franca* of American culture.

Unlike the well-documented "Anxiety of Influence" (where artists consciously reject their predecessors), this stylistic divide has led many composers to adopt a strict modernist stance, disregarding the music of the culture in which they live. That is, when many young musicians decide to declare themselves "composers," they feel the need to remove all pop music influences from the music they write in order to be considered serious.

Perhaps we can refer to this as the "Adoption of Influence": composers enter the academy to write music, and once there, they adopt the style and techniques of academia, even though in many ways this isn't their tradition. To a certain extent it is natural for students to adopt techniques of the Western classical tradition while studying at a music school, and this can be very valuable. However, for many, at some point they feel that in order to be taken seriously, a complete abandonment of their pre-academic music style is necessary.

This is not a critique of *all* composers, by any means. Many composers have come to incorporate a popular music influence and many simply don't have a popular music influence. That is, they were truly raised on classical music. John Corigliano, for example, recently did a setting of songs using texts of Bob Dylan (*Mr. Tambourine Man* among them). He claimed in an interview he had never heard these songs before, and only knew the poetry.[1] This is indeed an exception in today's media-driven culture. It is worth pointing out how exactly Corigliano was able to avoid this: he grew up in a family of professional concert musicians.

Many composers currently in and around academia did not have this upbringing, however. In the same way that Corigliano writes music that is very true to his musical heritage by *not* incorporating a popular influence (at least not directly), those of us who do have this heritage should not feel the need to suppress it and adopt the heritage of someone such as Corigliano.

In the field of electronic music, we hear a much more accepting community. Most of the composers of electronic music I know have come to it through popular means. Being involved with a recording session of a band leads to a curiosity in digital synthesis, and even simply playing guitar leads many to the field of electronic music. The electronic music community is increasingly embracing the popular music world (specifically popular electronica music), because we share similar tools and ideas. However, most pieces of electronic music programmed at electronic music festivals by younger composers are in a style that appears to be an "Adoption of Influence". For example, I have met many composers at conferences who present a tape piece that is extremely abstract and avoids even a hint of a beat. During a post-concert discussion over a few drinks, they offer a copy of their techno album, referring to it as their "real music."

In summary—this phenomenon of an "Adoption of Influence" generates a conflict: a push and pull between two passionate influences (that which one studies in the classical music canon, and that which one is raised on). It is my opinion that the incorporation of both influences will lead to interesting music, but more importantly that the conflict itself will lead to new and exciting frontiers in music. The conflict is not one that is easily addressed. Throughout this statement, I have used the pronoun "they", but could just as easily have used "I". I grew up with popular music nearly exclusively, and I have only in the last few years been able to acknowledge this conflict. I could not simply allow these influences into my music, it was a struggle to let some of them in, and the resulting conflict serves as a filter for certain ideas, gestures, and even notes. Incorporation of all of my influences (and after many years as a student, that now truly does include the classical music canon), is the only way I feel I will begin to write music that is "true": something I completely enjoy listening to, not because I wrote it, but because it is exactly what I want to hear.

Per Bloland

The issue of personal style and the incorporation/rejection of influences is, and I suspect always has been, a difficult one for young composers. Even were we to eschew aspirations of professional success, the desire to receive approval from those whose opinions we respect is powerful and often quite subtle. One of the primary challenges for a composer at any stage of his career is to achieve some level of personal satisfaction through the process of composing. This may come in many forms and certainly does not entail that composing always be enjoyable. But the results must be, in some way, meaningful.

The interests of the academy, on the other hand, with which most of us are associated in one way or another, are quite different. While particular individuals within the academy may be deeply concerned with one's personal sense of satisfaction, the academy at large essentially is involved in the accumulation of prestige.

In order to properly address the issue of popular music in the academy, it seems pertinent to clarify the terminology. The use of the term "popular music" in this context refers to music of the vernacular in general, rather than "pop", or top 40. I point this out not to belabor semantics, but to highlight what I perceive as a confusion of goals. Too often it seems that the incorporation of popular influences (meaning vernacular) is associated with the drive to increase accessibility. Both of these issues are currently "in the air" to a greater or lesser degree, depending on one's environment. They are, however, entirely distinct and, at least for our purposes, should be treated as such.

Another concern in dealing with this issue involves the overall level of tolerance evinced by the academy at large. General consensus seems to hold that there is currently a higher tolerance for stylistic excursions, in whatever form they may take, than during the era of high-modernism, particularly in the 70s and 80s. There are many stories of student composers who were discouraged from further pursuit of their degree because their music was not perceived as sufficiently academic. Certainly this is still the case to some degree and in some circles, but it does appear that overall the stylistic bandwidth has widened.

The potential for problems arises, I believe, when the incorporation of newly-available styles becomes an imperative. Once this occurs, the bandwidth mentioned above begins to shrink again, with a different crowd falling within its confines. The question referred to indirectly above remains: how does one maximize one's access to personally-meaningful composition? Though thorough discussion of this question is outside the scope of this panel, I will say that external suppression of otherwise-significant influences is antithetical to this goal. But how these influences are brought to bear is an exceedingly complex and, again, personal issue. It is certainly possible to channel specific aspects of a familiar genre in new directions. These aspects may be overt, such as specific types of rhythmic or melodic gesture, or more difficult to quantify, such as energy or drive. In any case, recognition of the diversity of modes of influence is as important as recognition of the diversity of personal tastes.

Margaret Schedel

I grew up in a different world than the rest of the panelists: my father would not allow me to listen to popular music. Until high school I didn't even like rock music; I found it grating, and so I didn't even seek it out on my own. The music I listened to was the music I played on the piano and cello—music from 1700 to 1900. Our radio was always tuned to the classical music station, and even though it emanated from New York, the programming was not very adventurous. I grew up in a world where all composers were dead white men, yet I wrote short pieces of my own.

My father bought me Finale and a MIDI interface to encourage me, but none of my music teachers ever showed a real interest in my compositions. I came to electronic music not through a band, but through a summer course at Oberlin College. There was a poster up at my high school for a week-long course in computer music and they mentioned Finale as one of the programs that would be taught. During that week, we never opened Finale, but instead learned about sampling, sequencing and synthesis. I was completely hooked, and chose my college based on its computer music program. Even though I wanted to major in computer music, I never thought I would/could be a composer. I thought I would continue to write pieces for myself while playing cello in an orchestra.

A year of struggling with tendonitis and a slow realization that I don't really enjoy playing in an orchestra made me re-examine my goals. Our orchestra conductor was a passionate supporter of modern music, so I was finally exposed to twentieth century music following from the classical tradition. I started taking composition lessons, but I had a very strict teacher who would force us to write atonal music and famously declared minimalism to be one of the most successful hoaxes in the history of music. I was very successful writing in what my teacher called the maximalist style, and what now is considered “new complexity”, but I didn’t feel true to myself.

I gravitated toward electronic music not only because I loved the sound world, but also because it seemed to be a more open community. I attended the ICMC in Banff and was astonished at the variety of works. As I started applying for academic conferences and attending the ones within driving distance I realized that despite the diversity, there was still a guiding aesthetic that did not match my own. After a string of rejections over a period of five years, (I had a paper accepted to an ICMC before I had a piece accepted) I decided to write a piece specifically to be accepted by an academic jury.

The first work I wrote in this style was programmed immediately. Of course I was pleased to have been chosen, but at the same time, I felt a stirring of dread. Again, I was stifling my own voice in order to be accepted. I’ve decided to work the system from the inside, and am now serving on the board of the International Computer Music Association. It is very difficult to be a composition teacher—to guide students without making choices for them, or unwittingly discouraging them from pursuing a wildly divergent aesthetic. My favorite teachers have been the ones who have exposed me to new works of all different styles, and encouraged detailed conversations about the merits and drawbacks of works by diverse artists. The production value of Britney Spears is amazing, and we can all learn from it!

I now count among my influences not only the music I grew up with, but also the meditative works of Pauline Oliveros, the quirky juxtapositions of Pizzicato Five, the glitch of Oval, and the straight-ahead rock of Led Zepplin, who I am ashamed to admit I never really heard before last year, due to an unfortunate confusion between the band fronted by Robert Plant and Def Lepard. I may not have grown up listening to a wide variety of music, but my teachers and fellow students have exposed me to a whole new world. It has been a struggle to find my own voice, but I have promised myself never to write another piece based on someone else’s expectation.

Robert Hamilton

“Fear and self-loathing in contemporary music (or how I learned to stop worrying and love to rock)”

The influence of modern “popular” music upon many of today’s young composers can be viewed as a natural continuation of musical evolution driven by today’s technology-powered musical society. There should be no reason why young artists working in the contemporary “classical” musical world should feel conflicted about having strong ties to other musical styles. On the contrary, having strong fundamental knowledge of the rich sound worlds offered by other musical styles, including musics of different world cultures or ethnicities, Jazz and yes, even “popular” music, should be viewed as an incredibly useful knowledge base upon which a unique and personal musical direction can be formed.

Modern composers live in a world where sound and music are omnipresent. We go about our days bathed in sound: wanted or unwanted, whether of our own iPod-regulated choosing or through the relentless media barrage of television and radio commercial jingles, movie soundtracks and varying demographic flavors of music television. Advances in technology over the last century have brought a high-quality musical experience out of the concert halls and into our pockets, creating a society weaned on loud-speaker-produced and -shaped sound.

Today’s musicians interested in the advanced study of musical composition, at least in the United States, are predominantly drawn to advanced degree programs at major universities and educational institutions for comprehensive studies based, for the most part, on the classic acoustic canon of musical history. In such institutions there can exist a remarkably closed-minded culture that virtually refuses to acknowledge any usefulness in the study of contemporary “popular” musical forms. Musicians seeking to succeed and excel in this environment can often feel directed toward working in established styles, which eschew the important lessons and influences that they themselves have developed in their own musical developments.

As a musician trained in “classical” music from an early age but brought up in a home filled with only “popular” music, I would agree with the proposition that often the world of musical academia seems to subtly pressure students away from “popular” musical forms even when students themselves have strong ties to those musical traditions. Perhaps unsurprisingly, musicians themselves working in more experimental modernist styles, including but not limited to computer/electroacoustic music, improvisation and Jazz, often seem more accepting and understanding of the positive influences that sound-based “popular” musics can offer. In the end, however, it will be somewhat understandably left up to each individual composer to stay true to his own artistic vision while at the same time assimilating diverse influences that will help him develop his own personal compositional style.

Footnotes

[1] http://www.soundtrack.net/features/article/?id=49: “As it happens, I don’t know these melodies—all I have are the words—so I’m setting pieces like “Mr. Tambourine Man” and “Blowin’ in the Wind” simply as a contemporary concert composer approaching American poetry. They will be completely different from the originals, obviously, because my world is completely different.”

Weisman Art Museum ◦ Thursday, 4:00pm – 5:30pm

Video & 60x60 Concert

60x60 Project: 60x60 is concert designed of 60 works by 60 composers, 60 seconds or less in length, to make a continuous one-hour-long concert.

Video Works to Accompany *60x60*:

I Went to Bed	Angela Veomett
Survey	Keith Kothman
Langue	Rafael Hernandez
What Happened?	Ivica Bukvic
Entropic	Marcel Wieckx

Program Notes

60x60 Project

These sixty pieces, also referred to as "signature works", will be performed in a continuous concert exactly one hour long. An analog clock marks the passage of time. Each pieces starts at the beginning of each minute. Works less than 60 seconds are padded with time before or after the work.

The goal of this project is to include many composers to represent a cross-section of contemporary music, representing many different styles and aesthetics as well as to produce concerts in as many venues throughout the world as possible exposing audiences to the variety of today's music composition.

Since its inception, the "60x60" project has completed two years in this annual concert series. Besides its annual world debut in New York City, in the past two years the project has received performances all over the United States and throughout the world including Birmingham, Los Angeles, St. Louis, Bucharest, Istanbul, and many more venues. It has also received a performance at Brooklyn College's International Electro-Acoustic Festival, as well as a multimedia collaboration performed at One Arm Red in Brooklyn, New York. This project represents a slice of the contemporary music scene as a showcase of music from composers around the world, writing today's music.

At the Spark Festival, 60x60 premieres a video accompaniment created by artist Shimpei Takeda. This work uses a number of visual motifs—water, trees, city lights, and more—to unify the sixty musical pieces into a single meta-composition.

Composers whose works comprise 60x60 2004 are:

Aaron Acosta, Liana Alexandra, John Allemeier, Christian Banasik, Dennis Bathory-Kitsz, Stephen Betts, Sandeep Bhagwati, Justin Breame, Scott Brickman, George Brunner, Robert Carl, Miha Ciglar, David Claman, Douglas Cohen, Noah Creshevsky, Leslie de Melcher, Patrick Dorobisz, Moritz Eggert, Karlheinz Essl, Carlo Forlivesi, David Gamper, Douglas Geers, Peter Gilbert, Robert Gluck, Daniel Goode, Ramon Gorgoitia, James Hegarty, Mark Henry, Erik Hinds, Bernand Hughes, David Jaggard, Keith Johnson, Michael Kinney, John Link, David T. Little, Guy Livingston, Annea Lockwood, Juan Maria Solare, Charles Mason, James McWilliam, Luis Menacho, David Mooney, Michael Murphy, Serban Nichifor, Richard O'Donnell, Maggi Payne, Mark Petering, Morgan Quaintance, Giuseppe Rapisarda, Laura Reid & Andrew Hudson, Robert Sazdov, Jacky Schreiber, Alex Shapiro, Emma Shiffrin, Allen Strange, Thomas Sutter, Vladimir Tosic, Eldad Tsabary, Robert Voisey

I Went to Bed

The formal idea for "I went to bed" grew out of an experience I had about ten years ago when a classmate of mine died. The night after his death my sleeplessness developed into near hysteria because the intense emptiness I felt inside. My mental state was reflected (and intensified) physically through a kind of panicked vertigo; I felt as if I was somewhere between the edges of outer space and the bottom of the ocean with no point of reference and nothing to grab onto. The intent behind "I went to bed" is to realize this fierce connectedness between one's mental and physical world through the narrative of my own experience with intense grief.

Survey

"Survey" was originally conceived as a large-scale work projected onto a 16-foot wide surface specifically constructed for the format of the piece. Survey deals with a tension created by the superimposition of constructed frameworks upon the natural landscape.

Langue

"Langue" seeks to express my fascination (borderline obsession) with type and the supposed inherency of sign, symbol, and language through the use of characters from the English alphabet deconstructed and transformed. The music seeks to invoke a meditative state during which the viewer may contemplate their understanding of how symbols work to communicate meaning. Fundamentally, "Langue" was inspired by that thing which happens when one stares at a picture so long or repeats a word so many times that its meaning is transformed (or even becomes lost).

What Happened?

This movie may be about everything, nothing, or anything in between. Which one is true? That's a pretty good question…

Entropic

Entropy, from the Greek word trope, meaning "transformation", is defined as "the degree of disorder or chaos in any physical system." In common modern usage, the word is usually used to describe the degradation of order into chaos. The sounds and video images in "Entropic" were made using algorithms inherently entropic: fractal noise generators, feedback loops and recursive algorithms. However aspects of chaos found in everyday life are also brought to light in this piece: wisps of smoke from a smouldering cigarette, endless reflections of light in skyscraper windows, or streams of people making their way across a busy city sidewalk.

Thursday, 7:00pm – 9:00pm ◦ The Whole, Coffman Union

Experimental Performances

Featuring:

Abinadi Meza

Alex Lubet, Doug Geers, Zhang Ying

0o400 — base8
Christopher Baler & Anne Resele

Ballet Mechanique
J. Anthony Allen, Noah Keesecker,
Liz Draper & Jesse Peterson

Program Notes

0o400

Through movement, interactive video projections and sound, base8 creates an environment that can't exist outside of digital circuitry. Reality and our understanding of reality are not always the same. As we create our own reality, we induce an alternative set of natural laws. Choreographer Anna Resele and digital artist Christopher Baker will tease your expectations of what "should." Disassociating cause and effect, base8 brings together interactive technology and dance to examine the intersection between physical movement and the perceptions thereof. "0o400" was first presented in the 2005 Best Feet Forward Festival at the Southern Theater.

Town Hall Brewery ◦ Thursday, 9:30pm – 1:00am

Experimental Performances

Featuring:

*_boombox_*	Jamie Allen
Sounding Spirals	Ray Dybzinski
	David Birchfield
Plato's Cave	David Means, Steve Goldstein, Carei Thomas

Program Notes

*_boombox_*

I created the boomBox as an unpredictably-involved controller for the manipulation of sampled sound. That is, it is a sort of music-concrete instrument. we are now well-adjusted to the metaphor of digital sound being arranged in 'containment' units of audible material. Most popular software systems represent the actuality of a sample buffer as a 'box' or rectangle in the graphical user interface. The boomBox interprets this metaphor most directly, allowing the performer to manipulate sample buffers in a visceral, physical way. The orientation, velocity, forces and position of the instrument allow for squeezing, pushing, pulling—even kicking or punching—of sound bytes. Many of the control signals are also available as sound output directly.

The piece touches on issues of surveillance and fear, and the present political climate. I am not afraid of your luggage.

Sounding Spirals

In 1998, Ray Dybzinski borrowed an oscilloscope from the physics lab where he worked. He hooked it up to all the equipment in his studio to see what the equipment sounded like. What was really cool was his Eventide effects processor. If he set it up just right, the oscilloscope showed a visual representation of the Eventide's sound in the form of mesmerizing, moving spirographs. The spirographs weren't just a visual trick that loosely synched up with the sound. No, the spirographs were the audio waves themselves! Friends came over and watched spirographs for hours. It was a small phenomenon. But they had little tolerance for the monotony of the droning sound that created the spirographs. So the small phenomenon stayed just that.

Time passed, and in 2002 Ray Dybzinski left Chicago and the band he helped found, The Timeout Drawer, to study ecology. Later that same year, he saw an awesome and inspirational show at Minneapolis' Bedlam Theater. He had an epiphany. He pulled out the Eventide and the oscilloscope again—this time keen on making actual music that still embodied the trippiness of the drone when viewed on the oscilloscope. *Sounding Spirals* was born. Inspired by contemporary bands like The Notwist and Blonde Redhead and classics like New Order and The Cure, *Sounding Spirals* blends electronic percussion, bass, and melodies with live guitar. For live shows, Ray Dybzinski projects the spirographs with a laser mounted in an old kitchen drawer.

Plato's Cave

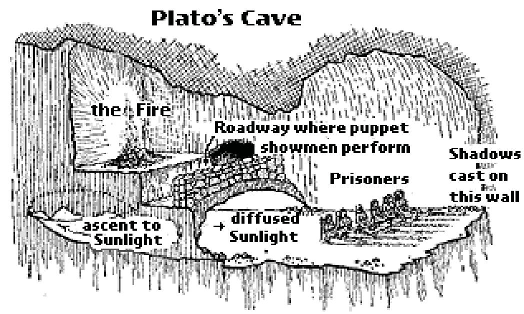
Carei Thomas, voice and synthesizer
Steve Goldstein, laptop computer
David Means, digital wind controller, electric guitar, laptop computer and MIDI performance system

"Plato's Cave: Sonic Meditations and Improvisations"

The allegory of Plato's cave seemed particularly relevant going through the public events surrounding the recent election, the war in Iraq, and the almost incessant barrage of images, sound bits and spin that has come to dominate public discourse. -dm

The Allegory of Plato's Cave

In the allegory, Plato likens people untutored in the Theory of Forms to prisoners chained in a cave, unable to turn their heads. All they can see is the wall of the cave. Behind them burns a fire. Between the fire and the prisoners there is a parapet, along which puppeteers can walk. The puppeteers, who are behind the prisoners, hold up puppets that cast shadows on the wall of the cave. The prisoners are unable to see these puppets, the real objects, that pass behind them. What the prisoners see and hear are shadows and echoes cast by objects that they do not see.



We may acquire concepts by our perceptual experience of physical objects. But we would be mistaken if we thought that the concepts that we grasp were on the same level as the things we perceive.

Friday, 2:00pm – 3:30pm ◦ Weisman Art Museum

Spark Cinema

Underground	Tom Lopez
Elemental Vamp	Allen Strange
1921>1989	Barry Schrader
Graveshift	Per Bloland
Neptune Flyby	Samuel Pellman
New Birds and Move	Hellbender Film Projekt
Laz	J. Anthony Allen
A Downward Spiral Turns Skyward	Christopher Penrose

Program Notes

Underground

Underground audio was composed in New York City, New York (2004) for a video by Nate Pagel. This is the second project in a series of works based on subway systems from around the world. The first project was based on the system in Paris and was titled *Métropolitain*. It has been shown at various festivals and galleries in San Francisco, Austin, and St. Louis. This second project was recently completed and features the visual and aural environment of the London underground.

Elemental Vamp

Music by Allen Strange
Computer animation and graphics by Gaben Chancellor
Brigett Loreaux as the Vamp

Based on an poem by James S. Dorr, *Elemental Vamp* weaves a lament by a 21st century vampire braving the hazards of the modern world. Blood tainted with HIV virus, massive doses of sunlight from a depleted ozone layer, and other obstacles force this creature into the protective environment of an outer space "carapace" to lick her wounds and then return for "more tasty fare of bloodsoaked men!"

1921>1989

When Michael Scoggins first came to me with quite detailed plans for his computer video work *1921>1989*, I was struck by the overriding importance of structure in the piece. While it was obviously in three large sections, the intricacies of the details of each section were such that they not only displayed specific characteristics which gave each sections its unique character, they also seemed to exhibit in visual terms the musical qualities of exposition, development, and expanded recapitulation, something akin to the classical sonata form. In addition, the precision of the timing of the movements called for composing a score that would catch the specific "hits" of the action. At the same time, I realized that constantly "stinging" the images would quickly grow tedious; some sort of deflection from the obviously expected was occasionally necessary in this regard. Finally I saw that the limitations of images and colors, which were explored in great detail of variation, demanded a similar approach in the musical materials.

I decided to employ these observations in composing the music, and also to take the attitude of scoring to a preexistent choreography. I saw *1921>1989* as a dance, not of human dancers, but of plastic geometric entities, constantly reorganizing themselves in different ways. The music, then, was arrived at by considering the score as composing music to a dance already created. The resulting work reflects these attitudes, moving from accompaniment to counterpoint and back again to a more synchronous style of scoring, thus reflecting the overall structure and plasticity of the piece and creating a unified whole.

Neptune Flyby

Neptune Flyby was inspired by the August 1989 encounter of the Voyager 2 spacecraft with the planet Neptune. The movement is constructed of five phrases, each of which consists of bands of sustained pitches that gradually modulate in timbre, vibrato depth, and spatial placement. These pitch bands are occasionally embellished by clouds of bell-like tones that are also modulated in timbre, depth of effects processing, and spatial placement. The video component of this work was created by Lauren Koss, a video artist from New York.

New Birds and Move

by Hellbender Film Projekt (Al Griffin—Video/Adam Kendall—Video and Music)

New Birds and Move is live, improvised video paired with pre-recorded music. It first appeared on "Eyewash Volume II," a compilation DVD of New York City video—artists and musicians.

A Downward Spiral Turns Skyward

A Downward Spiral Turns Skyward is an interactive video work intended for live performance. The work is an exploration of a complex and evolving space formed by geometric transformations of conical spirals. This spatial form of the work presents itself as both a polymorphic dancer, and as an encompassing architecture. Thus, scale, form and perspective are parameters of performance. The accompanying music is also under interactive control and its form is shaped by the same performance parameters which dilate, morph, and scale the 3-dimensional geometry of the space.

Friday, 4:30pm – 6:00pm ◦ InFlux Auditorium

"Audio Immersion" Concert

Meditation	Hubert Howe
Pre-composition	Mark Applebaum
Trajectories	Eric Lyon
Anastasis	John Mallia
Con Brio	Francesco Giomi
August Nights	McGregor Boyle
Species	Michael Berkowski
Phoneme Play	Josh Clausen

Program Notes

Meditation

Meditation is my first completely microtonal composition, based on 19-tone equal temperament. As the title implies, it is a slow, contemplative work that begins from a single tone, combines it with other tones, builds to larger and faster materials, and ultimately returns to a single tone as in the beginning. The basic sound is a vocal-like tone produced by three-carrier FM synthesis so that two formants are emphasized. Throughout much of the piece, the sound undergoes a crescendo and diminuendo with a corresponding timbre change that parallels the basic structure of the piece. There is no amplitude or frequency modulation in the synthesis of the sounds; all the beating that is present is a natural result of the intonation of the tones.

There are five sections in the piece in a palindromic relationship and a 2:1 tempo change between each, increasing at first and then decreasing. In the beginning, tones start from the middle octave (the first note is middle C) and expand outward into other octaves. In the second section, where certain highlighted tones travel between the loudspeakers, the basic "theme" of the piece is stated. In the middle section, tones are attacked with a more "bell-like" envelope, and the exact midpoint is a climax. After that point, material returns in a compressed form, and the piece parallels the opening sections, returning to a single octave and single tone as in the beginning.

The piece was composed in 1993 and synthesized with the csound program.

Pre-Composition

Pre-Composition is a work for 8-channel tape. Its sound source is my voice…or *voices*. *Pre-Composition* was commissioned by Electronic Music Midwest 2002.

Trajectories

Trajectories was composed in August 2004 for the Harvest Moon Festival/Symposium on Multi-speaker works. The central concern is to present multiple spatial trajectories that may be experienced contrapuntally and as fundamentally musical utterance. To this end the timbrel palette is restricted to sinusoids and noise, sometimes modified with simple filters. Trajectories, tunings and tempi are attached to individual sounds as markers to distinguish individual paths cooperating within a given texture.

Anastasis

Work realized in the Studios of the Institut International de Musique Electroacoustique de Bourges / IMEB

Anastasis is programmatic in its representation of Christ's *Descent into Limbo*, a subject often depicted in Medieval iconic art. The majority of sounds used are derived from concrète sources, some of which carry conceptual weight. For example, the recurring sound of wax being scraped away from the metal surface of the candle trays at Bourges' Cathedral St. Étienne: the residue of prayer—its removal, a daily chore (or performance ritual) captured in sound. Also, the emergence of a field recording of windmills at the work's close: transformation, by man, of nature's breath into energy as a storm blows in on the mountainside.

The piece itself is a stormy, transformative descent. Sounds of friction and resistance represent the interpenetration of spheres of existence. The dragging of wood along wood, glass on glass, and the grinding and scraping of metal against metal, are intensified through abrupt, pointed declamations and lead, ultimately, to the breaking of the gates of hell. The only purely electronic sounds used in the composition are dense, bristling textures that occur as interruptions of the long descent. They represent the accumulation of a mysterious, electrical energy in the empty tomb above—static glimpses of that middle sphere.

Anastasis was premiered in June 2003 at the Palais Jacques Coeur in Bourges, France—the same location where the source material for the sounds which open the work were recorded.

August Nights

August Nights, a purely electronic work, exists in two forms, one stereo, and one for a multi-channel sound system. The piece grew from sonic experiments creating material for a live electronic (flute and computer) piece entitled *Windfall II: Days of August*. I created more sounds than could be used, and found that the materials suggested another radically different piece. Synthesis techniques used include the phase vocoder, granular synthesis, and many others. The title comes from the composer's experience on the beach in the late evening. The work explores a shifting landscape of sonic materials in which nothing is as it seems. Timbres become tonalities, rhythms become timbres, and all are fluid.

Species

Species, a multichannel composition for fixed media, makes use of strictly synthetic, that is, non real world sounds. Developed and composed during Spring 2004, all aspects of the work are in some way organized according to John Conway's famous "Game of Life" algorithm, from simple variations in tone color to complex motions of sound through the multichannel listening environment. The work's title refers to the system of artificial "genetics" developed by the composer as an adaptation to the Game of Life's rule set, allowing for each sound event, however long or brief in duration, to contain a complete set of traits or genes which define its musical characteristics. These traits are passed among generations, shared within populations, and ccasionally even mutated as the Game of Life proceeds. The musical results include slowly changing drones, rich, lushly moving harmonies, and collections of tiny sound events rushing around the listening space.

The simple rules of the "Game of Life," as designed by John Conway in 1970 are as follows: A two dimensional grid contains "cells" which may be either living or dead. In the next generation, a dead cell will become living if exactly three of its neighboring cells are currently living. A living cell will die from overcrowding if more than three neighboring cells are living, or from isolation if fewer than two neighboring cells are living. Generations proceed to either a finite number or infinitely.

Phoneme Play

Phoneme Play is created out of the phonemes of a single 5-word sentence, which are presented in an exposition, and then meticulously sequenced to create a dense rhythmic texture. An exploration of mix-ups in syntax, both in the ordering of individual words and of their component sounds, emerges as words become slowly more discernable. The piece is structured in five parts. In the exposition, phonemes are presented as extracted from the full sentence, unaltered, and are then run through simple processing, creating new phoneme sounds with altered time and pitch parameters. The resulting sounds form the primary rhythmic texture of the piece.

Following the exposition are two episodes that employ the sonic materials derived from the first and fifth words, and then the second and fourth words, respectively. While the phonemes presented earlier create a driving rhythmic voice that is in constant flux between speakers, more heavily processed sounds derived from the original sentence appear, forming antiphonal relationships.

The fourth section presents the third word of the sentence with clear homophonic gestures, departing from the pattern of complex polyphony that was previously developed. After a brief restatement of the opening gesture, there is a stretto presentation of the full, unprocessed sentence, played in each of the speakers.

The final section returns to the driving rhythmic texture, this time employing all phonemes and their alterations. In this section, words are more clearly discernable and mix-ups in their orderings create tensions in meaning. As a climax of the texture is reached, a final statement of the sentence is presented by itself, concluding the piece.

Friday, 8:00pm – 9:30pm ∘ Lloyd Ultan Recital Hall

Electroacoustic Concert

I'll Have an Electric Mahabharata, Please	Anthony Cornicello
Shimmer	Andrew May Shannon Wettstein, piano
Purity in a Glass Darkly	Jake Sturtevant, piano Abbie Betinis, voice
Bass X Sung	Tae Hong Park, bass guitar
Path of Iron	Alycin Warren
INTERMISSION	
Is the same...is not the same	Robert Hamilton Cory Kasprzyk, saxophone
Solstice	Bonnie Miksch, voice
faktura	Dennis Miller
Gothic Tempest	Noel Zahler
Hopper Confessions	Butch Rovan Ulrich Maiss, cello

Program Notes

I'll Have an Electric Mahabharata, Please

While I was working on music for "A Dream Play", the Hindu elements in Strindberg's play inspired me to investigate the music of the Indian subcontinent. Although the tabla plays a significant role in the scoring for Dream Play, I was struck by the sound of the combination of sitar and tamboura. The resonance and droning of these instruments were a direct influence on my piece, "I'll Have an Electric Mahabharata, Please", which is written for violoncello and interactive electronics. The instrumental writing, as well as the computer part, was conceived as an extension of (and a distortion of) the harmonic series. The computer, using a program created using the Max/MSP program, processes the sound of the violoncello, augmenting the timbre of the instrument, and sending the sounds through four channels. As the title indicates, there are strong references to Indian music, both in the ornamentation techniques found in Hindustani music as well as the use of the raga *Gujari todi*. "I'll Have an Electric Mahabharata, Please", was written in the early part of 2003 for Jennifer Lucht.

Shimmer

Shimmer for piano and recorded sounds takes its title from from the poem Ralph Waldo Emerson wrote as a motto to his essay "Illusions." The second half of the poem begins:

When thou dost return
On the wave's circulation,
Behold the shimmer,
The wild dissipation,
And, out of endeavor
To change and to flow,
The gas become solid,
And phantoms and nothings
Return to be things,
And endless imbroglio
Is law and the world—

The gestures and ideas in this piece follow the model of the poem: they are constantly in flux, always becoming and dissolving, but never simply being. The recorded sounds were created from sketches for the piece performed by Shannon Wettstein, to whom Shimmeris dedicated with gratitude and admiration. The recording provides the underlying rhythmic pulse and harmonic skeleton of the piece, while at the same time presenting ghosts, echoes, and distortions of the piano part.

Purity in a Glass Darkly

Purity in a Glass Darkly was inspired by Psalm I. There are two poems I wrote that deal with the ideas and laws expressed by the Psalmist in this Psalm, one is recited by a spoken voice on the tape, and the other sung by a live voice. There is also a second voice on the tape, which includes the first and last verse of Psalm I in Latin, sung as the cantus firmus, which all of the musical material revolves around.

> Psalm I: 1. beatus vir qui non abiit in consilio impiorum et in via peccatorum non stetit in cathedra derisorum non sedit *(Blessed is the man who does not walk in the counsel of the wicked or stand in the way of sinners or sit in the seat of mockers)*. 6. quoniam novit Dominus viam iustorum et iter impiorum peribit *(For the LORD watches over the way of the righteous, but the way of the wicked will perish.)*

Poetry on a Psalm.

I. Meditate say I
Meditate say you
The blue in their eyes
The sky filled with lies
The sea of chaff
Blowing by in the wind
And they think they're free.
So I sit by my stream
I kneel in your dream
And I kiss your feet
And I am freed from hate
Humbled and Jumbled
I meditate say you—say I.

II. Purity silenced by a glass darkly
Towards the light my hand reaches
Interrupted by a sight
A Flight: 497 I think
Despite my fear of heights
—or 498
My feet hit the floor
—or 499
My head hits the clouds
Or…
The glass resolves as I pour it
down the aluminum sink
Spiraling down the drain.
Through the light a hand reaches
And pulls me through.
And Purity sings a song once again

Bass X Sung

Bass X Sung is a live piece for electric bass and signal processing.

Various rhythmic and timbral characteristics of the electric bass are investigated that occur when simple signal processing techniques (realized in SuperCollider) are combined with electric bass playing techniques.

Path of Iron

The title of this "train fantasy" is a too-literal translation from the French for "railroad" (*chemin de fer*), and refers back 50 years, to the very beginnings of *musique concrète*: Pierre Schaeffer's 1948 trip to the train station.

Two railroad lines crisscross the town of Charlottesville, Virginia (where I lived while working on this piece), marking the town with a large X. Several times each day, trains rumbled through the valley near our house and continued on, passing right through the center of town. Besides these slower trains, *Path of Iron* also includes train recordings from New York and New Jersey, where I lived before returning south. The train announcement was recorded in New York City's Pennsylvania Station; the two conversational voices are those of myself and John Gibson.

Solstice

Sacred day, full of flame and long desires,
immersed in rapture and a thousand songs,
you bring a flurry of foreseen fulfillments,
a burst of brilliance to our cheeks,
a breath of eagerness to rouse our hearts.

faktura

faktura (2003) is a work that explores a series of virtual environments, focusing on the infinite variety of forms and textures one might find. Morphing, evolving abstract objects appear against a backdrop of evocative music that sets the tone and affect of each scene. The piece develops over a 9-minute time frame, yet presents a timeless, shifting and (perhaps?) disorienting experience to the viewer.

The visual material of *faktura* was created with the POVray scene description language. Specific techniques include the use of morphing isosurfaces and the application of control parameters extracted from preexisting sequences of bitmap files, specifically to control the motion of new, synthetic images. Sonic Foundry Acoustic Mirror and the Symbolic Sound Kyma System were used for the music.

The Russian term "faktura" has a variety of meanings, including one published in the 1923 Constructivist manifesto: manner of construction. Other definitions include surface quality and texture.

Hopper Confessions: Room in Brooklyn

This multimedia work draws its inspiration from "Room in Brooklyn," a poem by Anne Carson (New York: Knopf, 2000). Carson's poem is polyphonic, exposing two different voices that speak to the condition of passing time: a painting by Edward Hopper (the 1932 "Room in Brooklyn") and a passage from St. Augustine's *Confessions*.

Carson's minimalist verse suggests a unique nostalgia—the voice of the poem is vaguely jazzy, although, like a Hopper painting, it never swings; the form is too empty to sustain that kind of movement. It is this very reticence that serves, paradoxically, to animate the painting, as if Carson were giving voice to the solitary figure who sits with her back turned from the viewer, re-enacting the time present that for her "is long," and, for the spectator, "is no more," to use Augustine's terms.

The present work adds another voice to Carson's polyphonic poem, through an acoustic and visual landscape that not only animates her animation, but explores, in its own way, the nostalgia Hopper embraced and Augustine bracketed. Mixing new and old images, photograph and canvas, still life and movement, the visuals offer a double-take on Hopper's interiors. The musical score represents a similar fusion of perspectives, through a series of discrete phrases that shift between skittish walking bass and mournful cantabile melody, mediated by the electronic interaction. Two temporal orders are bridged through the sound and the function of this electronic voice, which both binds and separates what is now and what is no more.

Friday, 10:00pm – 1:00am ○ Town Hall Brewery

Experimental Performances

Featuring: Seiji Takahashi & Michi Yokota
Neil Rolnick
Gregory Taylor

Saturday, 11:15am – 12:30pm ○ Lloyd Ultan Recital Hall

NeXT Ens Concert

NeXT Ens: An ensemble dedicated to performing new works of interactive acoustic and computer music.

NeXT Ens Artists:
Heather Brown, percussionist
Shiau-uen Ding, pianist/director
Kaylie Duncan, cellist
Timothy O'Neill, violinist
Margaret Schedel, technical expert/cellist
Carlos Velez, flutist

Scintillating Fish	Gabriel Ottoson-Deal
Invisible Images	Burton Beerman
Cassini Division	Margaret Schedel
Secret Pulse	Zack Browning
Tremor Transducer	Douglas Geers

Program Notes

Scintillating Fish

The actual Scintillating Fish belongs to Carlos Velez, flutist of NeXT Ens. It came from one of those machines you see in movie theaters, where there's a glass case full of toys and a mechanical claw with which you try to pick one up and drop it into a chute.

The movie we saw was forgettable, but the fish, shimmering purple and pink, with large spikes and big bulbous staring eyes, endures, striking terror into the hearts of all who see it.

Scintillating Fish was written for NeXT Ens in fall 2004. The interactive computer part was created using Nathan Wolek's Granular Toolkit for Max/MSP. Carlos's flute cadenza is improvised.

Invisible Images

Invisible Images for violin, violoncello, percussion, piano and prepared computer sounds is composed in three movements:

I. Rhythms of the Heart

II. Unseen Memories

III. Ghosts

I was introduced to electronic music at the University of Michigan. At this time we would record analog sounds, process them, and then splice them together into musical events. The process used in *Invisible Images* is similar to that analog process. I record sounds as digital samples, process them with functions such as cross synthesis, place them in a digital timeline and record the timeline as a digital sample. This digital sample of this completed event will be triggered from the computer keyboard as indicated in the score.

The fully loaded Kyma sound design system by Symbolic Sound was the platform for the construction of these sound files. This hardware system boasts of 28 digital sound processors, allowing such complex constructions as re-synthesis and morphing of samples of instruments from the acoustic ensemble into new and mixed sounds. This creates an extended ensemble with the computer playing sounds that are combinations of the instruments in the ensemble. The computer part will occasionally be aggressive but in general it will complement the music of the acoustic ensemble as if it were another variation of one of its instruments.

All of the pitch material is presented in movement one, but these same materials will be transformed into different characters in movements two and three appropriate to the distinctive quality of each movement. Essential to each movement is music that displays the individual and ensemble virtuosity of this group. Each member of the ensemble is a virtuoso performer in his own right and this music will be composed with this in mind.

Cassini Division

Saturn's stunning and alluring rings are actually made up of small particles in independent orbits around the planet. The Cassini division is the largest gap in these rings, the result of gravitational resonances with Saturn's moons. These resonances occur when one object has an orbital period that is a small-integer fraction of another body's orbital period, e.g., 1/2, 2/3, etc. The object gets a periodic gravitational tug at the same point in its orbit, causing the rings and concurrent gaps. The music is organized according to another small-integer fraction: the harmonic series. The first fifteen notes of the harmonic series are used as a tone row distributed among the quartet of instruments. Each instrument exerts a gravitational resonance on the other instruments through ring modulation, creating very complex sounds from mixture of acoustic elements. Each musician also controls individual parameters of the video which was inspired by pictures from the recent Cassini-Huygens Mission. (The original forty-five second video clip was created by Nick Fox-Gieg.) This work was commissioned by NeXT Ens and inspired by Morton Feldman's *Between Categories*.

Secret Pulse

Secret Pulse (2004) for flute, violin, cello and computer-generated sound was commissioned by NeXT Ens and neoPhonia. This composition continues a series of works written over the last ten years that explore the application of magic squares to musical structure. A magic square consists of a series of numbers arranged so that the sum of each row, column and diagonal is the same amount. The unique position of each number within the square is paralleled in the musical score by a particular style, rhythm, density, timbre and orchestration. Of the enormous number of magic squares it is possible to form, seven have been associated with the seven planets of the Ptolemaic Universe (Saturn, Jupiter, Mars, The Sun, Venus, Mercury, and the Moon). These "Ptolemaic Magic Squares" appear in De Occulta Philosophia, a book on magic by the Renaissance polymath Heinrich Cornelius Agrippa Von Nettesheim published in 1531. The "Magic Square of Mars" provides the structure and inspiration for the composition. I would like to thank David Bohn and Cyrus Pireh for their assistance in preparing the score and computer part. The computer part was produced using GACSS (Genetic Algorithms in Composition and Sound Synthesis) which is an original computer music software package developed by Benjamin Grosser at the Beckman Institute of the University of Illinois.

Tremor Transducer

Tremor Transducer was written to explore ideas related to two ephemeral phenomena: fire and sound. Both of these are seemingly disembodied yet able to instill awe or wreak destruction; both can exist as silky tendrils, sudden bursts, or raging calamities; and both depend on the air for their existence. Formally, *Tremor Transducer* could be either a composite envelope of a single sound or the transcription of heat levels as a fire burns. To me, it is both. The computer's role in the music is to create a picture within the picture, its incorporeal performance symbolizing the incorporeal nature of both sound and fire, floating above the musicians but also created by them, as if rubbing bows across strings could start a fire instead of a sound. *Tremor Tranducer* was written for NeXT Ens.

Saturday, 1:30pm – 2:15pm ◦ 225 Ferguson Hall

SmartMusic Demonstration

John Paulson, President of MakeMusic! Inc.,
University of Minnesota School of Music Alumnus

SmartMusic is the world's only successful commercial application of score following. Tens of thousands of teachers and students subscribe to its library of over 30,000 titles, extensive exercises, and innovative features. The demo will highlight three aspects of SmartMusic:

- Intelligent Accompaniment®
- Practice tools including assessment of student performance
- How publishers and users are creating SmartMusic files with Finale®, illustrating that SmartMusic is essentially a technology-enabled publishing platform

Saturday, 2:30pm – 4:00pm ◦ 225 Ferguson Hall

Manoury Keynote Lecture

Lloyd Ultan Recital Hall • Saturday, 4:30pm – 6:00pm

Shiau-uen Ding Recital

Narcissus	Thea Musgrave Elizabeth Marshall, flute
Into the Maelstrom	James Mobberly
Balladei	Christopher Bailey
Trying to Translate	Katherine Norman

INTERMISSION

Due (Cinta)mani	Eric Chasalow
Music for Piano and Computer	Corte Lippe
Tombeau de Messiaen	Jonathan Harvey

SHIAU-UEN DING, piano

Program Notes

Narcissus

Narcissus for solo flute and digital delay was written in 1988 using the VESTA KOZA digital delay box, which unfortunately, like so many hardware devices, no longer exists. The box had the capability of varying the delay time up to one second, a hold function, and a slow LFO modulation function, using three foot-pedals controlled by the flutist. David Wetzel (Mansfield University of Pennsylvania) and I have worked out a software version using MAX and have tried to replicate the effects as precisely as possible. At the same time, to help the audience better follow the piece, I decided to add the projection of the performance indications using Macromedia's Director. The flutist's job is simplified in the sense that s/he has only one foot-pedal to deal with. It controls both the digital effects and the visuals.

Into the Maelstrom

Into the Maelstrom was commissioned by pianist Barry Hannigan as a companion piece to *Caution to the Winds* (1987), the composer's first work for piano and tape. As in *Caution*, the tape part of *Into the Maelstrom* is constructed entirely from piano tones, which were subjected to various transformations using CSOUND software on a NeXT Station 250 computer.

It is my tenth such work (soloist with tape) and I find the process as inspiring now as I did with the first work in 1982. The combination of live performer with a tape accompaniment which has the same timbral basis creates a performance situation rather like a concerto, but with an invisible orchestra of multiple instruments of the same kind as the soloist, or perhaps more intriguingly, a concerto for performer and him/herself, or selves...

The title was added at the end of the composition process, and was chosen for several reasons. First, *Caution to the Winds* was a furious piece, and implied all sorts of furious natural phenomena, and the new work showed similar tendencies from the outset. I wanted to maintain the link to wind and weather in any case, but during the writing of *Into the Maelstrom* there occurred a seemingly endless set of human and natural disasters, beginning with the Los Angeles riots and continuing with hurricanes Andrew and Iniki, tornadoes in Wichita and Fort Worth, and, as of the evening of this writing, the continuing famine in Somalia, unrest in Bosnia, and earthquakes in both South America and Egypt. The word maelstrom means whirlpool or something like a whirlpool—given the continuous whirling chaos and confusion in the world, and given the fact that composers and other artists create work that is the product of their experience, I have little doubt that the furious materials which pervade this piece had their origins at least in part in these great events.

It is equally possible, I suppose, that I have merely been responding to and describing the increasing levels of chaos which occur when young children enter one's life...

programs

Balladei

Balladei can be heard as a twisted mish-mash of fragmented medieval-European musical syntax, especially fragments of the characteristic "double-leading-tone" and "Landini" cadence formulai utilized by Machaut, for example. Because of the nature of these materials (i.e. lots of fifths), one hears hints, throughout, of other kinds of music as well: "Americana" a la Barber or Copland, chromatic triadic progressions of Hollywood film music, North Indian Shenai music,Elizabethan dance music, Irish jigs, and so on. The pianist is not so much in the role of traditional virtuosic soloist (though the part is difficult and requires intense concentration and attention to detail) towering above the "orchestra" of electronic sounds; but rather, the soloist is like an adventurous child, cradled by the electronic sounds constantly surrounding her, sometimes responding to them, other times leading them to new places, or bursting free of them.

Trying to Translate

So often pieces for instrument and tape concentrate on finding points of contact between two worlds, making some kind of aural translation between acoustic and electronic sound. I decided to explore the polarity between the instrument and the tape, treating the issue as a feature rather than a problem. At times the piano sound is processed 'live' to enhance its independence from the recorded sound. Piano and tape inhabit the same world, but differently.

The tape explores some speech which is itself about issues of translation; a speaker describes the problems of translating from gaelic to english, and also the way that gaelic music, in particular psalm-singing, has declined over this century. I was struck by the beauty of her voice, and the emotion behind her meaning. I also share her sorrow that these old ways of making and sharing music about, and for, everyday life seem to be disappearing, and we are perhaps no longer able to translate their relevance and deceptive simplicity into the music that we write today.

The speech used is from a Radio 3 *Soundings* documentary and is used by kind permission of the BBC. The piece was commissioned by the Mead/Montague duo with funds provided by the Arts Council of Great Britain.

Due (Cinta)mani

Due (Cinta)mani (2002) is a piece for piano soloist (due mani) combined with electronic sounds that modulate and transform piano timbres, the attack and decay characteristics, and the shapes of entire gestures or even whole phrases. There is a great economy in the piano writing, and yet the combined result is a kind of tapestry of colors and shapes. Its narrative form evolves nonlinearly, with "cross-cutting" of the sort used in film-editing. This allows for multiple narrative streams to unfold simultaneously, enriching one another– the present idea, a second layer of commentary, and a third with the resonance of memory, all in "narrative counterpoint".

The origin of the cintamani pattern, three flaming pearls placed over sea waves, is uncertain, but it most likely has an ancient Buddhist origin. The lines representing the waves might instead connote tiger stripes or clouds. Cintamani appear frequently in the decorative arts of China, India, Tibet, and the Ottoman Empire, most often in textiles, carpets and ceramics. I have chosen the word for my title because of its iconographic power and mystery – also because of a personal interest in Asian art and culture.

The piece is in two movements, each based on the same harmonic material: *Three Symbolic Gestures* and *Cloudbands*.

Due (Cinta)mani was commissioned by Vicki Ray and is dedicated to her.

Music for Piano and Computer

Music for Piano and Computer (1996) was commissioned by the Japanese pianist Yoshiko Shibuya and premiered by her in Tokyo in Ocotober of 1996. The electronic part was created at the Hiller Computer Music Studios of the University at Buffalo, New York using the IRCAM Signal Processing Workstation, (a real-time digital signal processor), and the program *Max* which was developed by Miller Puckette and whose technical support helped make this piece possible. Technically, the computer tracks parameters of the piano, such as pitch, amplitude, spectrum, density, rests, articulation, tempi, etc., and uses this information to trigger specific electronic events, and to continuously control all the computer sound output by directly controlling the digital synthesis algorithms. Thus, the performer is expected to "interact" with the computer triggering and continously shaping all of the computer output. The instrument/machine relationship moves constantly on a continuum between the poles of an "extended" solo and a duo. Musically, the computer part is, at times, not separate from the piano part, but serves rather to "amplify" the piano in many dimensions and directions; while at the other extreme of the continuum, the computer part has its own independent "voice".

Tombeau de Messiaen

Tombeau de Messiaen is a modest offering in response to the death of a great musical and spiritual presence. Messiaen was a protospectralist, fascinated by the colours of the harmonic series and its distortions in which he found a prismatic play of light. The part of the work is composed of piano sounds entirely tuned to the harmonic series - 12 of them, one for each class of pitch. The 'tempered' live piano joins and distorts these series, never entirely belonging, never entirely separate. The associations of the world tombeau (tomber) suggested a falling motive for the work; at the end the piano extends this motive, flinging itself into a downwards vortex to the abyss.

Ted Mann Concert Hall • Saturday, 8:00pm – 9:30pm

Electroacoustic Concert

Musicometry I	Lawrence Fritts Esther Lamneck, clarinet
The Season and the Constellations	Frances White Renegade Ensemble, directed by Stan Rothrock
Artico	Giuseppe Rapisarda Immanuel Davis, flute
Snow	Wayne Slawson Maggie Bergeron, choreographer Jamie Ryan, dancer & co-choreographer
Cigar Smoke	Robert Rowe Esther Lamneck, clarinet
	INTERMISSION
Jupiter	Philippe Manoury Elizabeth McNutt, flute

Program Notes

Musicometry I

From Bach to Stockhausen, improvisation and composition have been inextricably linked. One of the most important current advocates of improvisation in composition is the clarinetist, Esther Lamneck, who has recently integrated improvisation with fixed medium electronic music compositions, including my works *Mappaemundi* and *Doctrine of Chances*. In her initial improvisations that formed the basis of *Musicometry I*, I found that her playing reflected the measure of such important qualities of my musical language as timbral texture, rhythmic gesture, pitch contour, and harmonic structure. Using these improvisations as the compositional basis of *Musicometry I*, I similarly sought to represent the measure of these qualities that I found in her own playing. The result is a truly collaborative work, in which the performer and composer adopt the essential aspects of the musical language of the other, as expressed in the dedication: "To, from, and for Esther Lamneck."

The Seasons and the Constellations

The Seasons and the Constellations is one of a series of works in which I used the consonant portions of human speech to shape the timing of the chords in the electronic part. This creates rhythms that are natural sounding, but unpredictable: to me, they are reminiscent of the patterns formed by wildflowers in a field, or stars scattered in the sky. The chorus is wordless, singing sustained vowels that hold the chords of the tape part together, like beads on a string. The title, a line from T.S. Eliot, invokes not only the star-like patterns in the tape part, but also the progression of the music through time, which seemed to me to echo the progression of the seasons of the year.

The Seasons and the Constellations was written mostly while in residence at The MacDowell Colony in New Hampshire in the winter of 2003. It was commissioned by the Dale Warland Singers with major funding provided by the Jerome Foundation, with additional support from the Alice M. Ditson Fund of Columbia University.

programs

Cigar Smoke

Cigar Smoke (2004) was written at the request of Esther Lamneck, to whom the work is dedicated. In the piece, notated sections alternate with cadenzas in which the soloist provokes and responds to sounds arising from the computer, which themselves consist of processed clarinet material and synthesized gestures generated during the performance. Software for the piece was written in C++ by the composer. The title refers to a large-scale work I envision based on the story of a different composer living under an occupation who steps outside for a smoke and is mistakenly shot by a nervous soldier (as happened to Webern). This music would accompany the moment when the composer begins to idle outside.

Jupiter

Jupiter, for flute and real-time electronic system, was commissioned by IRCAM and premiered there on April 25, 1987. The work is dedicated to Lawrence Beauregard. Miller Puckette is responsible for the technical concept, and the musical assistants were Marc Battier and Cort Lippe.

When I undertook to compose *Jupiter* in 1986, I had hardly any model at my disposal. Systems for real-time interaction between traditional instruments and synthesizers were still in their infancy. The first attempts were made in the early 1980s by Barry Vercoe and Lawrence Beauregard, who had the idea to connect his flute to the 4X machine. They were able to imagine the possibility of interplay between an instrument and a machine, which followed one another in real time, thereby freeing the performer from the bounds of fixed, unchanging tempo such as that produced by tape music. It was the arrival of Miller Puckette at IRCAM in 1984 that proved decisive for the invention of a device that could follow a score, and that provided the whole digital environment needed to realize this work.

The first success, therefore, was the control of tempo. But, encouraged by this experience, I decided to extend it to other elements in such a way as to ensure that the flute itself could generate a great deal of the synthesized music. Following a principle I hold dear, according to which, in any mixed work, the main instrument should be the central point of reference of the whole sound environment, I worked out various techniques permitting sound structures to be derived from the sound of the flute. This can extend from transformations or derivations stemming from the flute's own sound, all the way to controlling the evolution of synthesized sounds through an analysis of the soloist's ways of playing. These techniques, which I later named "virtual scores," permit an interactive connection between the instrument and the music heard through loudspeakers. In other words, the nature of the electronically produced sounds is, in part, a function of the way the soloist interprets his score. In no case is this a question of improvisation, because the whole score is strictly notated, but rather of analyzing the role of freedom, which is the basis of interpretation.

The score has seen several versions. In 1987, at the time of its premiere by Pierre-André Valade (who took part very much in the first experiments), *Jupiter* had a total duration of more than 40 minutes. A 20-minute "short" version was also composed for television. When the programming was transferred from the 4X machine to IRCAM's Music Work-Station, a third version was created restoring the length to about 30 minutes but without altering the work's sound content. Not until November 1996 did I decide to establis the definitive version, modifying the content of its synthesis programs substantially, an operation that could be compared to a reorchestration.

Real-Time electronic music, at least that which is organized in this manner (from this point of view, *Jupiter* is the first piece of its kind), still faces some obstacles in clearing the way forward, and one might have imagined that it would have been more fully developed by now. There is no doubt that for the moment, technological constraints are greater here than elsewhere, just as preparation and set-up time is longer than normal. In spite of the decade that has passed since the creation of this work, rather few experiments in this direction have seen the light of day. I remain convinced, though that this is the most substantial change that electronic music can undergo, since in introducing interpretation to electronic music, the very tenets of composition are shaken.

—*Philippe Manoury*
January 1997

Town Hall Brewery ◦ Saturday, 10:00pm – 1:00am

Experimental/DJ Performances

Featuring:	Keith O'Brien
	Local DJ Stars, TBA

Program Notes

Keith O'Brien

Tonight's performance involves Max/Msp processing of live electric guitar, hard disk samples and various drum perversions.

InFlux Auditorium ◦ Sunday, 11:00am – 12:00pm

Coffee Concert

Atmospherics/Weather Works	Andrea Polli
Incandescence	Benjamin Thigpen
My Heart Sings	John Welstead
AcGtr	Phil Manitone
Out of Breath	Paul Koonce
Spin	Don Malone
Detour	John Gibson

Program Notes

Atmospherics/Weather Works

Atmospherics/Weather Works is a software system first developed in 2003 for the creation of sonifications based on highly detailed and physically accurate meteorological data. 6 short sonifications were created from weather data centered around New York City describing the most intense 24 hour period of activity for Hurricane Bob, 1991 and The President's Day Snowstorm of 1979.

The first public installation of the storm sonifications was at Engine 27 in New York City. A 16-channel sound installation spatially re-created two historic storms that devastated the New York/Long Island area first through data, then through sound. The resulting turbulent and evocative compositions allowed listeners to experience geographically scaled events on a human scale and gain a deeper understanding of some of the more unpredictable complex rhythms and melodies of nature.

Visitors listening to the installation who had experienced one or both of the storms experienced a flood of memories. Some audience members found a metaphorical meaning in the series of rising elevations, finding the compositions nearer to the ground to be more visceral while those compositions representing activity closer to the top of the atmosphere were felt to be more ethereal and spiritual. Most listeners found that they developed a deeper understanding the more they listened to the compositions. This work has been shown widely in the form of an installation and as an interactive website created at the Daimon Center for Media Arts in Quebec and featured on the Whitney Museum of American Art's Artport Gatepage, May 2004.

AcGtr

AcGtr was created from manipulated acoustic guitar samples using MAX/MSP and Protools. It was originally written as part of the music for a collaborative piece with Alysse Stepanian called *Drainage*, an interactive, multi-media installation with sculpture, video, sound and gravity-driven mechanics. For more information on this piece visit the link below.

www.philipmantione.com/drainage.html

Out of Breath

Out of Breath explores the role of technology in remaking sound image and presence. Its material is the spectrum of a single flute note analyzed into groups of partials (odd, odd of the even, even of the even). In a series of visits to the analysis, the dismantled note is reconstructed—through changes to its envelope, tuning, transposition level, time-scale, and reverberation—to create a series of variations on the note's timbre and articulation. With the aid of an 8-channel sound system, the spectral groups are further distinguished by assignment to different speakers. The correlation of timbre with space that this creates not only adds a transparency to the evolution of each note's timbre, but also transforms our experience of the flute's presence by mapping its instrumental acoustic into a virtual one of architectural space and resonance.

As my intent was to explore sound image and presence, I guided my sculpting of successive notes to follow a kind of formal arch that traces the formation of the instrument's image followed by the extension and even disintegration of that image. While my simple goal was to evoke the aura of the individual performer exploring the instrument, my greater hope was to tap into the intimacy of the experience, and elicit, perhaps, some of the (private) timbral magic that anyone who has played an instrument knows.

Detour

In *Detour*, the subways of Tokyo and Kyoto—with their swirling machine roar and platform announcements—mingle with spiky synthetic textures. These two layers often intertwine, but now and then one suddenly interrupts the other, as if you were jostled while dozing on a busy train. The electronic sounds are meant to sharpen the qualities of the soundscape recordings, which I made on a trip to Japan, and sometimes to evoke the raucous sound and dazzling lights that form part of the Japanese urban experience. The disjointed continuity of the piece, which occasionally borders on the nonsensical, suggests the feelings of disorientation and dislocation that come with traveling in an unfamiliar, fast-paced city.

Sound Organization and Spatialization with John Conway's *Game of Life*

Michael Berkowski, University of Minnesota (berk0081@umn.edu)

Abstract: Cellular Automata processes serve as complex, yet largely predictable means of organizing elements of timbre, time, and spatial positioning in a musical composition. Due to its wide familiarity in popular science and its use in computer science education, John Conway's famous *Game of Life* cellular automaton was selected as the algorithmic basis for the composition of *Species*, a new work for eight-channel tape. All musical aspects of *Species* were integrated technically and conceptually by *Octoconway,* the composer's software adaptation of Conway's *Game of Life* rule set. In this paper, a few of the musically and technically interesting processes used in the development and composition of *Species* will be discussed.

1 Introduction and Background

Mathematician John Horton Conway's famous *Game of Life* algorithm serves as the compositional and organizational basis for *Species* (2004), a new computer music composition by the author. First introduced publicly in the October 1970 issue of Scientific American [Gardner70], and presented in greater detail and in Conway's own words in 1981 [Berlekamp01], the *Game of Life* has become one of the best known examples of a cellular automaton, a method of modeling dynamic natural or synthetic processes through a system of interrelated cells arranged in a space of one or more dimensions. For greater depth, and for the *Game of Life's* rule set, please consult *Winning Ways for Your Mathematical Plays* by Berlekamp, Conway, et al [Berlekamp01].

Octoconway is a custom software application written in C++ for advanced multi-channel, algorithmic score generation based on the principles of the *Game of Life*, but adapted to include a system of intercellular "genetics" which govern not only the temporal, timbral, and spatial characteristics of individual sound events, but also the interrelations of sound events, trait inheritance, and even mutation among them. The program itself lacks any method for sound synthesis, but is rather designed as a machine for organizing vast amounts of score data to be interpreted and synthesized in Csound. Furthermore, it may be adapted for compatibility with any other synthesis language following the orchestra and scorefile or event-list paradigm for non-realtime synthesis. Given a small amount of user input, the output of *Octoconway* consists of a number of text files to be synthesized for eight-channel playback, and additional data to be used for analysis and visualization by external graphing and statistical applications. The *Octoconway* application is not intended to compose a complete musical work in a single run, but rather to produce building blocks of larger compositions. In fact, the character of compositions developed with *Octoconway* depends largely upon the composer's choice of synthesis software and the instruments designed to fit the composer's timbral needs within the framework offered by *Octoconway*. A description of the procedure follows.

The user is initially prompted for a filename, which will serve as a prefix for all scorefiles and analysis files generated in that run. The system's random number generator is then seeded manually, permitting precise repeatability of the *Life* algorithm's random initial configuration when necessary. Next, one must specify the number of generations for which the *Game of Life* algorithm will be permitted to run before terminating, and finally, the user enters parameters related to the timing of individual sound events, including their durations, the density of simultaneous events, and the precision to which the algorithm must adhere to these specifications. When synthesizing the output scorefiles with Csound, each active cell of each generation will be manifested as a single sound event. Despite the granular characteristics present in the composite of numerous generations of sound events, the *Octoconway* software should not be regarded as a granular score generator, since all cells as individuals maintain full sets of unique traits influencing their interactions and generation inheritance.

2 Coping with the limitations of a simple cellular automaton

Typically, the *Game of Life* is a binary-state cellular automaton; each cell my be either on or off, and caries with it no memory of its state in earlier generations, no awareness of other cells except for those of its "neighborhood" at *time = t*, and no means of maintaining a data-set to describe its genetic, or in our case, musical traits. In developing the *Octoconway* software, data structures were implemented to hold a great deal of musical and genetic information for each cell within the grid, living or non-living at *time = t*. In addition to each cell's current state and position within the grid, the data structures hold several generic numeric parameters, which may serve as input fields to a software synthesizer. Such parameters include a sound event's starting time, relative to the beginning of the *Life* algorithm, its total duration, static or maximum amplitude, frequency, wavetable index, and Csound "instrument" number. Finally, each cell holds information about its life history, position within the listening space and the total amount of clock time elapsed that the cell has been continuously alive. The latter becomes useful for limiting the number of times an individual cell may sound before it undergoes some mutation, such as the lengthening of its event duration, or alteration of its amplitude.

The *Game of Life* has been further expanded to a multi-state cellular automaton, rather than its customary binary state. Though initially implemented as a means of introducing timbral variety among local cell populations, in development, it became useful for introducing resource competition between multiple "species" on the grid. This was accomplished in the following manner: the random initial configuration includes a certain distribution of living cells among non-living cells. Each living cell is also provided a random number between 1 and the software's maximum allowable species types. Next, the grid is divided into quadrants and all cells are converted to the "species" identifier determined to be the most numerous each quadrant, in effect producing regions within the grid where all species are alike. Figure 1a below shows first the random initial configuration, followed in figure 1b by the grouping by quadrants of species #1 in both upper quadrants and species #2 and #4 in the lower two. Species #3 has been eliminated entirely. Newly born cells will be of the same species as their neighboring "parent" cells, and during the algorithm's spread and migration of cells, collisions between populations of unlike species results in the less numerous population to be consumed by the more numerous.

Though the *Game of Life* is usually implemented on an infinitely extending grid, for practical purposes, *Octoconway*'s grid was limited in horizontal and vertical size. As a consequence of this confinement, given a random initial configuration of living cells, local cell populations tended to settle into stable states within a relatively small number of generations. Conway describes stable states in three categories: "Still life," which arrive at a grouping of cells that do not change at *time = t+1*, groupings which oscillate in place between two or more configurations with a period of *n* generations, and "Gliders," whose oscillations cause them to crawl across the grid with a period of *n* generations [Berlekamp01]. This proved conducive to composition, as many runs of the software resulted in a kind of complete musical "phrase," with clear progressions and points of arrival.

3 Data Mapping

Whenever one begins a musical composition based upon an algorithm or dataset, one must decide upon methods of translating the available data to musically meaningful and compositionally interesting sound, and the degree to which the algorithm will be aurally apparent to the listener. Rather than to establish fixed data mappings for works generated by *Octoconway*, it has been designed to output data in generic formats, which can be scaled according to one's needs in an external synthesis application. In their basic forms, *Octoconway*'s output fields consist of event starting times and durations in seconds, an amplitude parameter scaled between 0.0 and 1.0, a frequency parameter in Hz, two integer parameters which may refer to synthesis instrument or wavetable identifiers, and floating point coordinates for spatial position, which will be discussed in the next section.

When designing a synthesis instrument, any of the afore-mentioned parameters may be utilized in a number of ways, based on the needs of the composition. The following discussion details some examples of the mappings used in composing *Species* (2004). All sonic

Figure 1a: Random initial configuration.

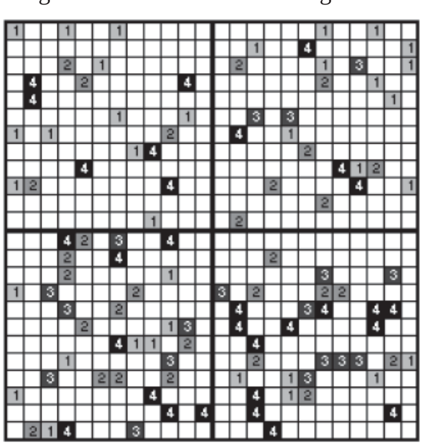
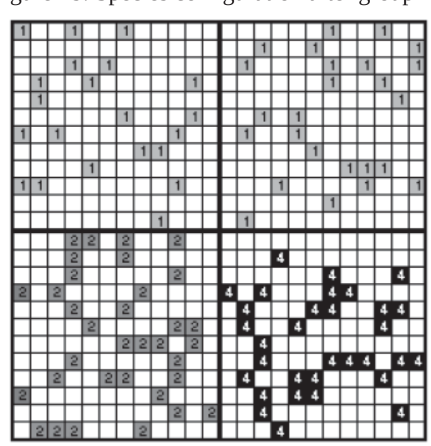


Figure 1b: Species configuration after grouping.



elements in *Species* may be categorized into two classes. The first class, which we shall describe as "long events," consists of spectrally complex timbres built of the harmonic series over a selected fundamental. Their implementation in Csound was accomplished by mapping the active cells of each generation horizontally (read left to right) to reflect progressing time, and vertically to reflect the number of the harmonic above the fundamental pitch. Each individual spectral component is therefore the result of the attributes of a single cell within the grid at *time = t*, and each aggregate of components, identifiable as a composite sound isolated in time from other aggregates, is built of all active cells in a single Life generation. Due to the *Game of Life*'s tendency to create perceived horizontal and vertical motions of cells within the grid, and the harmonic series' vertical mapping, several generations of the long event class played in sequence and separated in time may sound at times reminiscent of western Common Practice voice leading, although this is merely a consequence of the mapping scheme.

The second class, to which we will refer as "short events," consists not of composite, additive timbres as the long events, but rather the iterations of all cells individually over many generations. Typically, when generating score data for the short event class, the *Life* algorithm was permitted to run until all cell populations reached stable states within the grid, but since it was mapped to extremely brief sound events, as many as 200 generations may sound within the span of ten seconds, including tens of thousands of individual events. Unlike the complex mapping scheme of the long event class, the short event class utilizes a simple set of timbres with like amplitude envelopes and frequencies relative to each cell's position in the grid. In both event classes, the species identifiers were used to select from a palette of timbres, durations, and amplitude envelopes.

4 Cellular automata sound spatialization

A key feature of the *Octoconway* application and the compositions resulting from it is the use of cellular automata processes to organize sound placement within a multi-channel listening environment. Just as each cell within the grid maintained musical attributes, each was assigned a two dimensional coordinate position within the listening space each time it sounded. Using a simple linear panning map, the aural effect of this process in the case of the long event class of *Specie*s was to disperse the frequency spectrum throughout the listening space. Similarly, each short event cell is localized to a single spatial point, but may be placed differently the next time it sounds, based upon the positions of its neighboring and parent cells, and creating a perceived sense of motion among the aggregated short events. As one would likely expect, the initial placement of sounds in space holds a one to one correspondence to their positions in the two dimensional grid. However, beyond the first generation, the spatial relationships between individual sound events become increasingly complex. Active cells will exert a kind of gravitational influence over newly born cells in their neighborhoods, in that the different possible grid positions of parent cells affect newly born cells differently. For example, a cell born neighboring three adjacent cells on one side will be placed nearer to the average position of its parents than one born to cells spread around different sides of its neighborhood. A cell whose three parents are all placed in corners of its neighborhood will be placed at exactly the average position between them. Because most cells live and die in very short cycles and because they typically will not be born again in the exact spatial position in which they died, one should not expect their positions to collect in a small area over time. Populations that become stable should remain spatially fixed unless another migrating population collides with them. Figure 2 illustrates the changing use of space over 172 generations, as viewed from above. Notice that generation 1is dispersed evenly in the space, while the final generations, having reached stable states are similar to one another in spatial dispersion, and cell populations have become geographically separated.

It must be stated that despite our perceptions in certain instances, *Octoconway* contains no methods for describing true spatial motion for sound

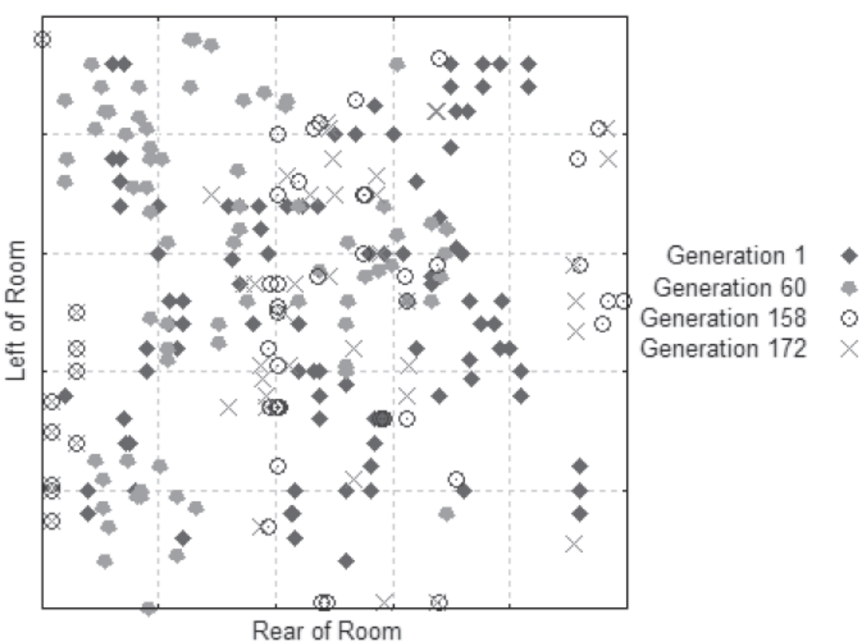


Figure 2: Actual spatial positions of sound events after 172 generations.

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events. Each event is placed statically in the listening environment and the illusion of motion comes either from allowing the overlap of sound events from different generations, or from mapping schemes which allow close proximity cells to share very similar characteristics when synthesized, as in the case of the long event class described earlier.

5 Conclusion

The *Game of Life* was found to be a useful means for generating and organizing large amounts of control data for music synthesis, and when one devises a set of genetic rules to govern musical attribute inheritance among cell populations in the automata system, one may create complete musical compositions conceptually unified, wholly beneath the *Game of Life's* rule set. Extending the genetic rules to govern sound spatialization as well provides musical meaning, and compositional interest by establishing complex spatial dispersions, perceptibly correlated with the sound events themselves, in addition to completing a work's conceptual design and implementation. Future projects will explore the use of mono-dimensional cellular automata systems to control sound spatialization in a stereo listening environment, and works incorporating correlated visual and aural elements with similar methods used to achieve octophonic spatialization with *Octoconway*.

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Rolling the jChing:

A Java-Based Stochastic Compositional System

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Abstract: The gamut-based compositional techniques utilized by composer John Cage in works such as *Music of Changes* defined a compositional framework which serves as the model for a compositional software application capable of transforming musical data cells using both chance-based and stochastic algorithmic functions. Written entirely in Java, the jChing makes use of the MusicXML data format to output transformed musical data. The jChing was designed to be used by composers to create dynamic reinterpretations of their own composed musical materials. This article outlines the functional model and technical specifications for the application and provides a basic example of the jChing workflow.

1 Introduction

While many composers find the application of algorithmic processes and models upon musical composition to be an effective and evocative method of work, the inherent calculation and mapping of computational data to musical form can be an extremely time-consuming and unnecessarily complex task. In *Music of Changes*, John Cage created a chance-based work by manually flipping coins to select musical data cells, which were in turn mapped to squares of the I-Ching. Cage's system was simple in design yet time-consuming in implementation. And while the methods the composer employed to select pitch and performance data were chance-based, the resultant composition remained fixed; the static notation of the piece removed any further element of chance from future performances.

The initial concept behind the jChing project was to replicate Cage's compositional process in software, automating both the pitch-cell selection and score-rendering processes, while at the same time creating a method where the transformations effected upon the original musical material could be easily and quickly replicated. In this manner, the resultant composition could itself be regenerated before every performance or even in real-time during a performance.

Using a class framework written in Java, it was relatively easy to create a basic model of Cage's Gamut structures and coin-flipping selection processes. The MusicXML (Recordare) data format provided a complete data output solution, whereby the functionalities of existing and prevalent music notation softwares such as Finale (Coda Systems) and Sibelius (Sibelius Group) could be leveraged in the presentation and further editing of output scores.

Once the basic system architecture was in place, it became apparent that the jChing system could be augmented to make use of a number of stochastic and probabilistic algorithms, further extending the range of compositional transformations available to a composer/user. The introduction of a basic system of weighting allowed for the possibility that algorithmically generated probability curves could be applied to aspects of the piece, including overall note density, note duration and note dynamics

1.1 Gamut-Based Composition

To create a chance-based compositional form from pre-defined musical phrases, Cage used a set of matrices of musical data cells mapped to cells of the I-Ching. These matrices are referred to as 'Gamuts' and the individual cells of each Gamut are referred to as 'Gamut Squares'. Separate Gamuts are used to hold note-phrase data (groupings of musical pitches and durations), dynamic level markings, and performance technique articulations. By randomly selecting Gamut Square cells, Cage sought to escape the inherent determinism he saw in traditional processes of composition. It was through chance selection that Cage realized a method of creating an overreaching compositional form without relying on his own compositional biases or preferences.

2 Using the jChing

Composers wishing to apply probabilistic algorithmic processes to their materials can enable weighting values for Gamut Squares to replicate more stochastic processes. After creating note-phrase cells through traditional compositional processes, composers enter those cells into the jChing input data file. Standard dynamic markings such as ***pp*** *(pianissimo)* and ***f*** *(forte)* are already defined in the system and can be given a weighting percentage to set the probability that those dynamics will be attached to any given note. Other system settings allow the composer to randomly or algorithmically assign various pitch transpositions and rhythmic expansions or diminutions to the cells. Currently the system is run by modifying and executing the Main.cls java class.

3 Object Data Structures

The highest hierarchically ordered object within the jChing object model is the Piece object. The Piece object acts primarily as a container for the Gamut object, the principle data-storage container for input data, and the Staff object, the principle data-storage container for output data. Piece objects provide logical data storage for Piece-level data elements (such as "Composer Name" and "Piece Title"). Both the Gamut object and the Staff object store Gamut Squares with the Gamut object reading Gamut squares note-by-note from the input data file and the Staff object ordering, transforming, and outputting Gamut Squares into a MusicXML formatted output file.

3.1 Data Input Structures

Contained within the Piece object, the Gamut and Gamut Square objects serve as key grouping data structures for the jChing data input process. Each Piece has one Gamut object, which in turn is made up of any number of Gamut Squares - cells of Note objects upon which transformations can be later performed.

As data is read from the input data file, individual Gamut Square objects are created for each successive Gamut Square. Within each Gamut Square, individual Note objects are created containing pitch and duration data for each note found in the input file. By the time the data input file has been fully processed, the Gamut object is populated with a set of Gamut Square objects, each respectively populated with a series of one or more Note objects. It should be noted that a musical rest is also considered a Note in this context and is stored as such.

3.2 Data Output Structures

During the algorithmic selection of Gamut Squares and their subsequent transformation, Staff objects are used both as containers for processed Gamut Square objects as well as representative staves within a multi-voice musical piece. When calculating the sequence of Gamut Squares for output, Gamut Squares are selected from the Gamut object based on the desired chance-based or probabilistic selection criteria and placed into a new order within the Staff object. In a multi-staved musical piece, all Gamut Squares for one Staff object are selected sequentially. Only after all squares for one staff have been selected will squares for the next staff be selected.

4 Gamut Square Transformations

The jChing is designed to allow users to effect transformations, either chance-based or probabilistic in nature, upon three core attributes of note sets within a piece: the ordering of Gamut Squares found in the piece, the relative amplitudes or dynamics for each note of the piece, and the absolute temporal durations of each note in the piece. Based on the differences in structure between Gamut Square objects and individual note objects, the data structures and methodologies by which the transformations are implemented are different. But whether algorithmic value selections occur in a hash-table of Gamut Square objects or in an array of amplitudes, the functionalities of these transformations remain essentially the same.

4.1 Gamut Square Ordering

The most basic form of transformation applicable to musical cells in a Gamut-based system is the relative order in time that each cell will be performed; essentially a virtual shuffling of Gamut Squares. By selecting cells at random a timeline of cells can be created to form a chance-based compositional structure. Such a transformation is wholly chance-based as it is equally probable that each cell will be chosen as any other cell.

By applying simple weighting values to each data cell, specifying the relative likelihood of each cell's selection within the Gamut, a simple stochastic system can be created. Generating the weights of relative cells based on probabilistic functions such as Gaussian distributions can impose a more ordered stochastic form upon the cells, giving the composer even more control over what many would still consider a relatively "random" compositional form.

Whether a chance-based or probabilistic algorithm is used to select Gamut Squares from the Gamut, selected squares are placed in their new order into a Staff object. If the piece being generated contains multiple voices or parts, multiple Staff objects are populated with Gamut Squares until a pre-set limit of either Gamut Squares per Staff or a total length of beats is reached, at which time the next Staff object is populated.

4.2 Musical Dynamic Weightings

Just as a Gamut structure can be used to facilitate algorithmic selections of note cells, so too can a simple table structure be used to apply occurrence-weightings to different musical dynamics. Composers can set weighting values for each desired level of dynamic from ***pppp*** to ***ffff***. A table of values in the input data file matches dynamic markings to percentages (from a combined total of 100 for the entire piece). For instance, if the ***p*** dynamic is to appear more frequently than the ***f*** dynamic, the composer can set the ***p*** to have a weight of 20, while the ***f*** could be set to 1; therefore the probability of selecting ***p*** is twenty times greater than ***f*** and will most likely appear significantly more frequently in the piece

On a note-by-note basis, dynamics can be selected from this table and applied to the Note object currently being processed by jChing. Dynamics can be selected using either a strictly chance-based selection or more algorithmic processes. Functionally, the table with added indices, more accurately realized as a multi-dimensional array, acts in a manner similar to a Gamut.

4.3 Gamut Square/Note Scalings

Composers wishing to effect duration changes to Gamut Squares or Notes can enable an option whereby a percentage value entered in the input file will determine the probability that any given Gamut Square or Note object will have its durational value multiplied by a multiplier value. Multipliers are entered as a range of numbers and a divisor; as cells are selected for scaling, a value derived from the range (in increments of the divisor) will be used to multiply the cell's duration. For logistical reasons, the cell can be either a Gamut Square (whereby all durations of notes contained within will be scaled) or an individual Note.

5 Input Data Formatting

In the early stages of development, it became clear that input data needed to be organized in a manner that was both comprehensible to the human user as well as formatted in a robust and logical way to facilitate easy data parsing and processing. After considering a number of possible data formatting solutions, a modified version of the SCORE (L.Smith, 1987) music data format was chosen for its simplicity and comprehensive coverage of musical expressions and data types. The SCORE 4.0 Music Data Entry Reference Manual (Sapp, 2002) stands as the standard formatting model for all musical expressions of jChing data input.

5.1 Header Data Declarations

Data representing elements such as the Piece-Name and Composer-Name, as well as structural characteristics such as the number of staff-systems, respective system clefs, and the overall size of the excerpt are entered into the Header Declaration of the .gam input file. Data from the header declaration will be used to populate Piece-level data in the jChing object model. From the following header declaration for the choral work *Diane Sumus In Fide* for SATB chorus, we can see that each data-value is prefaced by a data-tag in capital letters. Multi-part data such as the four values for SYSTEMCLEFS are separated using "/" marks.

```
PIECENAME Dianae Sumus In Fide
COMPOSER Robert Hamilton
POET Catullus
RIGHTS Copyright 2003, CDS. Publishing
SOFTWARE jChing
ENCODINGDATE February 14, 2004
SYSTEMS 4
SYSTEMCLEFS T/T/A/B/
PARTS Soprano/Alto/Tenor/Bass/
SIZE 18
```

5.2 Dynamic Weighting Declaration

Following the header data the user can define relative weightings for the range of dynamic values to be used in the piece. In the following partial definition of dynamic levels, the "NULL" weighting is used to define a cell with no specific dynamic marking.

```
DYNAMICS
NULL    45
PPPP        0
PPP         0
PP   10
...
```

5.3 Gamut Square Declaration

Figure 1 depicts a composer-defined musical cell in both standard musical notation as well as in the jChing input data format. Pitches are declared as a note name and accidental followed by an octave number.


```
START
NUMBER 1
FLIPSET 666666
METER /4 4/
CLEF TR
KEYSIGNATURE K1S
DURATIONS Q/E/E/Q/Q/
NOTES R/Eb4/AN4/F#4/R/
WEIGHTING 1
        END
```

Figure 1. Individual Data Cell

The .gam data file lists each Gamut Square cell used in a piece, complete with individual numbers, meters, clefs, key signatures, note pitches, and note durations. Each cell is prefaced by a START data-tag and ended with an END data-tag. For Gamut Square 1, we can see that there is a Treble-clef in a key with no flats or sharps and four notes with respective durations of one quarter-note, one-eighth note, one-eighth note, one quarter-note and one quarter-note. Both Note durations and Note pitch values are entered in "/"-delineated lists, with the order of values in each list corresponding to the order of notes found in the particular Gamut Square.

The METER data field shows that the cell can be interpreted to have a time signature of 4/4. The FLIPSET data field has been included for implementations of Cage's coin-flipping scheme that wish to mimic the composer's techniques exactly. Additionally, the cell is given a WEIGHTING value of "1", meaning it is given no additional weight in probabilistic computations.

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6 Data Output Formatting

Scores output by jChing make use of the MusicXML data format as defined in the MusicXML 1.0 Tutorial (Good, 2002) available from the Recordare.com website. According to the MusicXML data definition, score data can be grouped either in a "partwise" manner, where each score part or instrument is hierarchically superior to the measures contained within, or in a "timewise" manner, where each measure is considered one by one, grouping each individual part as belonging to the particular measure. By using XSLT stylesheets, MusicXML scores formatted in a "partwise" manner can be converted to a "timewise" manner, and vice-versa. Currently, scores created using jChing are formatted using the "partwise" definition. The cell-based design of the Gamut Squares and the linear nature of jChing's transformation processing seems more in keeping with the linearity of the "partwise" definition. For an in-depth description of data formatting using MusicXML visit the Recordare.com website.

6.1 Staff-based Output Ordering

Just as the MusicXML partwise data-definition sets up a macro-structure whereby individual measures are grouped together within parts, jChing orders data for output by selecting and grouping individual Gamut Square objects within Staff objects. Each Staff object acts as a container for all Gamut Squares that will make up a specific voice or part within the score; all notes from these Gamut Squares will be placed on the same staff on the written score. When transformations upon Gamut Squares are performed, the Staff objects monitor overall length and pitch ranges for the entire part and if need be can apply constraints to prevent the staff from growing too long or the range of the individual notes from exceeding the range possible for the staff's chosen instrument.

After outputting header information, the jChing processing steps through individual Staff objects and renders each Staff object as a separate part. Parts consist of a number of measures, each defined individually with both a set of measure-wide attributes and a set of note values.

6.2 Measure Calculation

One of the most important aspects of properly presenting scaled Gamut Squares on a written staff is the calculation of individual measure durations within each staff. When Gamut Squares are ordered in partwise fashion, each staff is ordered without consideration of events happening on other staves at the same time. One immediate issue is how to properly size measures and/or divide and tie notes together to preserve the intended rhythmic values of notes within Gamut Squares on a written staff.

Since the modification of time signatures for individual measures can have subtle differences in meaning for performers, the clearest solution of this issue is to effect a rule-based system of note splitting and tying. This system will be able to fit groupings of notes into a locked measure time signature and create subdivisions of tied notes (e.g. two-tied quarter notes instead of one half-note) to span measure lines. Such a system is currently under development.

6.3 Score Rendering

By applying either chance-based or probabilistic manipulations to the input score data, virtually any number of interpretations of the musical data could be made, resulting in an infinite number of possible Gamut Square orderings. Following the processing of data, musical scores can be created by simply importing the resultant score .xml file into a music notation software such as Finale or Sibelius.

7 Conclusion

The primary goal of the jChing project is to incorporate the chance-based and stochastic compositional processes utilized by composers such as John Cage and Iannis Xenakis into a score-generating compositional tool. By automating the mechanics of calculation for composers, the jChing can act as a valuable composition tool. In its current state, only basic system functionality is supported by the jChing, however the previously mentioned system enhancements all fit easily into the existing system framework. Additional development for the project is ongoing to incorporate more features and streamline existing processes. The scope of enhancements will include not only an increased number of stochastic and deterministic algorithms but also greater support for data input and output of MusicXML, a graphical-user interface for more user-friendly operation, and compatibility with the Max/MSP 4.5 implementation of Java for real-time use.

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Audible-Mobiles: An Application of Ecosystemic Programming in Kyma

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Abstract: Agostino Di Scipio's *Audible Eco-Systemic Interface* **project presents an elegant method of employing real-time interactive electronics to explore spatial diffusion of sound and structural design in electroacoustic music. Using Symbolic Sound's** *Kyma***, one can program a computer to function as an autonomous system in the sonic ecology of an environment.** *Audible-mobiles* **employ ecosystemic programming as a means of treating sound as analogous to multi-dimensional objects in a sculptural mobile. By applying the conceptual model of kinetic art to sound, I am exploring non-circular arrangements (***nets***) of sound spatialization and non-linear structural designs for music.**

1 Ecosystems

An ecosystem is an *autonomous system*, which may be composed of nested autonomous systems: "units that hold their ground by moving in their environments according to their inherent laws" (Nees, 2000: 42). These 'inherent laws' govern behavior in reaction to changes in the environment. Autonomous systems can effect change in their environment, to which other systems (and they themselves) will react. The relationships among systems and their environment--how they react to and influence each other--is called *structural coupling*. Inherent in all autonomous systems is the notion of *competition* between their constituent elements, which, based on their structural coupling, leads to *self-organization* (Nees, 2000: 43). This self-organization often results in a balance being found between all of the elements. This balance may be tenuous and dynamic, and depending on environmental changes, lost and found again in a similar or dissimilar form and manner.

2 Mobiles as Ecosystemic Art

The palpable sensation of sound seeking a balance was overwhelming the first time I experienced an example of ecosystemic programming. I was immediately struck by the analogy of a mobile. As a model for electroacoustic composition, it suggested an elegant means of addressing diffusion and interactivity in electroacoustic music. The more I followed this line of thought, the more it suggested structural designs in music I had not contemplated before.

A sculptural mobile is ecosystemic art. The individual elements or objects of a sculptural mobile function as autonomous systems which are structurally coupled to each other and the environment they inhabit. They are located in a space and programmed (by physical design) to have an interactive relationship to each other and the environment. As these objects interact with and change their position in the environment, our perception of the objects changes, yet the objects are recognizably the same objects. The structural coupling of mobiles is often *transparent* and exposed, enhancing our awareness of the balancing act that is literally being performed. Our awareness of the *potential* for change or motion contributes to the creation of expectations. The fulfillment or foiling of our expectations is an aspect of the process of dramatic revelation about the objects and their relationships to the environment. Perhaps Alexander Calder's poetic insight on art in general explains this drama best:

"How does art come into being? Out of volumes, motion, spaces carved out within the surrounding space, the universe. Out of different masses, tight, heavy, middling, achieved by variations of size or color. Out of directional lines--vectors representing motion, velocity, acceleration, energy, etc.--lines which form significant angles and directions, making up one or several totalities. Spaces or volumes, created by the slightest opposition to their masses, or penetrated by vectors, traversed by momentum. None of this fixed. Each element can move, shift, or sway back and forth in a changing relation to each of the other elements in the universe. Thus, they reveal not only isolated moments, but a physical law or variation among the elements of life, Not extractions, but abstractions. Abstractions which resemble no living things except by their manner of reacting" (Marter, 1998).

3.1 Ecosystemic Music

In Agostino Di Scipio's *musical ecosystems*, the music is the result of "a system in continual exchange with the surroundings and with its own history" (Di Scipio, 2002: 25). The computer, based on its programming, is structurally coupled with the environment via sound. "[The] computer *acts upon* the environment, observes the latter's response, and adapts itself" (Di Scipio, 2003: 275). [For a detailed description of Di Scipio's approach and music, see Di Scipio's articles cited.] A simple program exemplifying this principle directs the computer to produce sound and to adjust that sound's amplitude in response to the amplitude of the environment into which the sound is diffused. A feedback loop is programmed in which 1) the computer measures the amplitude of the environment's ambience, 2) the computer converts that data into control data, and 3) that control data adjusts the amplitude of the computer's output in an inverse relationship. The higher the amplitude of the environmental ambience, the lower the output of the computer and vice-versa. An audible balancing act ensues as the computer reacts to changes in the sonic ecology it has itself instigated (and continues to instigate).

3.2 Diffusion as an Ecosystemic Element

An embellishment of the amplitude control program enables it to control the spatial diffusion of sound in the environment. I see the art and practice of diffusion as thoroughly ecological in nature and a natural fit for ecosystemic programming. A fundamental premise of diffusion is to acknowledge the sonic properties of a space's ambience, to exploit the characteristics of a room's ambience to the musical advantage of the composition (Harrison, 1998: 118-124). By structurally coupling the diffusion of sound to the ambient response of a space, one not only acknowledges the ambience of a space, but empowers the space to actively exercise its will over the presentation of the sound.

Ecosystemic programming of diffusion offers one possible avenue of addressing Denis Smalley's observation that "spectro-morphological design on its own...creates real and imagined motions," and that "the failure to understand the directional implications and temporal pacing of motion is a common compositional problem" (Smalley, 1986: 73, 75). It may be especially musically effective to synchronize ecosystemic control of spectro-morphological aspects of a sonic gesture in conjunction with diffusion. One issue is the *transparency* (or in this case, lack thereof) of the structural coupling. In other words, the listener may be simply unaware of the ecosystemic mechanism in place, and does this matter?

3.3 Nets of Sound Spatialization

I believe a valuable direction to pursue with ecosystemic programming of diffusion is what Maja Trochimczyk terms *net-based* spatial designs: asymmetrical, non-circular arrangements of spatial diffusion, including multiple spaces. "Music," according to Trochimczyk, "may reflect the spatial shape of a net and, by doing so, reflect the growing awareness of the network-like structure of the physical and human worlds" (Trochimczyk, 2001: 51). *Nets* have certainly been explored over the past several decades, particularly in the case of sound installations. Ecosystemic programming that structurally couples nets of discrete spaces can further facilitate the connection of the audience and art(ists), connecting them directly with both the creation of the work of art and their environment. One amusing possibility has an audience--by chance or by design--competing as autonomous agents to influence the sound in an ecosystemic net to suit their competing aesthetic desires.

4.1 The Audible-Mobile

An *audible-mobile* is composed of *sound objects*, diffused from speakers located in a space or multiple spaces. These sound objects are treated as analogous to multi-dimensional objects in a sculptural mobile. Like the objects of a sculptural mobile, they function as autonomous systems structurally coupled within and to a larger environment. Sound objects are discrete sound events that may be of any complexity, length, or source and are perceived as distinct from other sound objects because of their behavior, spatial location, and certain spectro-morphological properties.

As the individual objects of a sculptural mobile have certain well defined properties, such as shape and color, I want to create well-defined yet dynamic sound objects, which reveal aspects of themselves through transformation. Transformation is made possible by programming spatial location and aspects of a sound object's spectro-morphology as variables structurally coupled to their environment. I equate these variable qualities with a sculptural mobile object's ability to present a perceptually transformed self as it moves within and responds to changes in the environment (e.g. air currents, temperature, and lighting).

A variety of individual or multiple sources can provide the sonic basis for a *sound object*, including prerecorded spectrum or sample files, different synthesis methods, and the ambient sound of the environment (which includes the audible-mobile's output). One object type with interesting potential has as its basis the spectrum of spoken or sung text, including the possibility of real-time crossing of the spectra of two complementary texts. This type of sound object introduces another facet to consider, the aspect of semantic content and the potential for semantics to suggest a gestural trajectory.

In the case of a sound object that uses ambient sound as a source and not just as control data to respond to, I liken its design to that of a sculptural mobile object constructed of reflective material. What it reflects (transformed or not) alters its surface appearance, but it retains its unique identity for the reasons cited above. Its reflections may inform us about other qualities of the object, such as its curvature. This reflective quality is, in its own way, another instance of structural coupling between the object and its environment, as the environment influences a quality of the object and our perception of it.

A sound object with a dynamic spectro-morphology can suggest a gestural trajectory and possess a real or perceived *potential* for gesture, creating expectations which <u>might</u> be realized. The interaction of the sound object in the sonic environment and the transparency of the structural coupling heightens our perception of the potential for change. In turn, our awareness of the various sound objects, their relationships to each other, and the environment, is heightened as they actively seek balance.

4.2 Structural Design

I am especially interested in modeling with sound a sculptural mobile's ability to project a dynamic composite structural design with well defined objects, objects whose transformational properties are the result of environmental interaction, not continuous re-creation. Lev Manovich, in "The Language of New Media," offers an attractive idea for approaching structural design. He states, "In general, creating a work in new media can be understood as the construction of an interface to a database" (Manovich, 2001: 226). From this perspective, the sound objects of an audible-mobile constitute a dynamic database of media objects. They are defined by their unique spectro-morphology, the spatial limits of their existence within the overall ecology of the space, and the balance they achieve within that ecology. The ecosystemic nature of the audible-mobile's programming constitutes the interface (see Di Scipio, "Sound is the Interface: from *Interactive* to *Ecosystemic* Signal Processing.").

4.3 Navigable Space

The structural design of a fixed media composition with ecosystemic diffusion presents sonic material in a linear, or sequential fashion. In an audible-mobile, I hope to create structural design through what Manovich identifies as the cultural form of *navigable space* (Manovich, 2001: 248). The database (of sound objects) constitutes a navigable space, navigable in the sense that there is no singular prescribed order or temporal condition for dealing with the individual sound objects. The navigability of this database space is emphasized by the literal spatialization of the database objects. One can navigate a trajectory through this database space physically, visually, aurally, psychologically, or in any combination of these methods. The sound objects coexist in time and a space or multiple spaces, to be contemplated individually, collectively, or, in the case of truly discrete spaces, as physically encountered.

The programming and transparency of the structural coupling can encourage a particular orientation or navigation of the space, but do not dictate it. Our sense of impact on a mobile's transformation may influence how we choose to interact with the mobile, and thus, "sound-making influence[s] the way listeners relate to their environment" (Keller, 2000: 55). To the extent that the structural design can be sequential, it unfolds as the audience interacts with the piece and defines their own trajectory through the database of media objects.

4.4 Installation or Performance Work?

Does an audible-mobile favor existence as a sound installation or as a performance piece? I believe the answer is either and both. The audible-mobile does favor presentation in spaces outside of the concert hall, and I am interested in pursuing the creation of nets of sound space in multiple, distinct, but structurally coupled spaces. The ecosystemic nature of an audible-mobile makes it site-specific, yet portable, a desirable quality for performances in locations not designed with concert presentations in mind.

My work with interactive art to date has focused on the interaction between performers, electronics, and me. In such works, the audience experiences a linear presentation of material determined by the performers and me. Ecosystemic programming opens up the possibility of a more immersive interactivity of audience, performers, and space. For instance, the performer's role can be to contribute to the sound of the space in order to instigate a musical response or contribute to the musical ecology of the space. In terms of structural design, performers can guide the trajectory of the audience through the database of media objects, or function as media objects themselves, crossing what is often viewed as a barrier between the audience and art(ist). Such a role for a performer in this situation suggests a powerful dramatic potential to explore.

5 Conclusion

Di Scipio's approach to interactive sound design—ecosystemic programming— enables the efficient structural coupling of diffusion and spectro-morphological properties of sound to the environment. This, in turn, enables the exploration of nets of sound spatialization that can function as sound installations and performance pieces. Finally, ecosystemic programming provides an effective method for applying artistic concepts from distinct media, such as kinetic art, to sound, the path of artistic inquiry taken in audible-mobiles.

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No Clergy: Real-Time Generation and Modification of Music Notation

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Abstract: *No Clergy* **is an interactive music performance/installation in which the audience is able to shape the ongoing music. In it, members of a small acoustic ensemble read music notation from computer screens. As each page refreshes, the notation is altered and shaped by both stochastic transformations of earlier music with the same performance and audience feedback, collected via standard CGI forms.**

1 Introduction

No Clergy currently runs on a Debian GNU/Linux system with Python, bash, the Apache web server, and GNU Lilypond. The ideal performance setting has one person serving as the "conductor" logged in to a shell on the server. It requires a small ensemble of acoustic performers playing any sort of monophonic pitched instrument. Each performer needs a web browser on which to view notation. There should also be one or more stations with web browsers pointed to the CGI forms used by the audience to react to what they are hearing.

2.1 Generation of Notation Markup

To run the piece, the "conductor" executes a bash script called *setup.sh* that contains several calls of a Python script (one for each instrument) called *make_ly.py*, which generates a text file with music notation markup for GNU Lilypond.

This initial page of notation is intended to be fairly "neutral", using a flat distribution of pitches, durations, articulations and other musically-significant data across either each instrument's range or some generic global ranges. The program also reads a configuration file for variation of these initial parameters, allowing different starting points for performances.

2.2 Storage as MusicXML

In order to perform stochastic transformations on the notation, *No Clergy* needs some method of storing musically significant information about each page of notation. I chose Recordare's MusicXML, described by them as "a universal translator for common Western musical notation from the 17th century onwards. It is designed as an interchange format for notation, analysis, retrieval, and performance applications" [Recordare]. Each xml file is generated with a date-time stamp filename, then compressed with bzip2 compression and filed by instrument. The most recent file remains uncompressed, to be accessed during the generation of subsequent pages of notation.

2.3 Rendering of Notation Markup

After the "conductor" has executed *setup.sh*, there are then files with Lilypond markup, one for each instrument. Lilypond is a Scheme-based music typesetting program which uses a TeX-like backslash notation, and is inspired by "the best traditional hand engraving" [Nienhuys]. It outputs to several high-resolution graphics formats (Figure 1).

Figure 1: Initial page of notation for trumpet

Because *No Clergy*'s notation output is intended for viewing in web browsers, it outputs to PNG (Portable Network Graphics) format. The performers then play their individual pages of notation. They are not required to stay in sync with each other.

3 Audience Feedback

As the performers play, the audience is able (and encouraged) to respond as they see fit, using a form shown in Figure 2. Audience members are able to affect both the overall direction of change (shifting articulations toward *staccato*, for example), as well as the range of variation. Narrow variation causes extremely soft dynamics to cluster around the minimum value of *ppp*. Wide variation allows more notes with mp or even f dynamic indications, even as the overall dynamic center point remains extremely low. This particular version of the form changes the configuration for the trumpet.

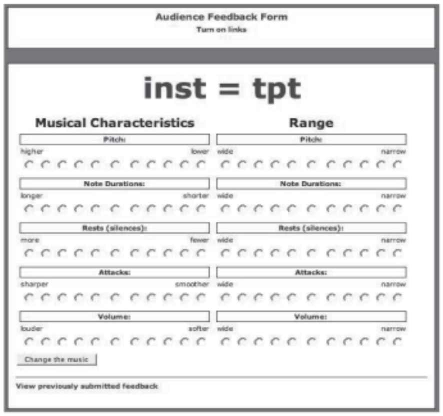

figure 2: Audience Feedback Form for trumpet

4 Subsequent Pages of Notation

For the 2nd and later sets of pages for each instrument, the conductor executes multiple calls to a Python script called *mutate.py*. Like *make_ly.py*, this generates Lilypond markup, but rather than using a uniform distribution, it creates a data set for Markovian transformations from the previous XML file for that instrument, as well as shaping the result of the Markovian operation according to the audience feedback.

An example of such output after several successive runs of the piece is shown in Figure 3. As you can see, the feedback has resulted in a thinner texture, with a narrow dynamic range around *mp*.

Figure 3: Transformed page of notation for trumpet

5 Other Performance Options

Currently, the *make_ly.py* and *mutate.py* scripts are run manually by the conductor. Since they are command-line scripts in a Unix-like environment, setting up scheduled executions with periodic resets back to initial page conditions are a viable option for different performance settings.

The piece as it exists is also intended for performance by real acoustic musicians. Were No Clergy to be demonstrated as more of an installation, making such demands of performers becomes more onerous. Since Lilypond can also output MIDI files in addition to files for visual presentation, MIDI playback becomes an option for installations. Music notation has also often been appreciated for its aesthetic beauty alone. Especially for a musically literate installation audience, visual presentation alone is also a feasible option.

6 Acknowledgements

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Acquisition/Licensing

http://nibbler.med.buffalo.edu/noclergy/ currently hosts *No Clergy*. Once it is officially released under the GNU General Public License, source code will be included in my dissertation and made available at http://kevinbaird.net/.

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etherSound: An Interactive Sound Installation

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Abstract: This article describes the interactive instrument/sound installation *etherSound* and discusses its artistic and ethical implications. *etherSound* is a work in progress and the main intention is to create a vehicle for audience participation through the use of SMS (Short Message Service). The two different contexts in which *etherSound* has been tried (in concert with performers and as a sound installation without performers) is discussed as well as the design of the system and the mapping between text and sound. A notion of a 'democracy of participation' is introduced. The relatively fast response of the system, the familiarity of the interface (the cellular phone) and the accessibility of the system suggests that the cellular phone can be successfully integrated in a sonic art work.

1 Introduction

etherSound was commissioned by the curator Miya Yoshida for her project The Invisible Landscapes and was realized for the first time in August 2003 at Malmö Art Museum in the city of Malmö, Sweden. The curatorial concept for The Invisible Landscapes project was the use of cellular phones in the context of experiencing and creating artistic expressions. The principle idea behind *etherSound* came to be an attempt at developing an instrument that can be played by anybody who has knowledge about how to send an SMS (Short Messages Service) from a cellular phone. The focus of my research project, of which *etherSound* is a part, is interaction between computers and musicians as well as non-musicians. *etherSound* is an investigation of some of the aspects of interaction between the listener, the sounds created and the musicians playing, and also of the formal and temporal distribution of the music that this interaction results in.

While interaction is an important aspect of musical performance in many genres, active audience participation is not as evolved in the western music tradition, and when explored, the result is usually not labeled as music, but rather as a sound installation, soundscape, sonic art or some other term that indicates alienation from the traditional notion of music. Opening up a musical work for others than trained musicians is not a trivial task; careful attention has to be paid to the purpose of doing so and to the intentions of the work. It is relevant to pose the question whether it is possible to reach a satisfactory result with almost no limitations on participation and, if so, can the result not be called music. However, before these questions can be addressed we need delineate the purposes for wanting to allow for public participation.

Public participation has been explored in the visual arts for almost a century, for artistic as well as political reasons, and if we look at it from a performing arts perspective, the audience visiting a performance can be said to participate in it—if only in a limited sense. Concurrently, especially in spheres of distribution and consumption of music, there is a tendency to objectify the musical work. As the power and irrational control excercised by the institutions of distribution increases, the freedom of choice and influence of the listener decreases [Adorno, 1962a]. Furthermore, western art music is to a considerable extent looked upon as a hierarchic process; a process that begins in the mind of the composer and ends at the level of the listener or, even before that, at the level of interpretation. It is fair to assume that bringing in an uncontrollable agglomeration of participants influencing the distribution of musical events will disturb this order.

In their article on the multi-participant environment *The Interactive Dance Club*, Ulyate and Bianciardi define one of the design goals as wanting to 'deliver the euphoria of the artistic experience to "unskilled" participants' [Ulyate and Bianciardi, 2002]. Instead of sharing merely the result with an audience, they attempt to unfold the creative process leading to the result and invite the audience to take part in this process. This ambition points to another issue: how to design musical interfaces that have a 'low entry fee, with no ceiling on virtuosity' [Wessel and Wright, 2002, Jordà, 2002] (see also [Rowe, 1993, Freeman et al., 2004]). With the recent technological advances there are innumerable tools that can be used for collaborative efforts [Barbosa and Kaltenbrunner, 2002], affordable devices that easily can be used as interfaces to computer-mediated art works. Not only has this the potential of changing our perception of the arts, it can also help us understand this new technology and the impact it has on our lives.

Traditionally, there is an intimate association between social class, level of education and cultural interests [DiMaggio and Useem, 1978, Bourdieu, 1979] that affects cultural consumption. Is it possible to make music that can counteract this 'closeness' of contemporary art and music, that can make conditions for classless and unprejudiced participation in the arts without compromising the content and the expression? I believe it is and I believe collaborative music is one way to achieve this. Roy Ascott, in addressing the issue of 'content' in art involving computers and telecommunications writes:

> In telematic art, meaning is not something created by the artist, distributed through the network, and *received* by the observer. Meaning is the product of interaction between the observer and the system, the content of which is in a state of flux, of endless change and transformation [Ascott, 1990].

Following this line of thought, it may be concluded that the need for a thorough insight in the history of art or electronic music is no longer a prerequisite for understanding a collaborative, interactive work. This limits the advantage of the educated listener and makes room for new interpretations of the term 'understanding' in the arts.

2.1 The Design

etherSound is an attempt to open a musical work to the uninitiated and provide for a notion of 'democracy of participation': all contributions are equally valuable. Accessibility without prior knowledge of music or musical training is an end in itself in this project. It should be noted that this obviously presupposes that the participant knows how to send a SMS and that the system makes it difficult for those who are not familiar with this technology[1]. It should also be made clear that using SMS text messages for interaction as it is implemented here does not allow for direct dynamic control. Every message generates one 'message-composition' and all control data is derived from the content of the message.

2.2 The first model

In the first version, realized in August 2003, the communication between the participant and the system was accomplished according to Figure 1. A SMS sent to the specified number was transformed to a XML file and transferred to a URL by a HTTP POST request. This part was handled through an external service. At the called URL, a JSP (Java Server Pages) was directing the POST data to a Java Bean [Java Enterprise Edition, 2004] that handled the parsing of the data and the connection to a MySQL database in which it created a new entry with the relevant fields.

It was due to security reasons at the museum where this version was realized that the HTTP request could not be handled locally. Instead, the local computer queried the server database for new entries on regular intervals. After some testing, sending a SQL query once every second seemed like a reasonable time interval. Shorter time intervals didn't accomplish a perceivably quicker response time and, since the synthesis program was running on the same machine, I didn't want to use more processing and network activity than necessary for this task (see section 3 for further discussion). After the text message had been processed, control signals where sent by MIDI to the synthesis engine.

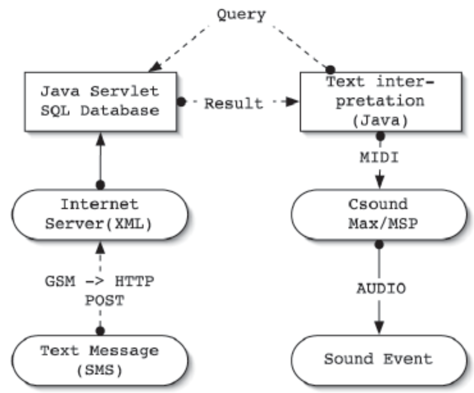

Figure 1: Communication in the first version.

2.3 The current model

Although the first version worked well and was fairly stable, it was a solution that required an external SMS processing service, and a local, reliable network connection. In order to make the piece more 'portable' and independent, the message receiving part has been rebuilt. Using the gnokii API [gnokii, 1995] it becomes relatively easy and reliable to connect a GSM phone to a computer and thus enable reception of the SMS messages locally. To have the possibility to review the activity of transmission, the messages are, just as in the first model, written to a database. In other words, the client-server model is retained but on one and the same machine. Furthermore, the MIDI connection between the control application and the synthesis engine has been replaced with OpenSound Control (OSC) [Wright et al., 2003, OSC, 1997] for speed, reliability and flexibility, using the library *JavaOSC* (see http://www.mat.ucsb.edu/~c.ramakr/illposed/javaosc.html).

2.4 The text analysis

The program handling the text processing and the mapping of text to control signals for the sound synthesis is written in Java [Java Standard Edition, 2004] and features a simple but useful GUI for control and feedback about the status of the system. It is here, in the mapping between the text and the sound, that the compositional choices have been made. There are three groups of parameters that are being extracted for every message:

- The length of the whole event
- The rhythm and articulation of the individual sound events
- The pitch and character of individual sound events

For the timing there are two parameters; a local 'life' index shaping the rhythms and the length of the current message and a global index that influences the current and subsequent 'message-compositions'. The global index is a function of the current and previous messages local indexes. The purpose of the local index is to make a simple semantic analysis of the message and discriminate between a set of random letters and real words. The participant should be 'rewarded' for the effort of writing a message with substance. The local index is calculated by looking at the average length of words and the average number of syllables per word and comparing these with constants:

$$i_2 = \frac{1}{\left(w\left(\frac{s}{w_c}\right) - s_l\right)^{1/2} + 1}$$

$$i_1 = \frac{1}{\left(w\left(\frac{c}{w_c}\right) - w_l\right)^{1/2} + 1}$$

(2.1)

where *c* and *s* are the total number of characters and syllables, *wc*is the number of words in the current message, *wl*and *sl*are constants defining the 'optimal' mean number of words/syllables. *w* is a weight defined by

$$w = \frac{1}{w_c - s_c + 0.5}$$

(2.2)

where *sc*is the total number of words that contains vowels. Through *w*, the index is decreased if the message contains words without vowels. The mean value of *i1*and *i2*is then multiplied by the arcus tangens of the number of words in relation to a third constant parameter, *ow*, delimiting the optimal number of words per message[2] according to (2.3).

$$lifeIndex = \frac{i_1 + i_2}{2} \arctan\left(\frac{w_c}{o_w}\right)$$

(2.3)

If we set *wl*to 4.5, *sl*to 2.0 and *ow*to 10 the result on four different messages can be seen from Table 1; the method distinguishes fairly well between nonsense and real words at a low cost. Similar or better results could conceivably be achieved in a number of different ways but this method appears to work well for the purpose. Since there is only audio feedback, it is important that all, even empty messages, will lead to a perceptible change in the sonic output.

The total length of the music derived from the message is a function of the local index. Any new messages received adds its local index to the instantaneous global index which constantly decreases exponentially at a set rate[3] . If a message causes the global index to reach maximum, it stops the playback of the current message and begins playing back a pre-composed pattern, sonically different from the output of a typical message, for about 30 seconds before resuming ordinary mode and starts playing back the message that caused the break. This feature is added to reward collaborative efforts. The global index controls mainly the density and the overall volume of the output, but also the distribution of random and stochastic processes in the synthesis.

Every word of the message generates one musical phrase. The duration of each phrase is determined from the number of syllables in the originating word. Punctuation marks bring about rests.

Table 1: Life index for four different messages

message	life index
hello	0.18882
Hello, my name is Henrik	0.81032
hjdks la s duyfke jhsldf hasdfiw uehr jkdsl	0.14448
From fairest creatures we desire increase, That thereby beauty's rose might never	1.44618

2.5 The synthesis

The synthesis engine is written as a Csound orchestra [Boulanger, 2000] (see also http://www.csounds.com/) running inside a Max/MSP (http://www.cycling74.com/products/maxmsp.html) patch through the use of the csound~ object (see http://www.csounds.com/matt/). The 'score' for the message to be played back is sent to Max/MSP using OSC. Max/MSP is responsible for timing the note events and preparing valid information for the csound~ object and the orchestra file associated with it. Due to processing power limitations only one message can be played back simultaneously; if a message is received before the previously received message is finished playing back, the new message will interrupt the first message.

All sounds heard in *etherSound* are generated with FOF (Fonction d'Onde Formantique) synthesis as this technique is implemented in Csound [Clarke, 2000, Byrne Villez, 2000], using both samples and simple sine waves as sound sources. There are two distinct timbres in each 'message-composition': one is a bell like sound whose timbre is governed by the series of vowels in the text. This sound has three or more voices and creates the harmonic progression. The pitches are mapped according to the ocurrence of certain key letters in the originating text[4] . After the initial chord has been introduced, all voices begin a glissando toward the centre between the outer limits of the chord, creating microtonal variations of an ever decreasing harmony, ending at a unison. This voice is a horizontal contrast to the second voice.

The second voice uses samples of a male reading a text in english[5] as its sound source to the FOF opcode. From this recording, short sample buffers (typically 4096 samples) has been extracted, one for each letter. The letters in the message are mapped one to one to these samples. In this voice the FOF synthesis is used to granulate the samples, thus creating an erratic, non-tonal texture under the harmonic bell-like sounds described above.

3 Discussion

The latency of the system in the first model, measured from when the participant presses the 'send' button to when sound is heard, is in the range of less than a second to a little over two seconds. This may seem long but, in fact, many users commented the fact that they experienced the response time as being short. The second model remains to be tested, but it is fair to assume that the response will be slower.

etherSound has been used in two different contexts. As a stand alone sound installation that users can interact with but also in combination with one or several improvising musicians playing acoustical instruments. In this situation, which resembles a traditional concert, the audience is 'playing' the electronic instrument and are given an important role in the development of the form. As can be gathered from the description of the system above, the sonic outcome of a received SMS is fairly strictly controlled. On the individual level, only a limited amount of control over detail is offered, and it is debatable whether *etherSound* can be called an 'instrument' at all. This was however never the intention. It is the *desire* to contribute to the whole that was intended to be the ruling factor, not the individuality of expression or the virtuosity of performance. Thus, *etherSound* is closer to a musical composition with a stochastic process ruling the distribution of sonic events.

An interesting aspect of the concert performance context appears if we compare it to an interactive performance for computer and instrument where the performer influences the output of the computer. In this model the performer and the computer constitute an ontological entity, a closed system that the audience can observe and listen to. However, in *etherSound*, the computer generated sounds becomes the common ground between the performers and the audience, a sonic field of communication and the audience can no longer be disunited from the content.

Whether or not the participants felt they had influence and whether this influence set creative energies in motion within the participant can only be proved, if at all, by performing empirical studies that are beyond my intentions and competence. I can however offer the lightweight, subjective analysis that improvising along with an audience in a way that can be done with this work, is an experience incomparable to traditional group improvisation.

4 Future improvements and further work

The aspect of 'democracy of participation' could be further expanded by also streaming the sound on the Internet, inviting participants anywhere to collaborate. It would also be desirable to allow for simultaneous playback of multiple messages, possibly through the use of several computers, and to add more depth to the interface and allow for 'expert' performers. One thought is to add the possibility to make a voice call to the phone connected to the system and interact in true real time, either by voice or by pressing digits. The text analysis responsible for calculating the life index could be further evolved, i.e. to allow for, and equally reward, typical SMS language such as 'c u 4 dinner 2nite'.

Since every performance of *etherSound* is 'recorded' in the database, the music can be recreated and altered. I am currently working on a fixed media piece using the data collected during one of the performances of *etherSound*.

5 Acknowledgments

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Footnotes

[1] Yet there is a great commercial interest in increasing the use of sms and, in Sweden, there has been a tremendous effort from the part of the GSM service providers to teach their customers how to use it.

[2] Since a SMS is limited to 160 characters these constants are set according to what kind of message content should be rewarded.

[3] The rate is context dependent. In a performance with improvisation it would be shorter than in an installation.

[4] For the sake of experiment and variation, I am changing these 'key notes' for every performance of etherSound.

[5] An excerpt from the recording of one of John Cage's lectures at Harvard College 1989.

Acousmatics, Sound Objects and Instruments of Music

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Abstract: Based on propositions by Pierre Schaeffer, this paper will demonstrate in what capacity the computer should be regarded not as a musical instrument in itself, but as a virtual arena where pseudo musical instruments are instantiated. A case study that addresses these concerns is provided.

1.1 Intention

The intention here is to gain a truer understanding of the role of Computers and their algorithmical minds in the composition of Electroacoustic Music and to be able to design and operate virtual musical instruments which reflect the phenomenological perceptual concerns posed by acousmatic listening, the Schaefferian Écoute Réduite [Schaeffer 1966].

1.2 Musical Instrument

In chapters 2,4-2,5 of his "Traité", Pierre Schaeffer [Schaeffer 1966] defined a musical instrument as being a sound-producing device endowed with three characteristics. First, the device has the property of endowing its sounds with a particular timbre, a "marque d'origine", that allows us to recognize all the sounds as coming from the same source. Second, the device possesses a gamut of possible physical manipulations that, when applied, produce the gamut of available sounds. Third, it possesses a collection of playing modes, of manners of playing, in other words, a playing style.

1.3 Pseudo Musical Instrument

Due to the supreme generality of their sound-producing capabilities, devices such as the computer, the tape recorder, the sampler, normally used to manufacture Electroacoustic Music, in themselves cannot constitute musical instruments. Nonetheless, this equipment can be used to produce pseudo-musical instruments, that is, virtual instruments that do not exist in the real world (they only exist in the form of electroacoustic simulations) but nonetheless possess the same three characteristics that Schaeffer isolated for a musical instrument: an origin mark (phenomenological timbre), a finite gamut of possible physical manipulations (and their resulting gamut of available sounds), and a style of playing.

Thus, it is important to realize that when one controls computer audio software through computer interfaces of any kind, one is not actually playing the computer itself as a musical instrument. Instead, it is the simulation the computer instantiated which is being played.

According to the extent that his simulations conform to this notion of Musical Instrument, the artist-musician will be dealing with phenomenological ideas of solos, duos, trios, and so on, all the way to orchestras of these virtual instruments.

With this pondered, in order to design such simulations of a Musical Instrument one should consider the perceptual unity of the Sound Objects [Schaeffer 1966] produced by the simulation, and how these are assembled into Musical Objects through the operation of a Musical System.

2.1 Acousmatics and Sound Objects

Originally, "acousmatic" was the name given to the disciples of Pythagoras who, for five years, had to listen to the lessons from behind a curtain, without seeing the master and in absolute silence. Resuscitated, this term is now used to define a sound that one listens without "seeing" (= caring for) the source where it comes from, a sound that disconnects from its source and becomes something else, a sound that disincarnates from its daily ordinary function of Source Index, thus entering the realm of Music.

It is this acousmatic way of listening that brought forth the Schaefferian term of "Sound Object": a perceptually cohesive sound event, listened with an acousmatic intention, in other words, perceived and appreciated for its own sound-value sake.

2.2 Musical Object

A Musical Object [Bittencourt 2003] is a collection of Sound Objects of any size, small or big, that encloses in itself a single and recognizable complete thought. Because it represents a complete thought, it has a definite beginning and an end: its boundaries can be assessed. Because it is recognizable, it can be repeated, varied, transmutated, combined with other objects, traced by our memory.

According to its "main course", to its foreground main ideas, a musical object can be said to gravitate between two poles: static, if the spotlight is focused on the constituent sound elements themselves, or dynamic, if the spotlight is focused on the internal evolution of the constituent sound elements.

In reality, all musical objects fluctuate somewhere between these two antipodes. The "static" nature refers

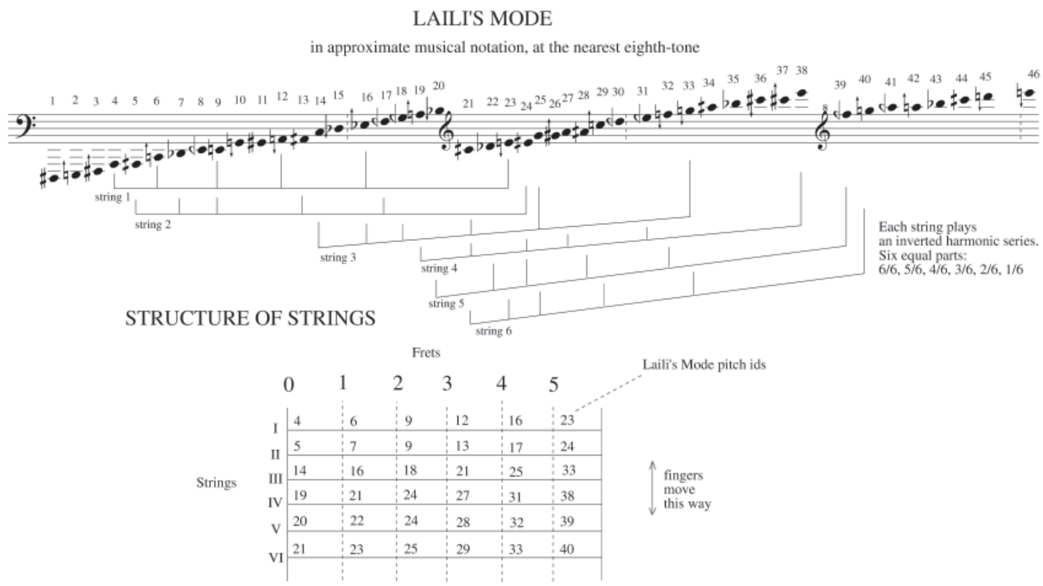

Fig. 1. Structure of Laili's Mode, and Tusk Harp strings

to operations in Musical Space, the "dynamic" nature, to operations in Musical Time [Bittencourt 2003].

2.3 Musical System

A Musical System is any set of rules that directly restricts the choices of sound possibilities. In other words, it is a set of constraints. To invent a Musical System is to create a set of rules that limit the use of the continuum of the characteristics of sound and that specify the universe of manipulations possible.

3.1 Case Study of Pseudo Musical Instrument and Musical System

I will here describe a reasonably-successful collection of algorithms I created for the seventh scene of my radiophonic opera *KA*, based on a story by Vielimir Khlebnikov. The interest here is that these algorithms materialize at the same time a pseudo-musical instrument and a Musical System with a precise collection of possible notes and timbres distributed in space, strict rules for manipulating these possibilities, and a complex rhythmical system.

3.2 General Description

Scene seven is supposed to contain an instrument made of an elephant tusk with five strings (later on, six) attached to the tusk by pegs of years. The five years on top show the times when the East invaded the West, and the five in the bottom, when the West invaded the East. It is also mentioned in Khlebnikov's story that each string is divided in six parts. Trying to conceive an image of this fantastic instrument, I thought of a C++ class that would "speak" through the RTcmix STRUM instrument.

First, I studied what happens when a string is divided in six equal parts. With frets positioned at those six points, your string will be set to play an inverted harmonic series: if 1x string length produces C3, for example, (5/6)x gives Eb3, (4/6)x gives G3, (3/6)x gives C4, (2/6)x gives G4, (1/6)x gives G5, everything in the natural tuning of the harmonic series, obviously.

Because this tusk harp was supposed to accompany the character Laili singing, I wanted it to use the "Laili mode", a microtonal scale I developed using another piece of software of mine, the ModeGenerator (see Figure 1). Thus, I searched for possibilities of finding six collections of six notes in this mode that could conform to that "minor chord" formation described above, with a maximum margin of error of a quarter tone, as if the strange tuning generated from the use of the Laili mode was derived from the frets being positioned slightly off from the equal string subdivisions.

To prevent the instrument from playing only arpeggios, the fingers were thought to move across and not along the strings. I was supposed to imagine five virtual fingers moving across the fretboards according to strict rules of fingering.

Each string of the tusk harp has its own fixed stereophonic positioning and a unique set of STRUM parameters so that each string possesses a different particular timbre. Also, a string has to be prepared to never play two notes at the same time. Unless it is played again, the string has to continue vibrating till the extinction of the sound, but if a string is still vibrating when a new pluck order is given, the previous note has to be stopped accordingly.

3.3 Implementation

To code such an instrument in C++, I designed a system of 3 classes.

A Strumline class is used to hold an RTcmix STRUM command and to keep track of its current state, if it is still alive (vibrating, that is), or not. There are four basic methods: one to set the STRUM command line, one to recall it, one that verifies if the previous note is still vibrating, and one that adjusts the length of the previous note (i.e. turns it off).

Next, we have a Tusk_String class that contains one Strumline object and is used to control all the operations necessary for a string to play. Here we have five methods: one to set the output printing stream, one to set the pitches (in Hz) for each of the six positions along the string (five frets plus the open string), one to set the STRUM timbral parameters and the stereophonic positioning for the string, one to receive and realize playing commands, and finally, one method to flush the last Strumline class buffer.

Finally, we have the Tusk_Harp class, which contains six Tusk_String objects (one for each string, of course). The constructor method initializes the strings with the STRUM timbral parameters selected, their stereophonic positioning, and the pitches that the string frets are supposed to play. The Play() method, the one used inside another program to actually play the harp, receives only the parameters string, fret, point in time to start playing, and amplitude. It functions basically as a routing system, relaying the information to the appropriate string.

With all this, the very complex operations required to play the tusk harp and materialize its results into sound are hidden from the main user. Inside the actual algorithm that generates a musical piece, the user has access to the Harp simply by calling its Play() method.

The next step to play the Tusk Harp is to formalize the fingering rules. Remember that the fingers are thought to move across the fretboard and the strings, and that you can play with all five fingers.

When moving fret-wise (horizontally, if we imagine the strings running parallel to the ground), we can either keep in the same fret, move to its neighbors or to no fret (open string). From an open string, we can return to any fret. String-wise (vertically), you can move according to the availability of fingers. The fingers are numbered from 1 to 5, in reverse order than the piano fingering tradition. You can move to a new string if there is a finger available in that direction, remembering that two adjacent fingers do not have to necessarily move string by string, that is, jumps are allowed.

Chords up to six notes are possible and depend on the position of fingers at each moment. Since from a fret you can only reach its neighbors, only two adjacent fret regions (of different strings, obviously) can be stopped simultaneously. For a six note chord, at least one of the notes has to come from an open string.

All this has been programmed into two methods: one that performs the melodic changes of position, and one that creates chords.

Finally, to make the tusk harp play some musical fragment, we still have to add rhythmical procedures. The one I used here is based on a fixed row of a user-defined number of durations. These durations are chosen at the beginning of the algorithm, between 0.3 and 1.0 second, scaled by a "speed" proportion also defined by the user. The way to deploy this set of durations is a little bit intricate, but it generates very interesting "syncopations".

First, a certain number of successive notes to play is defined, chosen between 2 and 7. The durations are always used in the same order they were originally chosen, but the first action performed for a successive group of notes is to hold the duration on the top of the pile as a rest to be performed at the END of the group of notes. As an example, figure 2 shows the rhythmical result when we have a row of three durations, a, b and c, and we play three groups of notes with lengths of 4, 2, and 4 notes, respectively.

The main program will be controlled by the user. At the command line of the program, he has to define the name for the output soundfile, the total duration of the musical fragment, the speed (the multiplication factor for the row of durations), the forbidden string (because the instrument will sometimes have only five strings), the number of elements of the duration row, the sound output mode (real time or disk space), and a random seed. The output result of the program is identical every time you run it with the same seed.

4.1 The Function of Algorithmical Composition

Although the decisions of what to play in the Tusk Harp example are made randomly, these decisions revolve around a system of probabilities based on strict sets of constraints. As you would expect from a Musical System, these algorithms "taint" the sounds that come from it in a very recognizable way. For example, the horizontal profile

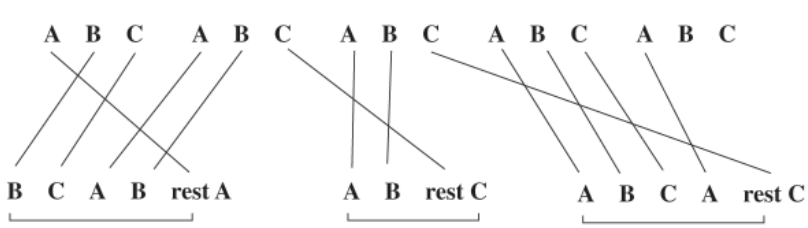

Fig. 2. Rhythmical procedure for the Tusk Harp

of the harp melodies and the structure of its chords are totally dependent on the fingering rules. An important point to notice is that these algorithms were created not to generate a musical passage, but to generate kindred musical materials. Here we have a finite set of possible sounds, carefully chosen so that they all seem to emanate from the same source (they bear the same “origin mark”, the same phenomenological timbre), and we also have a playing style, generated from the coupling of the rhythmical system and the fingering rules. In other words, the C++ code materializes a pseudo musical instrument, in Schaefferian terms.

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Spectral Delays With Frequency Domain Processing

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Abstract: In this paper the author presents preliminary research undertaken on spectral delays using frequency domain processing. A Max/MSP patch is presented in which it is possible to delay individual bins of a Fourier transform and several musically interesting applications of the patch, including the ability to create distinct spatial images and spectral trajectories are outlined.

1 Introduction

Delaying individual FFT bins in a short-time Fourier transform, can create interesting musical effects that are unobtainable with more traditional types of delay techniques. By delaying select bins by a small time value on one channel of a stereo signal, for example, distinct spatial images for spectral bands can be realized which can take on even more musically interesting characteristics when the delay values for the bins are dynamically assigned or are determined through signal analysis.

While several commercially available software plug-ins allow one to realize spectral delays,[1] the open-ended architecture of Cycling '74's Max/MSP allows an implementation with greater levels of control and the ability to explore some unique musical applications, such as that briefly outlined above, which commercially available plug-ins do not facilitate. [Zicarelli 1998]

2 FFT Implementation

The delay architecture employed in the Max/MSP patch is based on a model in which FFT frames are resynthesized from delayed FFT bins. The size of the delays, measured in integer multiples of the FFT length, are determined by indexing user-defined buffers which are updated at the signal level.

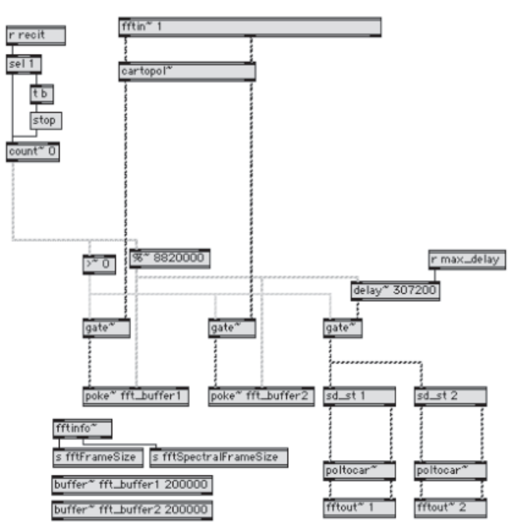

Figure 1. The pfft~ subpatch.

Figure 1 outlines the pfft~ subpatch which is used to transform the input signal. Windowing functions are automatically determined by the pfft~ object.

An FFT is performed on a signal with a Hanning window. Real and imaginary components are converted to magnitude and phase values before being written to two buffers via a pair of gate~ objects which open upon initiation of the delay process. A modulo on the index to these buffers and to the resynthesis abstractions is used to help conserve Max/MSP memory. An additional delay~ object is also used on the index to the resynthesis abstractions to provide delay headroom should the delay for a particular bin require indexing samples that have not yet been written.

The spectral delay process that constitutes the resynthesis part of the patch is contained within two abstractions, one for both the left and right channel. Due to limitations of the pfft~ object, each of these abstractions must be located at the same root level as the pfft~ subpatch. Figure 2 shows the patch contained within each of these abstractions.

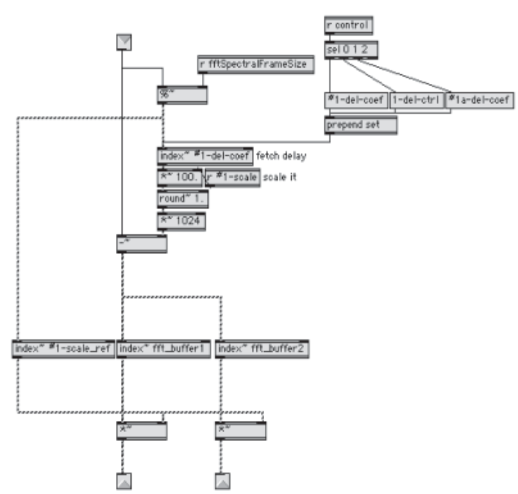

Figure 2. Spectral delay abstraction.

A signal is used to index a buffer which contains delays for each FFT bin. As noted, these delay values are integer multiples of the FFT length. The delay value is then subtracted from the current index to determine the sample number to read from the magnitude and phase buffers. A delay value of 3, for example, for bin #7 will mean that the magnitude and phase components of the resynthesized bin #7 will be read from bin #7 of the third previous FFT frame. While this is a crude way to realize these delays, it is computationally inexpensive and simple to implement.

As the delay values are integer multiples of the FFT length, the minimum delay time is defined by the FFT size. With a 2048point FFT at a sampling rate of 44100Hz the minimum delay time is 46.44ms, a 1024point FFT – 23.22ms, a 512-point FFT – 11.61 ms. While this makes it difficult to simulate interaural time differences between channels where the timing differences may be in the order of only a few milliseconds, it does nevertheless allow distinct spatial images to be realized through the precedence effect. This application will be expanded upon later.

Scaling functions, read from another user-defined buffer are also used to provide amplitude control over the frequency response of each abstraction. Like the delay buffers, these buffers can also be updated at the signal level. In addition, they can also be written to with values obtained from a separate FFT analysis of the input signal. This technique enables a degree of performance control over delay values and amplitude scaling which is particularly useful in interactive computer music applications.

3 Control

Several waveform~ objects are used in the patch as basic controllers to determine FFT bin delays and values for amplitude scaling. While the waveform~ object is a somewhat unwieldy way to attribute the large amount of data required by the FFT, especially in the perceptually significant initial 25% or so of the bins, one of its more attractive features is that it provides an instantaneous method of writing to buffers, unlike other objects such as the multislider which requires additional levels of control.

In an attempt to facilitate greater control over the waveform~ object, several macro functions have been added. These include the ability to instantaneously copy data from one buffer to another, the ability to increment or decrement by a small amount the entire contents of the buffer and the ability to write a value to a specific range of bins.

The buffers indexed in the spectral delay abstractions can also be determined through signal analysis. The following section of this paper will describe this application.

4 Musical Applications

The spectral delay patch allows several unique applications and musically interesting effects to be achieved. These include the following.

4.1 Signal analysis control

Through performing an FFT analysis of a control signal, which does not have to be the same signal as that processed, it is possible to establish correlations between the harmonic components of the signal and the corre- sponding delay times for the FFT bins. For example, strong harmonic components may produce long delay times for those corresponding bins while weak harmonic components may produce shorter delays. This implementation is presented in Figure 3.

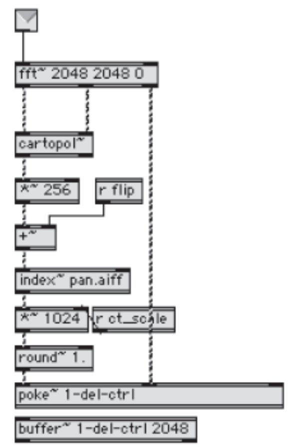

Figure 3. Signal control of delay times.

Through a simple inverse function, it is also possible to map short delay times to weak harmonic components and longer delays to stronger components.

Other interesting results can also be obtained through gradually morphing from one set of delay values to another—for example from random, noise-like values to userdefined values.

4.2 Stereo spatial effects

By varying the delay times of one channel with respect to the other it is possible to create unusual spatial effects across certain spectral bands. For example, referring to Figure 4, if the delays for FFT bins 1-20 on the right channel are increased over time a gradual panning to the left for frequencies below around 860Hz, for a 1024-point FFT, will occur. Frequencies above 860Hz will remain spatially stable.

Unlike other types of spectral panning algorithms [Torchia & Lippe 2003] that are based on the multiplication of a spectral band's amplitude with a coefficient, the spatial images created through spectral delays are created by the precedence effect. As noted by Wallach, Newman and Rosenzweig in their seminal study of the effect [Wallach, Newman & Rosenzweig 1949] the ability to localize sound through the precedence effect is affected by the nature of the sound itself. Sharp, transient sounds cannot be spatialized with the spectral delay technique quite as successfully as sounds of a more continuous, complex nature.

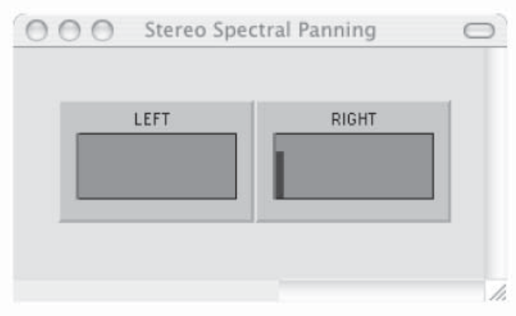

Figure 4. Spectral panning effects.

4.3 Multichannel spatial effects

Working on the same principles as those involved in creating stereo effects, the addition of two or more spectral delay abstractions can allow spectral panning effects to take place in more than two channels.

By cascading delays between channels spectral bands can be made to move in circular motions around the listener, see Figure 5.

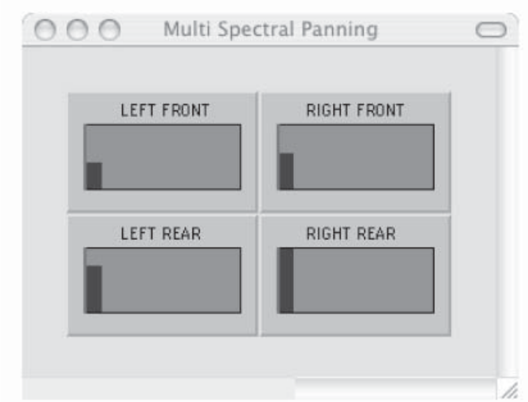

Figure 5. Circular spatial movement.

4.4 Spectral reverberation

By chaining delay abstractions together, a primitive type of spectral reverb can be created. With each abstraction simulating the effects of early reflections, it is possible to attribute different reverberation characteristics across the frequency spectrum. Striking effects can be created when these "reflections" are then sent to a series of all-pass filters which simulate a reverberant tail.

5 Future Work

The author is continuing to explore more refined methods of signal control and line message like control of delay times. Various methods of including spectral feedback within the patch are also being explored. Of particular interest as well is an exploration of whether it is possible to integrate head related transfer functions in order to simulate spectral movement that gives the spatial illusion of height.

6 Acknowledgements

The author would like to extend his thanks to Cort Lippe for his many helpful suggestions during research on this project.

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Footnotes

[1] See Native Instruments' Spektral Delay for example.

Real-time Spectral Attenuation Based Analysis and Resynthesis, Spectral Modification, Spectral Accumulation, and Spectral Evaporation; Theory, Implementation, and Compositional Implications

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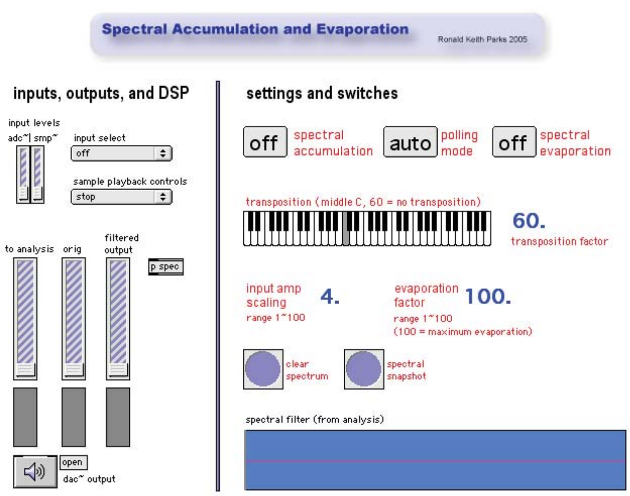
Abstract: Building upon convolution-based EQ (Settel and Lippe 1997 rev. 2001) spectral analysis data is utilized to attenuate FFT bins (derived from an FFT analysis of noise) to create an FFT/IFFT-based subtractive analysis/resynthesis module. Techniques for modification of analysis data prior to resynthesis, producing a variety of effects, are examined and demonstrated. Methods for retaining information from previous analysis (spectral accumulation) and for systematic data attrition (spectral evaporation) are introduced. A MaxMSP graphic user interface, designed by the author for implementation of the techniques, is discussed and described. Compositional implications are examined and musical examples are utilized to illustrate potential musical applications.

1 Spectral Attenuation-Based Analysis and Resynthesis



Analysis/resynthesis models have historically been oriented toward utilization of Fourier analysis of an audio signal in order to deconstruct the spectra to its component sine waves. Subsequently, the frequency and amplitude information gleaned for each partial from the analysis is distributed to a bank of oscillators for additive-based resynthesis (Lippe, 1996). Once the spectral data is acquired, a variety of modifications may be applied prior to resynthesis (Settel and Lippe, 1994). However, alternate methods of resynthesis may also be employed. This paper describes an analysis/resynthesis technique in which Fourier analysis is combined with FFT/IFFT-based spectral attenuation. Also addressed are some of the intrinsic techniques for modification of analysis data prior to resynthesis.

Building upon the analysis/oscillator bank approach to analysis/resynthesis, attenuation based analysis/resynthesis also employs Fourier analysis of the original audio signal to obtain the frequency and amplitude of the most significant peaks in the harmonic spectrum. In the current implementation analysis is achieved via the MaxMSP fiddle~ object[1] (Puckette, 1998; MSP port by Ted Apel, David Zicarelli). The incoming audio is analyzed and fiddle~ is configured to report the relative amplitude of the thirty-two most significant spectral peaks as determined by the analysis. This information is output from fiddle~ as a list of numbers for each reported spectral peak. The list includes the index number (or partial number), the frequency of the spectral peak in hertz, and the relative amplitude of each spectral peak. At this point in the process, attenuation based analysis/resynthesis departs from previous approaches in that the frequency and amplitude data are stored as sample values at pre-determined locations in a buffer (hereafter referred to as the *spectral index*) instead of being passed on to an oscillator bank. Each sample location in the spectral index corresponds to an FFT frequency bin of a predetermined size. The spectral index address for a given frequency can be determined by f/(sr/FFT-size) where f is the frequency in Hertz, sr is the sampling rate, and FFT-size is the size of the FFT in samples. Resynthesis is achieved by performing a Fourier analysis of white noise, then attenuating each frequency bin of the FFT output by multiplying it by the value reported by the analysis module, and stored in the spectral index, for each frequency bin location. The FFT/IFFT pair is embedded inside a pfft~ compatible patch to facilitate windowing and a variety of FFT sizes. If no energy was reported at a frequency, then that bin is zeroed (multiplied by zero), and no resynthesis occurs at that frequency location. All bins multiplied by a positive value will output energy at that frequency proportional to the energy at the corresponding spectral location of the analysis source as reported by fiddle~. More succinctly stated, white noise is filtered via a convolution based EQ that utilizes an analysis of the frequency spectra of an incoming signal as the basis for determining each FFT bin's amplitude value. Consecutive analysis/resynthesis, at regular time intervals (i.e. once per FFT), will result in an approximate subtractive-style resynthesis of the analysis source. The accuracy of the resynthesis varies, depending on the complexity of the analysis source and the precision of the analysis data output by the analysis module. As with previous analysis/resynthesis methods, the compositional potential of the attenuation-based analysis/resynthesis method lies not only in the resynthesis of an audio signal, but also in the capability to extract and modify analysis data before resynthesis occurs.

2 Modification of Analysis Data Prior to Resynthesis

In the current MaxMSP implementation of spectral attenuation-based analysis and resynthesis, the analysis data reported by fiddle~ may be altered before being passed on to the resynthesis module in a variety of ways. These modifications include frequency shifting as well as a variety of spectral-based modifications. The spectral-based modifications include techniques I have designated as *spectral accumulation* (the systematic retention of data from previous analysis), and *spectral evaporation* (the systematic attrition of spectral data subsequent to spectral accumulation or retention).

2.1 Frequency shifting

Frequency shifting is achieved by proportional displacement of the spectral index addresses for all frequencies output by the analysis module, prior to resynthesis. Given that the spectral index address for a frequency can be determined by f/(sr/FFT-size), frequency shifting is easily achieved by multiplying f by the appropriate transposition factor before calculating the spectral index address for f. The transposition factor is determined by first selecting a base frequency that represents no transposition (C or 261.62558 hertz in the current implementation) then dividing the frequency that represents the desired amount of transposition by the base frequency. For example, given a base frequency (i.e. no transposition) of C, 261.62558 hertz, transposition up by one equal tempered half step is achieved by dividing 277.182617 hertz (or C#) by 261.62558 hertz (C natural) then multiplying the incoming frequency (i.e. the frequency to be transposed) by the result. This calculation is performed before determining the spectral index address for each incoming frequency. For example, to transpose A up by one half step: 440*(277.182617/261.62558) = 466.1637 hertz, or B flat. If all analysis frequencies are multiplied by the same multiplication factor, the resulting resynthesis will be transposed by the interval represented by the distance between the base frequency and the transposition frequency. The current MaxMSP implementation features a graphic interface consisting of a five-octave keyboard icon for selection of the interval of transposition. The user selects the amount of transposition by clicking on the key that represents the desired interval of transposition. This value is output as a MIDI note number then translated into hertz using the MaxMSP MIDI-to-frequency converter object, *mtof*. The MIDI note number is displayed to the right of the keyboard icon and may be changed manually by clicking and dragging on the displayed number, thus allowing transposition by intervals not represented by the equal tempered scale.

It should be noted that simple frequency domain transposition of an incoming signal is easily achieved with the MaxMSP gizmo~ object. Therefore, the allure of the current method lies not in the harmonizer effect, but in the potential to offset or alter spectral data prior to the application of spectral accumulation or spectral evaporation (discussed below).

It is not necessary to scale all incoming frequencies from the analysis module by the same transposition factor. In practice, some data may not be scaled at all. A variety of methods such as spectral attrition (deleting some partials while leaving others intact) or spectral compression or expansion (fitting *n* partials into smaller or larger pitch spaces than they would normally occupy) are currently under development by the author.

2.2 Spectral Accumulation

In the current implementation, analysis data is output from the fiddle~ object once each analysis window, and then sent to the resynthesis module. Spectral accumulation is the systematic retention of that data from previous analyses. In the most recent MaxMSP implementation, spectral accumulation can be switched on and off. When spectral accumulation is off, the spectral index buffer is zeroed at the conclusion of each analysis window. When spectral accumulation is on, the spectral index buffer is not cleared of values received from previous analyses at the conclusion of each analysis window. This results in a type of spectral histogram, with the energy at each frequency bin retaining the most recently received value for that address. For example, if the frequency bin centered at approximately 440 hertz receives a magnitude of *x*, then that magnitude will not be altered until a new value is received from the analysis module, or the user manually clears the data. As a result, the spectral index will contain analysis data from the most recent analysis and from previous analyses. The resynthesized result will bear characteristics of all audio analyzed from the time that spectral accumulation was switched on, or the user last cleared the spectral index buffer.

Several effects can be achieved using spectral accumulation. The incoming audio can be sustained indefinitely at pitch, or, as previously suggested, the analysis data can be shifted along the spectral axis prior to accumulation and resynthesis. Also, infinite reverb type effects can be achieved by gating input so that only signal values above a minimum threshold are resynthesized. Additionally, the fiddle~ object can output analysis data once per window period, or it can be put into 'poll' mode and output analysis data only when requested by the user. Using this technique it is possible to take a series of 'spectral snapshots', each consisting of only one analysis window, and layer them onto one another in the frequency spectrum. This method is analogous to multiple exposures on the same photographic film, creating composite images taken at different times. As with all collage-like methods in which data is accumulated over time, it is possible to saturate the image, or in this case the spectrum, with too much information. Therefore, a systematic method for data attrition is desirable.

2.3 Spectral Evaporation

Subsequent to data retention (spectral accumulation) it will, at times, become desirable to thin or completely clear the spectral index buffer. Since the spectral index data is stored as samples in a buffer, it is possible to alter that data after it has been written into the buffer. The indiscriminate deletion of all data is easily achieved by simply clearing the spectral index buffer, thereby erasing all previously accumulated spectral information. However, this method results in an abrupt cessation of sound that is of limited compositional interest. A more systematic approach to clearing the data holds potential for more compositionally germane results.

Spectral evaporation is the systematic time-based zeroing of data in the spectral index buffer. This is achieved by sequentially and randomly selecting a bin addresses and writing a zero to that address, thereby eliminating the energy output from the resynthesis module at that frequency region (if any was present). Currently, a pseudo-random uniform distribution is implemented to select frequency bins for attenuation. The MaxMSP *urn* object is utilized to avoid repetitions of randomly generated numbers. Adjusting the frequency at which the *urn* object produces random numbers regulates the rate of spectral evaporation. In the current implementation the rate of spectral evaporation ranges from 0 to 100, 100 being the fastest possible evaporation and 0 no evaporation.

More systematic and targeted applications for bin attenuation are possible. For example, in the current implementation all frequency bins that have not yet been selected for attenuation are equally likely to be selected (i.e. uniform distribution without repetition of variates). However, other probability distributions may be employed in the spectral evaporation process in order to focus the attenuation on a particular frequency region or regions. Also, alternate methods for bin selection may be of interest. Finally, once selected, bins need not necessarily be attenuated. One possible avenue for future applications of this technique is the random selection of a frequency bin coupled with a randomly selected magnitude for that bin. Both bin selection and the bin value could be linked to some form of user input.

3 Compositional Implications

To date I have utilized spectral accumulation and evaporation in two interactive computer music compositions, *Afterimage 3* for percussion and MaxMSP and *Afterimage 6* for guitar and MaxMSP. Although numerous real-time and non-real-time processes are employed in both works, the accumulation of spectral data based on real-time analysis of audio input and the time-based spectral evaporation of the accumulated data is featured prominently in both compositions.

For example, the opening gesture of *Afterimage 3* consists of a series of sounds produced by sliding one concrete block on top of another. These sounds (basically band-limited noise) are fed into the analysis unit and the analysis data is accumulated for resynthesis (spectral accumulation). Spectral evaporation is then employed to modify the initially accumulated spectral data for approximately the first sixty seconds of the piece. Subsequent applications of spectral accumulation and evaporation include the prolongation of the complex spectra of a sound created when the player taps the concrete block with a large metal bolt.

Spectral accumulation and evaporation appear prominently in the final section of *Afterimage 6*. The guitarist performs a series of staccato chords, each of which is analyzed and the spectra allowed to accumulate. The effect is that of the multiple exposures on the same photographic film as discussed previously. Spectral evaporation is then applied to thin the data. In addition, analysis of subsequent chords, containing a subset of pitches present in the proceeding series of chords, is written to the spectral index, thereby reinforcing some frequency regions while others are allowed to evaporate.

4 Summary and Suggested Possible Future Research Directions

Real-time spectral attenuation based analysis and resynthesis is a frequency domain based method for collecting data from an audio source then utilizing that analysis data to resynthesize the original sound by mapping that information to an FFT/IFFT based subtractive synthesis module. A variety of methods may be employed to alter the data prior to resynthesis, creating a variety of effects. Additional effects are achieved by retaining data from previous analyses (spectral accumulation) and the systematic attrition of accumulated data (spectral evaporation).

A number of methods for data alteration, both prior to and subsequent to analysis, remain tantalizingly unexplored at this time. Some of the techniques mentioned previously, that are currently being explored by the author, include spectral attrition, spectral compression and expansion, weighted probability spectral evaporation, and stochastic alteration of analysis data prior to resynthesis.

The MaxMSP patch described in this paper is available for download at the author's website at http://faculty.winthrop.edu/parksr.

5 Acknowledgements

The author wishes to acknowledge the work and continuing support of Cort Lippe, without whose mentorship this work would not have been possible. Thanks also to Zack Settel for his invaluable contributions to our field, Miller Puckett and David Zicarelli for MaxMSP, and Ted Apel for the OSX port of fiddle~. Special thanks to the numerous colleagues who aided in the conceptual and programming aspects of this work including Eric Ona, Samuel Hamm, David Kim-Boyle, and James Paul Sain.

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Footnotes

[1] The author has developed an FFT-based method for analysis that does not require fiddle~, however, that method is not described in this paper.

Text Sound: Intermedia, Interlingua, Electronica

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"Where conventional communication ends, everything begins." Alexei Kruchenykh

Background

This genre of composition originated in 1953 in Stockholm, Sweden, when *musique concrete* and concrete poetry developed and evolved into a true intermedia art (as defined by Dick Higgins in 1965).

Spoken Word: vibrations, motion, energy:

Parallelism between poetry and music enabled a meeting place where sounds (timbres) become compositional determinants, creating a complex palate for spoken word-based compositions, created through extensive use of studio and computer facilities.

The Music:

Part 1:

The Pioneers: music of Lars-Gunnar Bodin, Sten Hanson, Bengt-Emil Johnson, Ilmar Laaban and Åke Hodell and the Fylkingen language group. Discussion/ background and CD playback.

Part 2:

The second generation in Sweden: music of Erik-Mikael Karlsson, Mats Lindström, Bill Brunson, Åke Parmerud, Tommy Zwedeberg, Anders Blomqvist and others. CD playback as time permits.

Part 3:

The North Americans: music of Charles Amirkhanian, Larry Wendt, Steve McCaffery (The Four Horseman), Steve Ruppenthal, Charles Dodge, Jon Appleton. CD playback as time permits.

L'Objet Sonore Maintenant: Reflections on the Philosophical Origins of *Musique Concrète*

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Abstract: Pierre Schaeffer, theorist, composer and inventor of *musique concrète*, borrowed heavily from phenomenology when describing his privileged theoretical entity, the sonorous object (*l'objet sonore*). This paper briefly describes how Schaeffer arrived at his conclusions concerning sonorous objects, and its affinities with contemporaries (John Cage) and disciples (Murail and Grisey). Four objections are raised which question the cognitive, philosophical and aesthetic conclusions implicit in *l'objet sonore*, and an argument is put forward for abandoning the ontological framework behind Schaeffer's theorizing.

Pierre Schaeffer's *Traité des objects musicaux* bears the subtitle "essai interdisciplines." Second only to music, phenomenology plays a central methodological role in Schaeffer's text. An avid and astute reader of Husserl and Merleau-Ponty, Schaeffer used the method of transcendental-phenomenological reduction (or époché) to arrive at his privileged theoretical goal—a full description of the sonorous object (*l'objet sonore*).

1 Schaeffer's Phenomenology

All phenomenological reduction begins from the naïve or natural standpoint:

> I find continually present and standing over against me the one spatio-temporal fact-world to which I myself belong, as do all other men in it and related in the same way to it. This "fact-world," as the world already tell us, I find to *be out there*, and also *take it just as it gives itself to me as something that exists out there*. (Husserl, Ideas, 96)

In the natural standpoint we are situated as subjects within an external world, interacting with objects. We possess no doubts about the existence of the objects with which we interact. By no means is the natural standpoint naïve in a pejorative sense of the word; any claims about the world that posit physical subsistence to exterior objects are contained within the natural standpoint, including the physical sciences. For instance, if you are an anatomist describing the workings of the eye from a physiological point of view, you may claim that the red that we see is, actually, neither red, nor blue or nor green. Red, blue and green are merely the result of the interaction of different frequencies of light striking a retina, being transmitted as electric impulses along an optic nerve, and interpreted in the brain. Although this may be correct as a physiological description of the external world, it still remains naïve in this sense: it accepts, without examination, a belief in the exterior world. As Schaeffer states, "Le discours élaboré de la science est fondé sur cet acte de foi initial" (Schaeffer, 266).

This is not to criticize the results of science as useless or mistaken. In fact, "to know it [the external world] more comprehensively, more trustworthily, and more perfectly than the naïve lore of experience is able to do...is the goal of the *sciences of the natural standpoint*" (Husserl, 96). The transcendental-phenomenological reduction, or époché, brackets out the physically subsistent and exterior world in order to describe the essential structures of lived human experience. For this reason, phenomenology differs from skepticism. Schaeffer (following Husserl) compares and distinguishes the époché from the Cartesian method of doubt: "Mettre en doute l'existence du monde extérieur, c'est encore prendre position par rapport à lui, substituer une autre thèse à de son existence. L'époché est l'abstention de toute thèse" (Schaeffer, 267).

The acousmatic reduction, although still within the naïve standpoint, is a preliminary step towards the reduction to the sonorous object.

Larousse defines acousmatic as follows: "*Acousmatique, adjectif: se dit d'un bruit que l'on entend sans voir les causes dont il provient*" (Quoted in Schaeffer, 91). To be quite literal, there is nothing in this definition that requires the transcendental-phenomenological reduction; all that is necessary for the adjective acousmatic to be correctly predicated of some sound is that the cause of the sound be hidden. In fact, the definition implicitly asserts that *there is* some external cause which is producing the noise, and that the visibility of this cause is somehow hidden. For Schaeffer, the acousmatic experience still allows for the attempt to identify sources, however, it bars access to visible, tactile and physically quantifiable assessments of sounds. *The acousmatic experience reduces sounds to the field of hearing*. Schaeffer, addressing this explicitly, describes what happens when one attempts to identify sources solely within the field of hearing: "Surpris souvent, incertains parfois, nous découvrons que beaucoup de ce que nous croyions entendre n'était en réalité que vu, et expliqué, par le contexte” (Schaeffer, 93).

For Schaeffer, the mechanical reproduction and transmission of sounds ushered in an acousmatic world. The recording of a horse’s gallop across the Pampas, played back in the heart of Paris, is an example of acousmatic sound. Now, of course, we *recognize* the sound as a horse galloping, we can easily trace the sound back to its index. Yet, acousmatic sounds opened up a possibility for Schaeffer that afforded a mode of listening more rigorous than merely the acousmatic renunciation of causes.

The further goal is the reduction of signification; sound is always in danger of being apprehended as something other than itself. Take, for example, the recording of the galloping horse. Here, “Il n’y a pas d’objet sonore: il y a une perception, une expérience auditive, à travers laquelle je vise un *autre objet*” (Schaeffer, 268). The sonorous object is only attained when sound no longer functions as a medium for signification.

Acousmatic sounds give indirect access to *l’objet sonore*, and its corresponding mode of listening, *l’écoute réduite*. In reduced listening, we no longer listen through the recording in order to discover its index, nor use the sound as in intermediary for some informative thing (an object, a person, an interlocutor or his thoughts). “C’est le son même que je vise, lui que j’identifie” (Schaeffer, 268). Sound, holding itself at the threshold of the transcendental-phenomenological reduction, asserting no claim about the exterior world, and maintaining its stubborn integrity in the face of occultation by signification, is *l’objet sonore*.

Disclosed only at the end of a two-step reduction, the sonorous object possesses a paradoxical feature: although methodologically final, the sonorous object is ontologically first. “It is necessary to re-visit the auditory experience, to re-grasp my impressions, to re-discover through them information about the sonorous object” (Schaeffer, 270). All this re-visiting, re-grasping, and re-discovering supports the claim that *l’objet sonore* is revealed as the “originary experiene” of phenomenological investigation (Schaeffer, 270). It is the “thing” discovered by following Husserl’s dictum, “back to the things themselves.” Being posited as the condition of the possibility of aural apprehension (whether musical or otherwise), the sonorous object is the necessary metaphysical substrate of all signification, indexicality, or reference. It is that thing which bears any and all sonic properties.

2 Contemporaries and Disciples

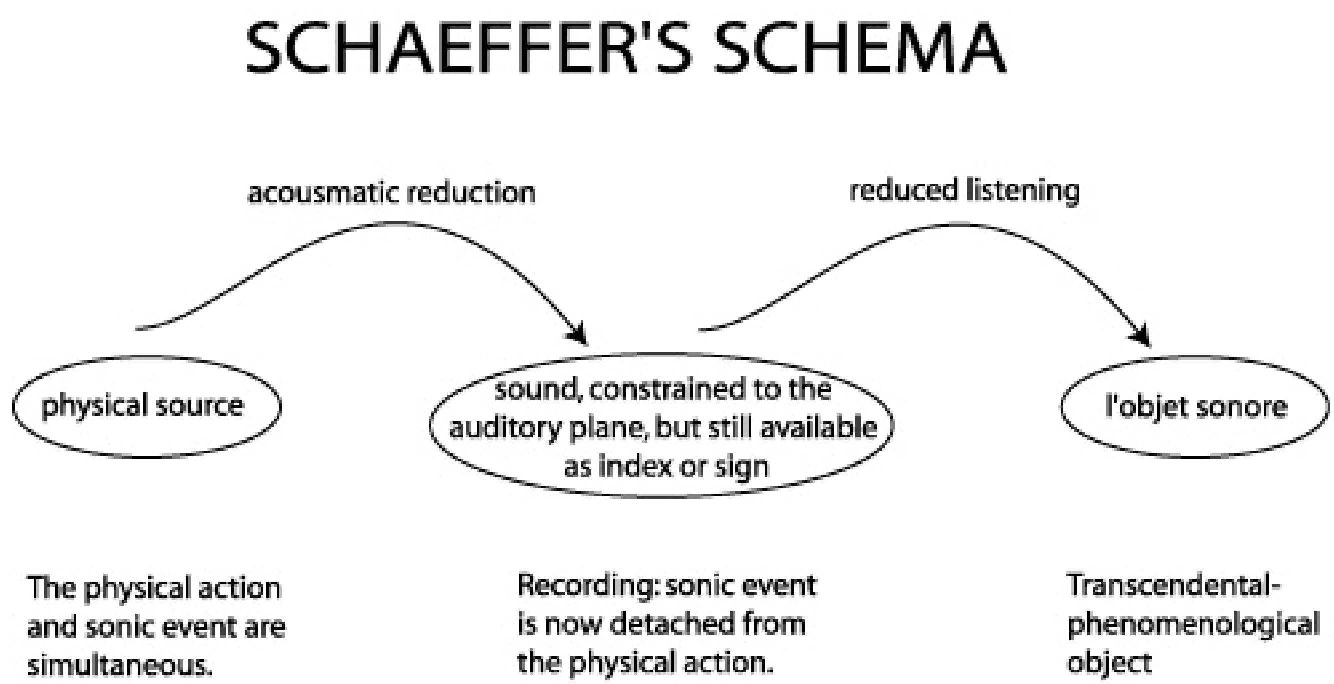
The goal of Schaeffer’s theorizing is clear: to create a musical aesthetic where sound-as-such is made audible. In this respect the aesthetic of sonorous objects articulates a view held by both Schaeffer’s contemporaries and disciples. Compare this passage from John Cage:

> A sound does not view itself as thought, as ought, as needing another sound for its elucidation, as etc.; it has not time for any consideration—it is occupied with the performance of its characteristics: before it has died away it must have made perfectly exact its frequency, its loudness, its length, its overtone structure, the precise morphology of these and of itself. (Cage, 15)

And this passage from Tristan Murail:

> The composer does not work with 12 notes, *x* rhythmic figures, *x* dynamic markings, all infinitely permutable–he works with sound and timbre. Sound has been confused with its representations.
> (Murail, 158)

Figure 1: A two-step reduction from the naïve standpoint to the sonorous object



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Or this passage from Gérard Grisey, where he describes his music as *transitoire*:

> ...because it radicalizes, first of all, the dynamism of sound understood as a field of forces, and not as a dead object [un object mort] and that it aims, second of all, to sublimate the material itself to the benefit of pure sonorous becoming. (Grisey, 291)

In short, Schaeffer shares an aesthetic with other composers who believe in the existence of a musical *ding-an-sich*. For Schaeffer, Cage and the Spectralists, music ought to be just sounds as such, stripped of anything we may be tempted to call "meaning".

3 A Critique of *L'objet sonore*

With this thumbnail sketch of *l'objet sonore* in place, I would now like to raise four objections: 1) By remaining faithful to the phenomenological method, Schaeffer also demonstrates one of phenomenology's disadvantages, namely, a tendency to ontologize: the endpoint of Schaeffer's reductions is to arrive at the essential, the general, the substrate, the thing shared by all sonic events. All sounds are reduced to a metaphysically posited bearer of properties, which *de jure* can be no physical thing. The goal of phenomenology's reduction to essences is to move beyond the contingent cultural and historical factors in sonic apprehension. Schaeffer clearly shares phenomenology's drive towards the metaphysically eternal, and ever present.

2) It is important to remember that Derrida's earliest deconstructive work was directed against phenomenology, exposing the "metaphysics of presence" which directed its conclusions from behind the scenes. Obviously, there is no space here to give a full account of Derrida's critique, nor reconstruct its application to new music. Let this short example suffice: in Baillet's monograph on Grisey, the Spectralist project is lauded for being a "rejection of the arbitrary." As opposed to the unmotivated permutations of Serialism, Spectral music is motivated (hence, non-arbitrary) through remaining as close a possible to the temporal and harmonic properties of spectra.

> On touches here upon one of the major traits of Grisey's esthetic which one can define as a rejection of everything arbitrary. This does not concern the elaboration, the composition of music, which reveals fundamentally the creative choice, but rather the manner in which music develops in time. (Baillet, 39)

Can a work legitimately be described as motivated, merely by projecting the brief, fluctuating life and death of a sonorous object onto the global temporal scale? If harmonic spectra (and their temporal properties) are Spectralism's stand-ins for the sonorous object, it is essential that we pose the question whether this music is truly motivated, or merely ideologically duped into believing so, due to its tacit commitments to the "metaphysics of presence."

3) Another line of attack has been articulated by aestheticians and theorists like Roger Scruton, Andrew Bowie, Fred Lerdahl and Ray Jackendoff, who are interested in the metaphorical and cognitive dimensions of music. From this perspective, the only relevant musical features are those reducible to an elaborate system of metaphors or categories, which we project upon sounds; metaphors of space, direction, progression, goal-orientation, contour, causality, vitality, and so forth. Interestingly enough, this argument accepts the acousmatic reduction, disregarding the physical causality of sounds, but ultimately defends an *a priori*, rule-based or categorical conception of music—the perfect Kantian complement to the sonorous object as *ding-an-sich*. However, this position is also open to a critique of "psychologism," typically concerning itself with a conservative defense of tonal music, and unable to garner a convincing account of musical aspects such as timbre, mass, grain, and so forth.

4) Finally, I believe that it still remains unclear what exactly it means, experientially, to perceive a sound-as-such. Can we imagine an instance where a sound is apprehended apart from any and all aspects? If this simple criterion fails, it jeopardizes the entire project of the sonorous object.

4 In Lieu of Reductions

To be fair, it must be said that *l'objet sonore* was, for Schaeffer, primarily a theoretical entity, to be distinguished from his more practical, aspect-laden *objets musicaux*. Although, contrary to Schaeffer, I believe that there are no un-musical objects, I agree that aspect-descriptions are quite necessary, simply because I am of the view that there is no perception that is not perceived under the guise of some aspect. In fact, a goal for new music (one that is especially applicable to new electro-acoustic composition) is *to bring uncommon aspects*, continually apprehended but seldom noticed, *into audibility*. In addition to frequency, duration, amplitude, timbre, and their various morphologies, one can imagine an open-ended list of aspects such as mass, grain, allure, density; modes of iteration like discrete, iterative, continuous, discontinuous, stable or unstable; morphological shapes like turbulence, weak-break, open-close, siren/wind, creak/crack, shatter, explosion, bubble; and innumerable others.

These last set of descriptive terms are borrowed from Trevor Wishart, who rejects the acousmatic premise by arguing for an electro-acoustic musical practice founded on two central principles: gesture and landscape. Without a strong connection between physical causality and sound it is impossible to make gestural knowledge musically relevant. In addition, knowledge of the physical world and its workings is essential in picking up significant cues about metaphorical and meaningful landscapes projected in electro-acoustic composition. Rather than segregating physical causality from the apprehension of sounds, turning sounds into either *dingen-an-sich* or psychological categories, the entire acousmatic framework and reduction to sonorous objects, with its commitment to the ontological priority of metaphysical presences, needs to be rejected.

Aesthetics does not require a reduction from the natural standpoint to some logical or essential grounding; aesthetics begins and ends from within the natural standpoint. As conscious subjects, always already within a world replete with rich, semantically dense aspects, the grounding is simply the indubitable fact of perception. This does not mean that the task for new music is merely transfiguring the commonplace; the commonplace can take care of itself. Rather, a real task is to create works that, through intentional, imaginative and intelligent construction, organize and balance sonic invariants with cognitive categories so as to bring uncommon, yet continuously apprehended aspects into audibility.

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Note: unless cited, all translations from French are mine.

Aspects of Flow: Structural Elements in Barry Truax's *Riverrun*

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Abstract: Barry Truax's 1986 work *Riverrun* is an early and significant example of the technique of granular synthesis, and is recognized as a classic of electroacoustic music. *Riverrun* is notable for the way in which it explores continua between pitched and non-pitched regions of material, built up from massed "grains" of sound. Besides the carefully ordered large-scale control of these granules, Truax also employs a tonal plan which is concealed through the course of the piece, but which contributes to its coherence nonetheless: *Riverrun* is, at a deep level, a very slowly articulated G-major triad.

1 Introduction

Barry Truax's 1986 work *Riverrun* is an early and significant example of the technique of granular synthesis. This work is widely recognized as a classic work of electroacoustic music ("EA" hereafter), and is frequently cited in articles and websites that deal with granular synthesis. Nearly twenty years after its composition (an eternity in this ephemeral, technology-driven genre), *Riverrun* continues to exert an influence on the EA community. Its significance is further attested to by the sheer number of references to the work in current writings—virtually all discussion of granular synthesis makes mention of the piece. These facts alone would constitute sufficient reason to look closely at the work's structure and materials, but there is also a more personal motivation: I have been utterly fascinated by the piece for many years.

In my own work as a composer I have long been attracted to the notion of creating complex textures out of very simple materials, and *Riverrun* sets a remarkable standard in that regard. The work is realized entirely by means of granular synthesis; it is formed from tiny "grains" of sound which coalesce into large-scale sound masses in such a way that the grains themselves cease to be heard as distinct elements, but are shaped into perceptually larger gestures and textures. These grains are formed from very basic sound materials—in *Riverrun*, Truax primarily uses sine waves or basic FM material; there is no use of sampled material in this work (though he did so in subsequent pieces). The material clearly evokes drips, drops and flow of water, despite its synthetic origin.

2.1 Water as Image and Metaphor

In *Riverrun* it is the motion of water in all its aspects, from droplets to trickle to torrent, that is the fundamental image which informs the entire work. It is Truax's careful control of the way these "droplets" both accumulate and dissipate that draws and directs the interest of the listener's ear, and which accounts for the success of the work in general. The term "control" is the key—even seemingly randomized material turns out to be carefully controlled; material which cannot easily be heard so turns out to be rigorously directed. One of the remarkable aspects of this work is the way in which it continuously engages the listener over a near twenty-minute span while generally (though not exclusively) avoiding any repetitive rhythmic structures. Truax accomplishes this by controlling the following aspects as structural elements: first, bands of granular material are deployed contrapuntally, creating large-scale gestures of similar and contrary motion; second is the use of what Truax calls "tendency masks," wherein granular material is directed either towards or away from zones of pitch, and finally, the use of a deceptively simple tonal scheme which binds the work together as a whole and creates a powerful sense of closure.

In the opening seconds of the piece (shown in Fig. 1), we find ourselves engaging with the matter from which the whole piece is constructed in a relatively sparse fashion. These are the first "droplets" of the torrent that will follow. Notice how the entire passage consists of seemingly random nodal clicks, which very gradually gather in density over the course of the excerpt. ("Nodal" is a term which refers to sonic material that is situated midway between noise and note—it appears to have a pitched aspect, but the actual frequency is difficult to perceive.) Truax arrays the material in roughly three layers of strata. The two most audibly apparent are the two lower layers. The longer-duration material resides in the lower frequencies, from about 100Hz to 1.3 kHz. The next "layer" is less dense and occurs in the frequency range of about 1.5kHz to 7.5kHz.

Throughout this section of the work, the texture is in continuous and gradual flux, with a constant flow towards greater and greater density of events. In the first section, shown in Figure 1, we are able to hear individual grains quite distinctly. By about a minute into the piece, the grains have reached a point at which they begin to be perceived as a larger sonic mass. It is this beautifully ordered accumulation of density and energy that holds and directs the listener's ear.

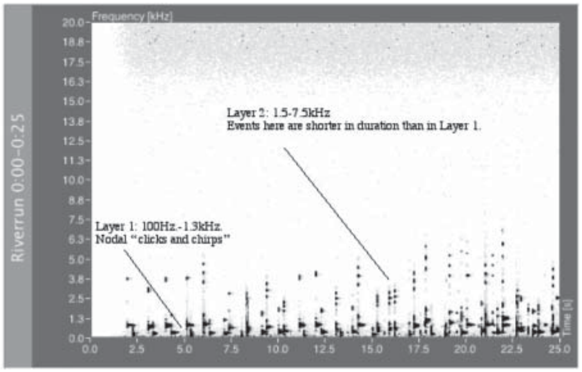

Figure 1. Sonogram of *Riverrun* 0:00-0:25

We can see and hear (with a recording of the work) how this continues to develop in Fig. 2. The material that was shown in Fig. 1 has continued to accumulate mass, and by the point displayed in Fig. 2 the composer pushes the material into a higher register. Here, approximately 7 seconds into the excerpt, the material in the 5-10 kHz range has greatly increased, to a very audible effect. Truax also creates a contrast amongst these grains by making the higher-pitched grains shorter in length than the lower ones—clearly discernible in the sonogram, and easily heard. At no point is there anything that could be described as "static." Throughout the entire span of the work the grains are either in a state of accumulation or dissipation, or changing in tessitura; usually in some combination of these.

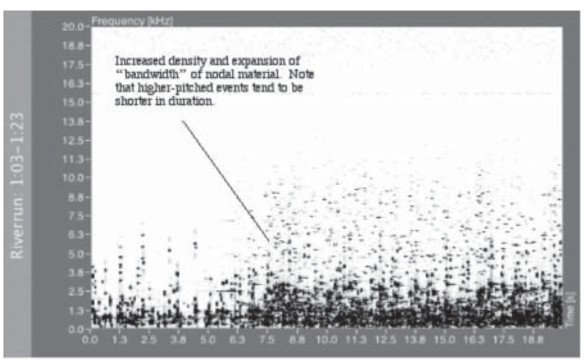

Figure 2. Sonogram of *Riverrun* 1:03-1:23.

2.2 Granular Counterpoint

Examining a more substantial duration of music (i.e. two minutes), higher-level structural control becomes very evident, as displayed in the sonogram in Fig. 3. The lower band of grains (up to about 3 kHz) continues to accumulate in density, and also makes a very slow and gradual descent in pitch. At this point, the texture has become extremely complex, with material moving in different directions simultaneously.

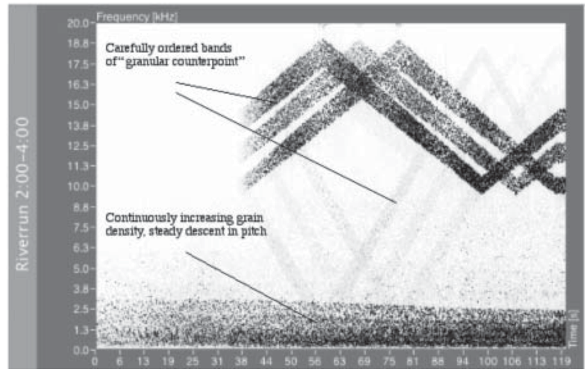

Figure 3. Sonogram of *Riverrun* 2:00-4:00.

Most striking in this sonogram are the contrapuntal bands of ascending and descending material—the issue of Truax's careful control over large-scale granular motion is certainly not in doubt at this point. The contrary motion of these bands of fauxbourdon-like material could not be plainer. Perceptually, the lower and steeper bands are more readily audible than are the higher and darker bands. It had been suspected that this work had some macro-contrapuntal design at work, in addition to the micro-polyphony of the interaction of the individual grains. The sonogram in Fig. 3 supports this idea very strongly. This passage of granular counterpoint continues for roughly three minutes. Later in the work, this type of material returns in a more prolonged fashion lasting for nearly six minutes.

2.3 Tendency Masks

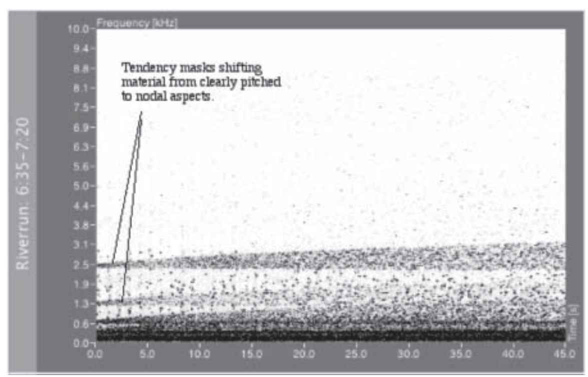

Figure 4. Sonogram of *Riverrun* 6:35-7:20

Fig. 4 displays another facet of *Riverrun*—that of gradual shifts to and from pitched versus nodal regions of material, an aspect that dominates the latter half of the piece. This sonogram displays a progression from a clearly heard D-natural, which bends upwards and then disappears as a discernible pitch. (This D also serves as a key structural element—as an early dominant signaling the final descent to G at the end of the piece.) The latter portion of the work deploys this process extensively, using what Truax calls "tendency masks" to control how readily the grains are perceived as being pitched. These tendency masks control how tightly banded together the grains will be in regard to frequency. Grains that are close enough together will be perceived as having pitch; as the bandwidth allowed by the tendency mask increases (as shown in the sonogram), the pitched aspect will diminish until it disappears.

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2.4 Pitch Logic

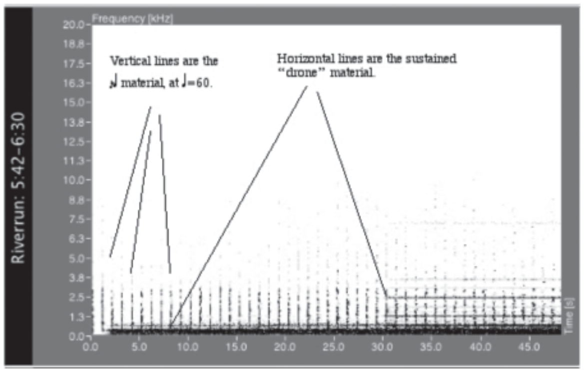

Figure 5. Sonogram of *Riverrun* 5:42-6:30.

Fig. 5 displays one of the rare instances of any sudden change in this piece. This sonogram displays a steady quarter-equals-60 pattern, which has emerged from the continua that has preceeded this point. Here is the only place in the work where sharply-etched, distinct attacks take place. While this pattern is quite regular when it appears (at about 5:40), the timbre it possesses is not so stable. Further, as the figure continues, these quarter notes gradually acquire grace-notes, which become ever more separated in time. At about 30 seconds into the excerpt, higher-pitched material enters to support the lower-pitched drone. This is a sharp departure from the premise that the piece has been arguing up to this point, that of slow, gradual change. This abrupt shift is likely in response to a need for some contrast; an intuitive musical choice. Even with the "sudden" changes heard here, these elements are still subject to their own gradual evolutions. After this section, *Riverrun* resumes its slow, shifting flux, but now with new tonal elements added, which guide the listener's ear through the remainder of the piece.

Unfortunately, no sonogram can be used in order to discern a hidden tonal element that is key to the piece: *Riverrun* is, at a very deep level, a very slowly articulated G-major triad. This is carefully obscured by two factors: first, by the glacial pace at which the triad unfolds, and also by the fact that Truax intersperses nodal material between the regions of specific notes, further blurring the relationships of pitch. This description of the latter part of *Riverrun* as a triad leaves out some decorative aspects of the tonal progression, including some subdominant material, but the triad is the predominant tonal structure. While the listener may not be especially conscious of this fact as the work proceeds in real time, the triad nevertheless creates an underlying organizing principle, which helps sustain interest throughout the duration of the piece.

3 Questions and Conclusions

In this brief study of *Riverrun*, we have only begun to examine the various means by which Truax offers rich sonic variety and structural coherence. Many questions are raised that could offer insight into a number of issues. The matter of prolongation is highly relevant and needs to be explored much more fully. The interplay of motion between nodal and pitched regions of material is a principal and binding element of the piece; many issues of perception are raised with this facet of Truax's composition. This preliminary overview needs to be greatly expanded in detail, both by examining more closely the manner by which the granular material is deployed and also in more fully assessing how *Riverrun's* organic unity is ultimately achieved.

Barry Truax has demonstrated, through *Riverrun* and other works, the vast potential of granular synthesis technique in the creation of EA music. By controlling the individual grains with a very high degree of precision, complex textures and structural events are easily achieved which have a striking richness to the listener's ear. Truax's skill at directing granular processes through various phases of flux over long spans of time, especially in *Riverrun*, is evidence of the power of this technique. The power lies not in the grains themselves, but in the way that their flow is ordered and directed. It is for this reason that *Riverrun* continues to set a standard this genre.

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The 0th Sound

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Abstract: Despite its emancipation in the latter part of the 20th century, the integration of silence into the very fabric of musical expression, particularly in electroacoustic music remains limited. This may be in part attributed to its unique and seemingly limiting traits, but perhaps most importantly to the lack of methodology by which its assimilation could be successfully expanded. By associating the notion of silence with the mathematical paradox of the number 0 it is my intention to offer a set of ideas and exercises by which an artist could expand their utilization of this unique member of the musical language.

1 Preamble

The following paper is by no means a complete and/or finite work on this topic of gargantuan proportions, nor does it offer an exhaustive set of solutions to the problem it addresses. Yet, what it does provide is a scaffolding with critical starting points which will hopefully facilitate discussion as well as inspire additional ideas and/or concerns on the given topic in order to assist the author in assembling a more complete documentation, In pursuit of the ultimate solution, it is author's intention to expand the subject into an extended article and in due course a textbook suited towards the academic environment as well as for the purpose of self-betterment as an artist and an audience member.

2 Introduction

Even though the silence has been a part of the musical expression for as long as the concept of music itself has been known to the human kind, ironically it was also the last expressive element to be recognized as a fully equal member of the musical palette. Granted, examples of its deployment in the form of a cessation or interruption of musical ideas can be traced all the way back to Haydn (such as in the closure of his witty String Quartet Op.33 No.2 a.k.a. "The Joke"), and quite likely beyond. Yet, its integration as a musical idea, rather than an interruption or an antithesis to the music arguably has not been achieved in a believable manner to this very day. Naturally, this is not to say that there were no works that have attempted to accomplish this seemingly impossible feat, which in itself may very well suggest that such amalgamation of silence and sound may be impossible to attain until our perception and understanding of music has changed in its very core.

2.1 Background

When discussing silence it is imperative that we address the important contributions of John Cage, his forerunner Alphonse Allais [Solomon 2002], as well as their contemporaries whose work has greatly assisted in the emancipation and proliferation of silence. We should certainly acknowledge Cage's ubiquitous *4'33"* which Paul Griffiths refers to as "music reduced to nothing, and nothing raised to music" [Griffiths 1995]. Through nearly total absolution of composer's control, this work has become an epitome of the thin line that separates sound from silence and therefore questions the very existence of silence [Cage 1973]. It is interesting that through Cage's hands (or should I say ears?) silence underwent arguably its most liberating and at the same time the most self-denying moment in its history—on one hand it had finally become the focal point of a work of art, yet through this very role it had also negated its own existence, at least in our physical world, that is.

While some of the late 20th composers have certainly made strides towards equality between the sound and silence, such as the Richard Chartier in his *Series* (2000) [Chartier 2000], and the politically charged *two minutes fifty seconds silence* (2003) by Matt Rogalsky [Rogalsky 2003] (latter being more of an extension of Cage's doctrine), other composers from Cage's generation as well as his contemporaries have unfortunately shared less consolidating visions of silence. Christian Wolff talks about silence being an "absence of anything specified" [Wolff 2004], while Ralph Lichtensteiger who maintains a collection of thoughts on silence on his webpage titled "Silence (Everything [that] had been said in the saying of nothing)" [Lichtensteiger 2004], presents us with a looser definition that in many ways coincides with the Henry D. Thoreau vision of silence as "the universal refuge" [Thoreau 1985]. Susan Sontag, the recently deceased writer and activist defines it as the "artist's ultimate other-worldly gesture" [Sontag 2002] which, if anything, further separates silence from sound, placing them into two altogether different realms. All of the aforementioned thoughts share the same poetic wealth and naturally the source of inspiration, yet what they also have in common is that they fail to provide any insight as to how to bridge the rift between the realm of silence and sound, a rift that prevents us from harnessing the real strength of silence.

It is interesting that one of the most hopeful definitions of silence comes from the writer, rather than a musician. Aldous Huxley once said that "silence is full of potential wisdom and wit as the unhewn marble of great sculpture" [Huxley 1996]. As an example of one of the few thoughts that subscribe more potential to the underdog of the sonic world, this quote truly speaks of great unexplored potential that remains hidden away in the endless void of its singularity personified by an untouched piece of marble stone. Yet, there were musicians who shared interesting views of silence by correlating music with other forms of art. Such is the conductor Leopold Stokowski who stated that "a painter paints pictures on canvas. But musicians paint their pictures on silence" [Simpson 1988]. Remarkably, painters such as Robert Rauschenberg and his contemporaries have dealt with the notion of canvas as the focal element of the artistic expression by creating series of "white paintings," before such ideas gained momentum in music [Joseph 2000]. This was naturally due to greater tangibility of the base color notion in visual arts, where the white and black colors were generated by all-inclusiveness or total absence of colors respectively offering a finite set of possibilities out of which all were obvious and readily perceptible. Silence, on the other hand is an elusive notion whose manifestation is often obstructed by extramusical events that may or may not be observed as integral to the work of art.

3 Silence as a Physical Manifestation

As can be seen from the aforementioned examples, with the exception of the more contemporary contributions, silence historically has been observed as a cessation of musical activity, an anti-musical device that generally lacked motivic and/or developmental qualities. Here, I am obviously referring to silence in its untainted form whose purity is arguably achievable only in theory. As such, it has been observed as a physical (acoustic) manifestation that could be described as:

- a cessation of musical motion
- a cessation of time
- an interruption
- subordinate to sound
- singular and unchanging

By the same token, there are some musical devices that share common traits with silence yet are not the same. As a result they are often mistaken for silence and as such help further obfuscate the notion that we are trying to pinpoint and hopefully demystify. Hence, for the sake clarification we should state what silence as a physical manifestation clearly isn't:

- a background noise
- an attenuation
- does not co-exist with the unnatural reverberating envelope of a ceased sound
- spectrally dependant

4 Silence as a Musical Event

Just like any other physical event that has any musical potential, silence has two facets, two ways through which its qualities can be assessed and quantified. One is obviously the aforementioned physical or acoustic manifestation, while the other is silence as a musical event and which to us is a much more interesting quality. Before delving any further I believe that it is critical to emphasize and clearly delineate the difference between the pure physical manifestation (regardless of its feasibility) and its psychoacoustic counterpart. To clearly relate these two counterparts let us take another look at Cage's *4'33"*. If we allow ourselves for a moment to ignore the composer's intentions with this piece, we could ostensibly interpret it as a manifestation of pure psychoacoustic silence from the traditional musical perspective, despite the obvious and inevitable noises that would emanate from the audience during its performance (which would be regarded as mere non-musical side-effects of having the piece performed in a traditional concert setting). Yet, if we observe the event purely by monitoring physical manifestations that take place throughout the duration of the event, we could inescapably notice that the piece itself would be far from the pure physical silence. Naturally, there are shades in between these two extremes, some of which may very well eliminate the presence of silence even in the psychoacoustic realm. For instance, one could observe the noises emanating from the audience as the core musical material and therefore negating the very implication of silence as suggested by looking strictly at the composer's score. And the list goes on. From the given examples we can therefore observe that the silence as a musical event offers greater flexibility in terms of its contextual importance as well as its perceivability.

It is obvious by now that the concept of silence as a pure physical manifestation is not of much use to us musically as it is not only impossible to reproduce in the real world but is also musically uninteresting due to its exclusivity and therefore incompatibility with anything including itself. Hence, for our purposes of unlocking the full potential of silence without sacrificing its core ideals within the musical context we will adhere to the psychoacoustic notion of pure silence which implies, as exhibited in the ideas stated above, an <u>intentional</u> cessation of perceptible musical activity without the regard for the environmental sonic contamination. Yet, for the purpose of easier association with the world of numbers, we will not completely abandon the notion of silence as a physical manifestation and will in the next chapter use it to draw an objective parallel between the two seemingly disparate dominions.

5 Zeros and Silences

The world of numbers is driven by objective, clearly stated laws. There are, however, exceptions. One of them is the number zero. Obviously, we cannot multiply nor divide with the number zero as such operation both logically and mathematically yields inconclusive results. Properties such as these separate number zero from the infinite plane of numbers. Yet, without the number zero the world of numbers would indeed make no sense. In this respect the number zero shares a lot in common with the silence as a physical acoustic manifestation. Silence, just like the number zero, is a starting point or a white canvas if you like, upon which all other values depend and stem from. To put this statement into perspective, let us for a moment consider a world of musical expression without silence as a psychoacoustic manifestation. As preposterous as this proposal may seem, it certainly gives us some insight as to how impossible such a system would be to even imagine, let alone utilize as a cradle of one's artistic expression.

The strong link between the number zero and silence can be corroborated further in the digital world where the waveform representation of silence yields an array of zeros, while its spectral view is represented by the total absence of any frequencies and/or amplitudes (0 bands and therefore 0 amplitudes). Granted, the silence, just like any other sonic event is meaningful only within the context of time. Even so, the mathematical zero could be observed as a geometric intersection of multiple planes which could easily accommodate multidimensional qualities of sound and therefore silence as well even beyond the simple time/energy two-dimensional realm.

It is important to notice that the number zero can be associated just as successfully with the psychoacoustic concept of silence as with its acoustic counterpart. Obviously in the case of extremely loose treatment of the definition of psychoacoustic silence, as we will find out shortly, it may eventually fall outside the context of this correlation. Yet, the strength of this link on all other accounts is unambiguously indispensable and as such should not be treated lightly.

6 Learning from Numbers

Silence as a psychoacoustic phenomenon can, and under the right circumstances should be treated as pure. In such a state it can be observed as being analogous to the number zero, as it shares many traits with this paradoxical member of the world of numbers. This parallel, that redefines the silence as the 0^{th} sound is of great importance as it can help us decipher the real musical potential through use of tangible and mostly rational methods inherent to the art of numbers.

Consequently we find that the *0^{th} sound* is certainly an appropriate synonym for the silence that elegantly encompasses its irreconcilable acoustic and psychoacoustic properties. But what good could such a correlation do to our understanding and more importantly our ability to harness its potential?

By using very basic sound synthesis operations we could easily agree that the addition and/or subtraction the *0^{th} sound* and any other sound event, including the *0^{th} sound* itself will yield results comparable to the ones achieved by performing similar operations using numbers. Such operations in this context are however of little interest as they yield no constructive results and as such are useless to the music-making process. It is also worth pointing out that we need to observe number zero strictly as a unique singular value, rather than a recurring digit which is a result of our human-made base-ten system.

Where the true potential of this analogy stems from is the hierarchical implementation of the number 0 within the larger context (i.e. as part of an equation). By scrutinizing the role of the number zero in an equation we can clearly observe its varying levels of importance which largely depends upon number's position. For instance, if a number 0 is the result of an equation, even though it in itself does not yield any quantitative value, it does help us define interrelationships between the variables that are found on the opposite side of the equation. This would be musically equivalent to two or more sounds whose blend results a silence through mutual cancellation of frequency bands.

Let us, for instance, imagine an equation that yields 0 in a recurrent pattern (i.e. sine function). We could use this kind of analogy to produce temporary but periodic cessation of sonic activity that would by no means suggest cessation of musical time as was the case with many of the historic utilizations of silence. On the macroscopic level this would pose as a motive – counter-motive relationship, while on the microscopic level it could be perceived as a part of the pulse-like modulation process.

There are naturally many other analogies we could extract from the fascinating correlation between the number zero and the psychoacoustic concept of silence. By no means would all of them yield revolutionary findings, but certainly a number of them could offer interesting alternatives to the common ways of utilizing silence within the context of a work of art. If we were to sum-up many of the aforementioned parallels we could generate the beginnings of a vast list of potential functions of the 0^{th} sound that lean towards the acoustic end of functional spectrum:

- musical motive or counter-motive through superimposition and/or contrast
- musical pause without temporal interruption by means of consistent duration
- modulating timbre via short modulating bursts
- …

Accordingly, we could also produce a list of more psychoacoustic approaches to treatment of the *0^{th} sound*, some of which would in certain cases be so far removed from the idea of absence of sonic material that it would cease to be classified as such. Therefore we could say that 0^{th} sound could be:

- phased in and out to co-exist with fade-out and fade-in envelopes of the surrounding sounding events[1]
- superior to sounding events through adjustments of pace that suggests its musical superiority as well as via superimposition over the singular and unchanging sound
- spectrally localized by affecting only certain portion of the aurally perceivable spectra
- …

Obviously the last option is where the *0^{th} sound* would become so removed from its original idea that it would be practically impossible to distinguish it from the process of band-pass filtering. Yet, if we refer back to the world of numbers, this kind of situation would be easily justified through the use of sets, where a larger set would contain several subsets, some of which would be empty and therefore equal to 0. By elaborating upon this idea, we could conceivably subdivide the spectra into multiple bands (or subsets) and generate melodies by alternating their presence. Through such psychoacoustic manipulation, the *0^{th} sound* could become the focal melodic element of a work of art and therefore achieve true synergy with the aurally perceivable counterparts.

7 Benefits and Limitations

Besides the obvious and important expansion of ways to deal with and/or incorporate the *0^{th} sound* into one's creative process, the aforementioned exercises could also help the artist more rapidly develop one of the most critical traits that generally take the longest to master simply because they require experience and wisdom over talent—the idea of musical pace. With the greater focus on utilization of silence as a structurally and musically important element, the artist would have to exert greater effort to make such integration a successful one and in the process of doing so reexamine the important decisions that affect the overall shape and form of the piece.

Naturally, the suggested method does not come without shortcomings and limitations. The *0^{th} sound*, regardless of its arguably newfound potential, due to its singularity cannot carry the same weight as the aurally perceptible material without recontextualizing and overextending its definition to encompass dubious space between the sound and silence. In this realm of gray, the *0^{th} sound* may also pose as a perplexing member of the musical language that has no universal pull or tendency to resolve. As such it may introduce additional points of contention during the artist's creative process in terms of its role and relation towards other material. Finally, there are limits beyond which calling a musical event a subset of *0^{th} sound* would be simply detrimental.

8 Conclusion

While in its current form this paper has barely scratched the surface of this seemingly inexhaustible topic, it has certainly provided some concrete leads suggesting possible avenues that may require additional attention to produce a wealth of new and creative ways in utilizing silence. Even so, it is my belief that before any of these steps are to make a lasting dent in our art, we need to take on our own social and cultural demons which have shaped our perception of music separating silence from sonic events in a fashion that discourages any meaningful correlation between the two seemingly disparate realms. By means of active intellectual self-betterment as well as ongoing compositional efforts, I believe that we all can not only affect our own artistic output, but also foster aesthetic changes in perception of contemporary musical art and with it yet once again redefine the role of the *0^{th} sound*.

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Footnotes

[1] I am intentionally avoiding the term of fading in and out in order to create a distinction between the presence and absence of sound

RTcmix: Recent Developments

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Abstract: The RTcmix sound synthesis and processing program works by accepting scripts in any of several languages, and then rendering audio in real time. Recent work extends the syntax of RTcmix scripts to support more flexible and extensible means of real-time control. A new editing program, RTcmixShell, makes it easier to get started with RTcmix scripting.

1 Introduction

RTcmix is a program for synthesizing and processing audio in real time, either interactively or off line. The program was derived from Paul Lansky's Cmix by Brad Garton and David Topper and has a long history of use by composers [Garton and Topper 97, Gibson and Topper 00]. It is free software, in the sense that you can download and use it free of charge, and — more importantly — that you can see the source code, modify it, and distribute your changes. RTcmix runs on Linux and Mac OS X. A Windows port is under way.

Recently Douglas Scott and I have contributed important new features to RTcmix, making it more powerful and flexible. This paper offers an explanation of the latest features in RTcmix 4, which make it much easier to control sound in real time. This should be of interest to anyone who has used RTcmix or another text-based audio program, such as Csound or SuperCollider, or anyone who would like to learn what RTcmix can do for a composer or sound designer.

You control RTcmix with a scripting language or via a custom interface program that embeds the RTcmix functionality. (One such program is David Topper's GAIA, Graphical Audio Interface Application [Topper 04].) Three scripting languages are available: Perl, Python and MinC. The latter is RTcmix's own interpreter, modeled on the C programming language.

You can use any text editor to write the scripts. (I like Vim.) For users new to RTcmix, I've written RTcmixShell, a simple editor that provides play and stop buttons, syntax highlighting, and various RTcmix-specific amenities, such as function hinting. (Press a key to see a list of functions; choose one to insert its name and see its argument list.) I plan to add graphical facilities for table construction, audio interface selection, and so on (figure 1).

To make sound in RTcmix, you set up tables and other control structures; then you invoke *instruments*, which synthesize audio or process live input or sound files. Instrument *calls* have *arguments* that determine the behavior of a "note." (A *note* is the sound generated by one instance of an instrument, regardless of whether this comes across as one note in the conventional musical sense.) An argument is often a variable whose value you set earlier in the script. Here is a typical instrument call, with some arguments supplied as variables and some as literals.

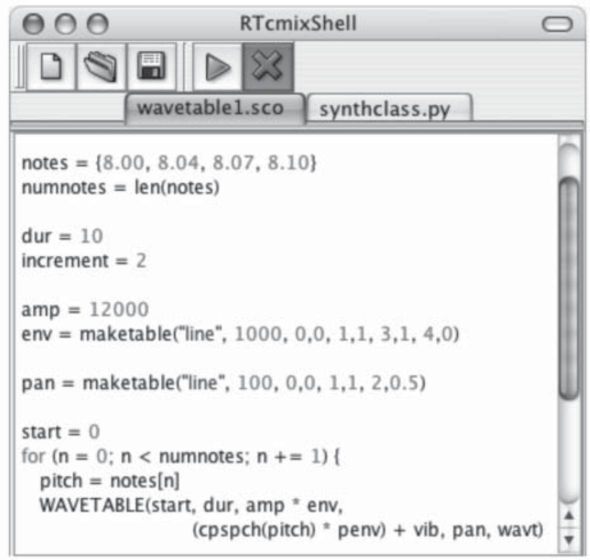

Figure 1: The RTcmixShell script editor

```
DELAY(start, 1.25, dur, amp, deltime, feedback=0.9,
0.5, 0, pan)
```

The sound output goes to the system audio driver or to a file for inclusion in a different RTcmix script or another program. RTcmix now supports the ALSA sound driver on Linux, as well as Mac OS X CoreAudio, including multichannel interfaces like the MOTU 828 mkII and Digidesign 192 I/O.

2 Why Bother?

People sometimes ask: "Why would I want to use RTcmix, when there are so many other wonderful tools?" It's true that with the availability of extraordinary commercial programs, such as Max/MSP and the Native Instruments series, it's harder to argue for a text-based approach. But any program can influence your compositional process, and each person must find the set of tools that fits well with his or her way of working. Text-based programs can offer greater generality, flexibility and precision, and sometimes make it easier to express certain ideas. For example, I find it much less confusing to construct a complex loop in one of RTcmix's procedural scripting languages than to connect a bunch of Max/MSP objects in the right graphical order. (It can also be easier to debug a script.) For people who want the best of both worlds, Brad Garton has written rtcmix~, an MSP object that embeds much of the functionality of RTcmix. (His latest work incorporates the version 4 improvements I describe below.)

Another advantage of scripting languages — at least relative to "hard-wired" software synthesizers like Native Instruments' Absynth — is easy extensibility. Using the Python front end to RTcmix, I built a large algorithmic loop-generating program, called Hula, which has its own special-purpose scripting syntax that can be extended by arbitrary Python code [Gibson 04]. Hula lets you create multiple *player* objects, each with its own tempo and note pattern, and makes it easy to specify a large number of randomly changing note characteristics.

Working with scripts in a Unix command-line environment can lead to novel ways of managing work flow. When I compose in RTcmix, I use a *makefile* to describe dependencies between the many scripts and sound files that go together to form the piece. If I make a small change to one script, typing "make" regenerates all necessary sound files, in the correct order. This may seem a minor point, but one of the difficulties most people face when composing computer-based music is organizing their work and keeping track of many details. Scripts can help.

3 Dynamic Instrument Control

The improvements in RTcmix 4 center around dynamic control of instruments. Formerly, serious limitations made it awkward or impossible to control instrument behavior during the course of a note. All the arguments to an instrument call were constant values. Instruments that supported some time-varying parameters did so via the *makegen* table-creation function. You created a table with makegen, giving it an ID number that the instrument expected. One drawback was that instruments tended to expect the same IDs, leading to confusion and unanticipated results. RTcmix 4 introduces a new way of specifying time-varying parameter changes that is clearer and much more flexible. Instrument arguments are no longer limited to constant values. In the DELAY example on the previous page, *deltime* now can be either a constant or a reference to a table, MIDI controller, or other real-time data stream.

A new family of functions creates these time-varying parameter references. This is best illustrated by example (figure 2). The *maketable* and *makeconnection* functions return a reference that you can store into a variable — such as *deltime* — and then pass to an instrument in order to control a parameter continuously during the life of a note.

The *maketable* function lets you create many different types of table, containing lines, curves, splines, waveforms, random numbers, numbers culled from text or sound files, etc. Functions like *addtables*, *multtables*, *inverttable*, *reversetable*, *shifttable* and *quantizetable* let you combine and reshape tables.

The *makeconnection* function establishes a link to a real-time data stream, providing a convenient way to control parameters via MIDI or mouse input. The incoming data is scaled to fit a range you specify, and is smoothed depending on the value of *lag*. Mouse input provides a convenient way to test the behavior of an instrument when its parameters change, as well as a reasonable way to operate a multichannel panning instrument, of which RTcmix has several. MIDI input currently is limited to controlling the sound characteristics of a note while it plays, rather than triggering new notes. Future work will implement this second possibility. You can use any MIDI channel voice message to control RTcmix instruments.

RTcmix supports real-time connection types via a plug-in system, which means you can write your own plug-in to read data from a USB microscope or any other device. We hope to make plug-ins for Open Sound Control [Wright and Freed 97], as well as Electrotap's Teabox [Allison and Place 04] and other sensor interfaces. The rtcmix~ MSP object employs a connection plug-in to stream control data into RTcmix from MSP inlets.

To some extent, you can treat a dynamic reference as you would a constant. For example, you can add or multiply two references — say, to scale one type of MIDI input by another — or multiply a constant and a reference, as in the following code excerpt. In figure 3, a wavetable oscillator instrument plays a note each time through the loop. The base frequency changes randomly from 100 to 2000 Hz, but the glissando is always up an octave, due to the multiplication of *freq*

```
amp = maketable("line", size=1000, 0,0, 1,1, 9,1, 10,0)
deltime = makeconnection("midi", min=0.01, max=0.5, default=max,
                         lag=80, chan=1, "cntl", "foot")
feedback = makeconnection("mouse", "x", min=0, max=1, default=0, lag)
DELAY(start, inskip, dur, amp, deltime, feedback, ringdur, inchan, pan)
```

Figure 2: *maketable* and *makeconnection*

and *gliss*. The "nonorm" tag suppresses normalization of maketable output, which would scale the line segment so that its values fit between 0 and 1. Tables

```
// exponential curve from 1 to 2
gliss = maketable("curve",
         "nonorm", 100, 0,1,3, 1,2)

// loop for 10 seconds
for (n = 0; n < 10; n += 0.5) {

  // random constant frequency
  freq = irand(100, 2000)

  WAVETABLE(n, dur, amp,
             freq * gliss)
}
```

Figure 3: Combining a constant and a dynamic reference

normally are read using linear interpolation, but it's possible to ask for no interpolation or second-order interpolation when creating the table.

4 LFOs and Randomness

Two other functions create dynamic data internally, rather than pulling the data from outside of RTcmix, as does makeconnection. The *makerandom* function generates a stream of random numbers, using one of several distribution types. The numbers emerge at a frequency that you specify as a constant or as another dynamic reference. The following code creates a reference, *amp*, to a stream of random numbers that range from –3 to 2.5, using a Gaussian distribution and a frequency that moves from 0 to 20 and back. The minimum

```
// line from 0 to 20 to 0
freq = maketable("line", "nonorm",
          100, 0,0, 1,20, 2,0)

amp = makerandom("gaussian", freq,
        min = -3, max = 2.5, seed)
```

Figure 4: *makerandom* with dynamic frequency

and maximum values can also be set using a dynamic reference, rather than a constant.

The *makeLFO* function generates a cyclical stream of numbers, using a standard waveform (sine, sawup, sawdown, square or triangle) or any waveform supplied as a table reference. The frequency and amplitude of the LFO can be constant or dynamic. A variation of makeLFO allows specification of a value range rather than an amplitude. In figure 5, LFO frequency changes randomly (twice a second) to values between 1 and 9 Hz. The sine wave is bipolar, with amplitudes ranging from -0.1 to 0.1.

```
freq = makerandom("linear", 2, 1, 9)

vib = makeLFO("sine", freq,
           min = -0.1, max = 0.1)
```

Figure 5: *makeLFO* for random-speed vibrato

We could use the *vib* reference returned by makeLFO as a multiplier for the frequency input of WAVETABLE, thus creating sub-audio rate frequency modulation.

5 Massaging the Data

Additional functions let you condition the data generated by the functions described above. The *makeconverter* function takes a dynamic reference and applies one of RTcmix's converters to the incoming data. As an example, we often want to work with gain in terms of decibels, rather than linear amplitudes. But most RTcmix instruments accept the latter. Figure 6 shows how you might handle this problem. We

```
gain = maketable("line", 1000,
         "nonorm", 0,0, 1,90, 4,0)

gain = makeconverter(gain, "ampdb")

WAVETABLE(start, dur, gain, freq)
```

Figure 6: *makeconverter* for amplitude conversion

construct a table containing a decibel ramp from 0 to 90 dB and back. Since WAVETABLE wants linear amplitude instead, we route the *gain* reference through the decibel-to-linear amplitude converter, *ampdb*, before passing it on to the instrument. RTcmix also supports conversion between its various pitch formats: cycles-per-second, linear octaves, octave-point-pitch class, and MIDI note number.

The *makefilter* function creates control data filters of various sorts. They operate in a manner analogous to that of makeconverter. The filter types currently available include *fitrange*, which scales incoming data to a range that can change dynamically; *quantize*, which snaps values to a grid defined by a (possibly changing) quantum; and *smooth*, which applies a dynamically adjustable first-order low-pass filter to the data, so as to smooth over any discontinuities.

6 Project Status

Most RTcmix instruments have been rewritten to take advantage of the new features while remaining fully compatible with older scripts that use the makegen function. RTcmix 4 is still under development and will be available for download in the spring of 2005, from ftp://presto.music.virginia.edu/pub/rtcmix. People interested in the bleeding edge may download the nightly snapshots, though you must compile these yourself. Fortunately, we have greatly improved our build system for this release, so compiling is much easier than it used to be. We encourage everyone to try RTcmix, and we welcome all suggestions for improvements.

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Musical Landscapes Using Satellite Data

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Abstract: Landscapes have always served as a source of inspiration for musical composers. Using the tools of sonification, a number of musical compositions were created using satellite imagery of urban areas in Alberta, Canada. Using the landscape as a source of data for sonification creates a variety of interesting sonic and visual experiences; we are letting the landscape sing.

1 Introduction

Sonification of data is the rendering of sound from data that contain no native acoustical signal. Given the wide array of data possibilities, it comes as no surprise that sonification projects are often interdisciplinary in nature. For this project, the combination talents in the musical/visual arts and natural sciences were used to create interesting musical compositions from satellite image data.

Vast quantities of satellite imagery of the earth's surface are collected on a daily basis. The analysis of these data is a complex combination of visual interpretation and digital image processing. Scientists studying the data from these images are primarily focused on retrieving the information they contain in a static image-processing environment. These images provide us with not only data about the planet, but have an aesthetic appeal that is often overlooked. The overhead view provided by these satellite images present our world from a unique perspective. Our natural and human-modified landscapes create interesting visual shapes, arrangements, and patterns on the landscape. This research was focused on different ways of interpreting our places. We examined a variety of different visualization techniques in conjunction with data sonification to explore what satellite images sound like.

The use of sound to aid in the interpretation of data has found many practical uses from the Geiger counter, sonar, and many medical displays to name but a few. In this instance, the use of an auditory signal is more easily interpreted than a visual cue. Other more recent research has involved the implementation of sound to help the blind navigate using computer maps and the global positioning system (Golledge et al. 1991; Fanstone, 1995; and Jacobson, 1996).

With the advent of more user-friendly software applications for the production of sound, the development of new and novel ways of using data sonification to interpret complex data sets will become more common. From analyzing geographic data (Zhao, et al. 2004), climate change data (Quinn, 2000), to helping understand atomic particle movement (Sturm, 2000). The majority of these research projects have focused on either the need for complex data analysis or on the transformation of data into sound only. In this project we present a combination of a variety of visualizations of the actual data in conjunction with the sonification of these data, yielding a true multimedia experience.

2 Motivation

People have always tried to survey their environments from above. The earliest maps were markings on clay tables from Babylonia dated around 2500 B.C., which depicted the 2-D location of important landmarks. These markings were meant to help people describe the relationships between identifiable features from a planimetric perspective that we do not have, but all seem to understand. Over the proceeding centuries, civilizations have developed techniques and technologies to make this process more accurate, but it wasn't until the advent of the first photograph that recordings of the earth from a bird's-eye view was made possible. Since that time, images of the earth have become a major source of geographic information and geographic awareness. We are now able to remotely sense our place on earth with a dizzying array of sensors, spatial and spectral resolutions. Recently, these instruments sent to other planets to be our new explorers.

With the ever-increasing volume and variety of complex data and the advent of multimedia technologies, sonification is beginning to play an increasingly important role in data exploration (climate change data, human genome project, etc.). The vast quantities of information produced by modern instrumentation open up a wide variety of interests in new representations of this information. The motivation for this project was to explore the use of satellite imagery as a source of data for creating musical compositions. While composers of music have always used landscapes as a means of motivation, we wanted to explore the ways that landscapes, by using satellite data and sonification tools, could create their own sound.

In this instance, we were more interested in the creative process than in the direct interpretation of these data in a scientific context. When experimenting with the composition of these data it is important to recognize that artistic products are not cold, objective, and reproducible experiments. Normally artistic endeavors involve human decision-making that shapes the nature of the content and its form of expression. While often an artistic work may derive from inspiration—ideas or emotion and use traditional forms appreciated by others and be thought of as being mostly subjective and personal, a creator may utilize concepts that are from outside of the normal artistic activity.

The majority of sonification efforts to date have involved the transformation of many different types of data into sound. In this project, we present not only a sonification of satellite image data, but visualization as well. The visuals are meant to complement the musical composition, and in the piece entitled "Spiral from Nose Hill" the 3-D fly through of the data approximates the position of the sonified data. This technique enriches the musical experience by using the power of the visual system to help transmit the emotional response triggered by the sonification.

3 The Data

All of the remotely sensed data used for this project come from the Landsat satellite system (Landsat-7). This remote sensing system is in sun-synchronous orbit approximately 700 kilometres above the earth's surface and is continuously acquiring images for the management and monitoring of the earth's resources. The Landsat series of satellites records data from a variety of areas of the electromagnetic spectrum (from the visible to thermal infrared) yielding many different views of earth. While the main motivation behind most earth observation satellites is to provide data on the surface condition of the earth, these images have a visual appeal all their own. The profound natural beauty displayed by the patterns, colours and textures on earth is a secondary product of these images and one that is often overlooked. They represent a form of natural art, and as such, can inspire, create interest and possess the ability to move people in many ways.

For this project, images of the cities of Lethbridge, Calgary, and the town of Bassano, Alberta, Canada were used (Figures 1-3). As the satellite imagery provides six different spectral bands, a wide variety of options existed for the selection of data for sonification. Transects of image data were then extracted (with X, Y coordinates as well as spectral bands) from each of the images to provide a flow and direction to the data. These transect were selected for their aesthetic appeal; there was no predetermined rationale. For example, in the Southside movement of Singing Lethbridge from the Sky, the transect moves from the downtown area, with it's busy pattern of office buildings, roads and parks, through a residential area and terminates in a park. Other areas were selected for their spatial patterns, which were then transformed into rhythmic sequences.

Figure 1. Landsat Image of Lethbridge.

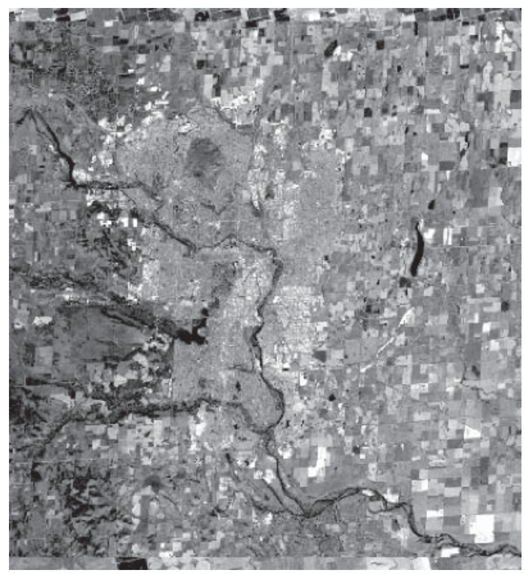

Figure 2. Landsat Image of Calgary.

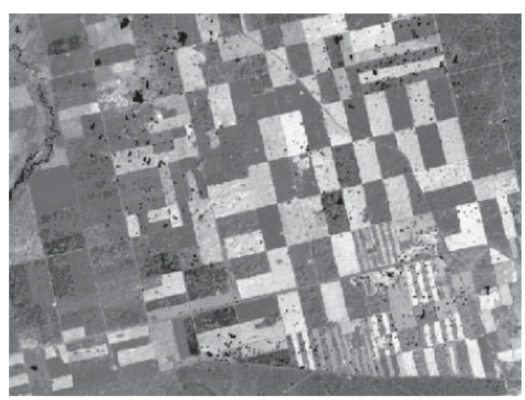

Figure 3. Landsat image of Bassano.

4 Sonification

The sonification of the satellite data was performed in Max/MSP. Max/MSP is an object-oriented programming environment that allows for a wide range of flexible options for the transformation of data into sound. In the crafting of the musical pieces, values like the transect coordinates and the spectral bands from the satellite imagery were used to drive different sonic parameters. The end result was designed to not only present the data, but to convey a sense of place through sound. An example of the programming required to produce this sonification is presented in figure 4.

In creating this sonification experiment, we were seeking to transcend the new, the news, the trend, the latest and the greatest, the right now, or the buzz. Of course humans are interested in non-mundane things, that is a given. This always has been and will always so be. The end goal was to present the listener with an experience that transcends the newness of the sound and enables them to identify with it. In this sense, music created using satellite data can present a geography of sound that can strike a chord for the listener.

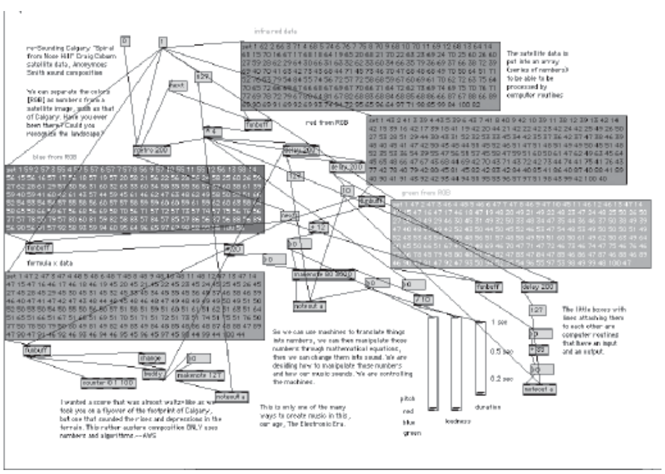

Figure 4. Sonification programming for Spiral from Nose Hill.

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Personal Effects: Weaning Interactive Systems from MIDI

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Abstract: Interactive music systems in early implementations usually made use of the Musical Instrument Digital Interface (MIDI) standard. The MIDI standard has been recognized since its inception to be slow and limited in its scope of representation [Moore 88]. Reliance on outboard MIDI gear has doomed a generation of interactive works to obsolescence as the requisite hardware becomes unavailable. Faster and cheaper machines have in recent years made it possible to perform analysis, synthesis, sampling, and effects on the CPU of a general purpose personal computer, simultaneously with the execution of control level software. This paper discusses the advantages, limitations, and technology of such an approach.

1 MIDI Love/Hate

MIDI was the dominant protocol for the design and implementation of interactive music systems for a long time, and its use still persists today. There were good reasons for this dominance, particularly at the end of the 20th century when these systems were first being developed. MIDI synthesis, sampling, and effects gear produced high-quality digital audio at an affordable price. Moreover, offloading the synthesis duties onto a dedicated piece of hardware freed the CPU of the computer to concentrate on control level analysis and composition.

On the other hand, MIDI transmission rates are too slow to handle large control streams. Synthesizer manufacturers retreated into bland repetitions of the same sampling-based architectures. The need to stimulate demand by introducing new models every few years meant that works written for commercial gear faced technical obsolescence in a very short period of time as specific boxes broke down and could no longer be replaced.

Small wonder, then, that composers have embraced a new generation of technology that allows the rendering part of interactive music systems (synthesis, sampling, and effects) to be handled by the CPU of the same computer calculating larger control structures. The most widespread instance of this phenomenon is the Max/MSP platform, which itself reflects the evolution of the technology: Max alone is a MIDI-processing environment, while the later MSP extensions incorporate real-time digital audio processing into the control-level structures organized by Max.

The strength of the concept has led to a wealth of alternatives, however. Miller Puckette's open source Pd system is itself a primary reference for the development of MSP [Puckette, Apel, & Zicarelli 98]. A phenomenal outpouring of open source digital audio applications is listed on Sourceforge [sourceforge.net], and distributed through the AGNULA project [www.agnula.org]. Beyond the fervor of commercial and individual developers, which has led to such influential packages as Cook and Scavone's Synthesis Toolkit (STK) [Cook & Scavone 99] and the CLAM library [Amatriain, Arumi, & Ramirez 02], there have been several efforts to standardize digital audio rendering protocols for various reasons.

2 Digital audio standards

The Open Sound Control standard (OSC) is one of the most direct approaches to resolving the networking and representational limitations of MIDI [Wessel & Wright 98]. Other platforms have been shaped by international standards organizations, or by their connection to existing specifications. Two of these are the Structured Audio Orchestra Language (SAOL) [Vercoe, Gardner & Scheirer 98] and JSyn [Burk 98].

Both are deserving of discussion for different reasons: JSyn because a working implementation exists and is in widespread use. SAOL is of particular interest because it is defined as part of the MPEG-4 standard, and it may come to pass that MPEG-4-compliant devices will implement some version of it as adoption increases.

JSyn, developed and distributed by SoftSynth and its lead programmer Phil Burk, is a unit-generator-based real-time synthesis library for stand-alone applications or Java applets. Units can be dynamically allocated and inter-connected to support varying synthesis and processing topologies even as sound is being produced. JSyn applets are realized on a client machine through the use of a plug-in attached to the user's web browser.

While JSyn implements a unit-generator paradigm that is familiar from several previous synthesis languages, the SAOL specification is written as a high-level description of a language that has been adopted as part of the MPEG-4 standard [Vercoe, Gardner, & Schierer 98]. Soundball, Inc. of New York City has developed a compiler that implements SAOL as a plug-in to a web browser. The compiler takes SAOL instruments and compiles them into native instructions on the host processor of the client machine. Another implementation is sfront, a translator from SAOL to the C programming language written by John Lazzaro and John Wawrzynek. While sfront is more complete, generally available, and supported by an online tutorial book, it cannot run in real time as it must undergo the translation from SAOL to C. Once the resulting C program is compiled, that can produce real-time sound.

3 Navigating the choices

Given the embarrassment of choices, composers may be forgiven for hesitating over which way to turn. The author's solution has been to develop a personal library of audio sampling, synthesis, and effects routines in C++. While starting anew with such a project inevitably entails reinventing several wheels, it facilitates coordination with an existing control layer [Rowe 01] and seems the most expressive way to develop new ideas: a set of personal effects.

Moreover, some years of experience with this approach has led to an appreciation of MIDI despite its flaws. In particular, the signals coming from a MIDI instrument are often far faster and more accurate than that which can be produced by a real-time analysis of the corresponding audio signal. Pitch-tracking of a piano is unlikely to be better than the MIDI signal emanating from a disklavier anytime soon. The combination of open source references into a personal library (itself open source) has proved a flexible and enduring way to incorporate the lessons from such hard-won experience.

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papers

Jonathon Harvey, *Mortuos Plango, Vivos Voco*: An Analytical Method for Timbre Analysis and Notation

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Abstract: When examining an electronic tape work, pitch is often an irrelavent analyiticalsdflj measure. In some instances with pitched material, the harmonic context can hardly be considered the primary thematic content of the work. In many tape works it is timbre and gesture that characterize the piece. In this paper synopsis I will present a method for analysis and notation of the timbral content of a piece. I will draw initially from the work of Chou Wen-Chung, using Jonathon Harvey's *Mortuos Plango, Vivos Voco* **as an exemplar of this method.**

1 A Method of Timbre Notation

The approach I will use to look at Jonathon Harvey's *Mortous Plango, Vivos Voco* is a derivation from Chou Wen-Chung's paper on Varese's *Ionization,* in which the various percussion instruments are grouped into seven timbre families: 1) Metal, 2) Membrane, 3) Snare, 4) Wood, 5) Rattle/Scratcher, 6)Air Friction, and 7) Keyboard (Van Solkema, 27). Looking at a piece's timbral framework can lead to insight into the work when pitch material is not the primary concern. Jonathan Harvey's *Mortuos Plango, Vivos Voco* does contain pitch elements, but the focus of the listener is primarily on the evolution of timbres throughout the piece.

1.2 Parameters

To analyze *Mortuos Plango, Vivos Voco* using timbral structures, we must begin by defining the parameters that will be associated with a system of numerical notation. *Mortuos Plango* is a unique example of this method in that a vast majority of the piece resides in the upper register, with particularly bright sounds. Therefore, many of the timbres employed share similar qualities. For my analysis, I have placed them in seven primary categories with additional timbres included in subcategories.

1. Deep Bell
2. Chime (high bell)

3a. Child voice (low)
3b. Child voice (high)
3c. Child voice (choppy)
4a. Synthesized bell
4b. Synthesized bell, Sporadic—quick attacks, non-sustaining
5a. Synthesized "wind": pitch shifting
5b. Synthesized "wind": higher pitched, more sine-wave quality

6. FM Synthesizer
7. Pedal tone: similar to 4, but sharper, with stationary pitch.

It is important to note that not all categories are determined solely by timbre. For example, 5a and 5b are both similar synthetic sounds, however, 5b is notably higher in pitch, which gives it distinction from 5a. In this instance, the difference could be related to the similarities and differences between a violin and a cello. Both retain many of the same physical properties, and research suggests that even orchestral performers of these instruments have had difficulty distinguishing them in experiments.[1] However, the Berg *Violin Concerto* performed on a cello would be a notable difference from its intended instrumentation. Similarly, 3a and 3b are both children singing, but, due to register, qualify as unique timbres. This is not to say, however, that they bear no resemblance to each other whatsoever; they remain grouped by the same family.

Situations such as 3c pose a new problem. The same voice as 3a and 3b is presented as fast, rhythmically complex, and for short bursts of time. Because the primary sonic material represented in 3a and 3b is not present, these sounds are distinctive, but related, to their 3a and 3b predecessors.

One could assume, based on the programmatic content of *Mortuos Plango*, that it deals with dualistic combinations of timbres (the polar life-death combinations implied in the title). On analysis, this appears to be the case. We can see in the categories that sonority [7] is a pedal tone that is derived from [4]. This derivation is distinct from [4] due to its insistence in pitch, register, and unique placement in the piece. Other timbres throughout the piece become transitory: particularly [2] and [4]. They often "convolve" into each other, as well as conglomeratly "convolve" into other timbres (notably 5a). It is imperative that we incorporate these sounds into our analysis to fully understand the nature of the timbral unions. The combined timbres can be broken into three groups: Paired Sonorities, Sonority Evolution, and Sonority Convolution.

2.1 Paired Sonorities

To define *paired sonority*, we will begin by tracing the [1] and [2] timbre groups. The piece opens with both [1] and [2] as its primary material. At 0:25, [2] disappears, while [1] continues. The next entrance of [2] is by itself (at 1:41), and the next entrance of [1] is accompanied by [5]. These two entrances are not formally significant because each of them is very brief as compared to their opening gesture. Additionally, both groups at this point quickly become another group due to *convolution* or *evolution* (see below).[2] The next entrance of either timbre occurs at 2:37, when they both enter together. This sonority recalls the opening gesture, although it is shorter in duration. Again, at 3:05 both [1] and [2] enter together (offset slightly).

2.2 Evolved Sonorities

The second principal type of combined timbre incorporated into *Mortuos Plango* is *sonority evolution*. In these cases, one group is transformed into another, already existing, timbre group. Significant use is made of groups [2] and [4] in this particular piece. For example, when [2] evolves into [4], it is notated [2®4], while in transit but upon reaching its destination group it simply becomes [4].

Harvey makes use of family similarities when incorporating sonority evolution. One finds several occurrences of family evolution, such as the passage at 3:38: [3a®3b®3a®3b®3a].

2.3 Convolved Sonorities

Convolution, in this sense, is not referring specifically to the process of audio cross-synthesis although it was certainly a factor in the production of the sounds. For the purposes of this paper convolution refers to the *concept* of cross-synthesis: the sounds need not have been manufactured using such a process in order to fit this definition.[3] Convolution is an essential step in an analysis of this type in order to relate timbers to one another, as well as trace the paths of sonorities. This is distinctive from sonority evolution in that the result is a *new* timbre, related somewhat to characteristics of both initial timbres.

Our first occurrence of convolution (notated as *), occurs at 2:03. Sonorities [4a] and [3b] are convolved into a new sonority. For timbre classifications, these sonorities become complex structures that occasionally warrant their own category. However in this instance, the [4a*3b] sonority retains the primary timbre of [4a]. The result is [4a] with rhythmic and, to a lesser extent, pitch attributes of [3b].

3. Conclusion

It is not this author's intention that these concepts were a primary factor in realizing this piece. Rather, timbral analysis gives an insight into the unconscious tendencies of the composer, particularly how they orchestrate in this medium. By using families of timbers, one can listen to tape music for orchestrational detail and exactitude.

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Footnotes

[1] Research by Srinivasan, A., et al. Published in the *Proceedings of the 7th International Conference on Music Perception and Cognition detailed timbre recognition studies in which subjects confused instruments in similar families (violin, cello; clarinet, bass clarinet, etc.), but rarely had problems identifying timbres of instrumental families individually.*

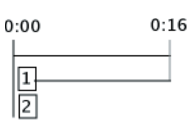
[2] At 1:45, [2®4]; at 2:19, [1] and [5a] become [1*5a].

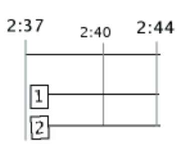
[3] Convolution in terms of cross-synthesis is most likely the means by which some, if not all of these materials were generated. Convolution, strictly speaking, is defined as:

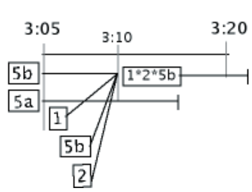
$output[n] = a[n] * unit[n] = a[n]$

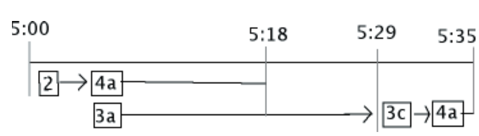
For example, at time n = 0, *unit*[n] = 1, but for all other values of n, *unit*[n] = 0. (Roads, 420)

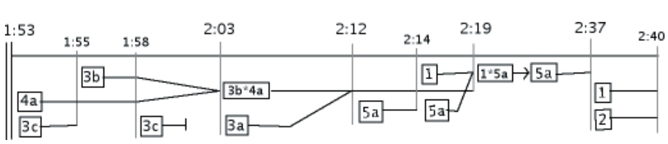
Examples











papers

The Voice as a Source of Gestural Control

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Abstract: My current research focuses on definitions of musical gesture to inform the development of hardware and software techniques for the measurement of performance phenomena and the composition of musical works demonstrating applications of these measurements. This paper introduces *With a Wave of My Voice*, a project applying an instrumental gesture typology to the creation of an instrument for the continuous control of digital media with the voice. I also encourage research in gestural control to include the investigation of latent performance phenomena.

1 Introduction

This paper introduces one approach to the application of the term "musical gesture" in the creation of interfaces and instruments for musical expression with the sung human voice. The project *With a Wave of My Voice* adapts an instrumental gesture typology proposed by Cadoz and Wanderly to a description of the voice as an instrument; I developed a real-time hardware and software interface intended to give vocalists a sense of gestural control over parameters mapped to the continuous modification of digital media. This project is part of an effort to define "vocal gesture" and to implement responsive media instruments driven by the human voice as part of on-going research by the Topological Media Lab (TML) in Gestural Sound. The TML provides a locus for studying gesture and materials from phenomenological, social and computational perspectives in the form of responsive media and expressive instruments.

2 Motivations

The project comes from a desire to develop a musical interface that makes explicit latent performance phenomena. The sung voice was selected for its vast expressive potential and for its seemingly paradoxical ability to induce an intense corporeal response without making physical contact with external objects. It is hoped that this project encourages the development of new musical interfaces which explore increasingly subtle aspects of performance and serves to accelerate technical development beyond the already well documented strategies for measuring discrete and pronounced performance phenomena.

Building on research defining "musical gesture," *With a Wave of My Voice* applies a typology of "instrumental gestures" to vocal production [Cadoz, Wanderly 2000]. The instrument measures changes in the size of the abdomen as proxy for the use of breath as an excitation and parametric modification gesture. It also monitors changes in vocal spectra as proxy for changes in the mouth cavity as a parametric modification gesture.

3.1 Technical Implementation

The technical implementation privileges simple and computationally inexpensive measurement and data processing techniques to ensure speed and reliability for real-time performance. Data from the breath hardware, vocal cavity analysis, and other processing are handled by a Max/MSP application which is compatible with Macintosh OSX and Windows XP operating systems. The project sought to develop techniques for detecting continuous parameters as part of a larger strategy promoted by the TML to "avoid making a macro-diagnosis of any 'gesture' and use simple data reduction" (X. W. Sha, e-mail correspondence, October 5, 2004).

3.2 Breath Measurement

The breath measurement hardware is built around a stretch sensor from Merlin Systems Corporation that represents displacements of up to five centimeters as a linear voltage change when strapped around the abdomen of the vocalist (figure 1). Data analysis in Max/MSP assists in distinguishing between parametric and excitation gestures.

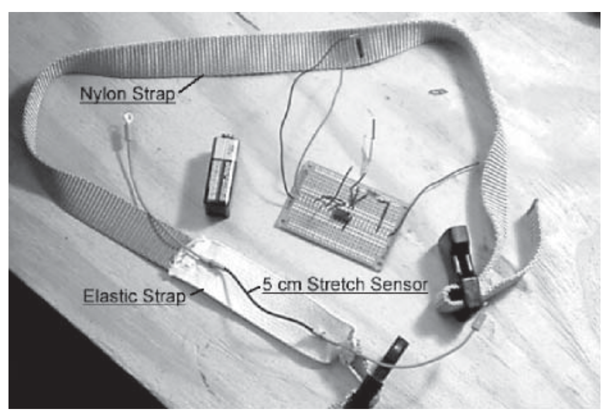

figure 1: 5 cm stretch sensor on elastic and nylon straps

3.3 Vocal Cavity Measurement

Changes in the vocal cavity are deduced by monitoring amplitude changes of a small, fixed frequency range of the singer’s voice (figure 2). This measurement is largely insensitive to pitch but may be confounded by changes in gross vocal amplitude and is compensated for by comparing changes in the target frequency range to changes in the total amplitude. Special care was taken to develop a technique which provided an alternative to formant analysis on the grounds that a greater sensation of control will be attributed to an instrument which responds continuously as the mouth is opened or closed, as opposed to an instrument which associates a set of phonemes with a set of discrete parameter values.

4 Future Research

With a Wave of My Voice has had one public performance to date with the composition *Calling Crick(alerbel)ets* by the author in November 2004 at the Georgia Institute of Technology. The composition of new works and close collaboration with the performing vocalists in rehearsal are required to better understand a performer’s sensation of control over media parameters when using the instrument. These and other collaborations with performers will be necessary to recommend the most fruitful improvements to the existing hardware and software.

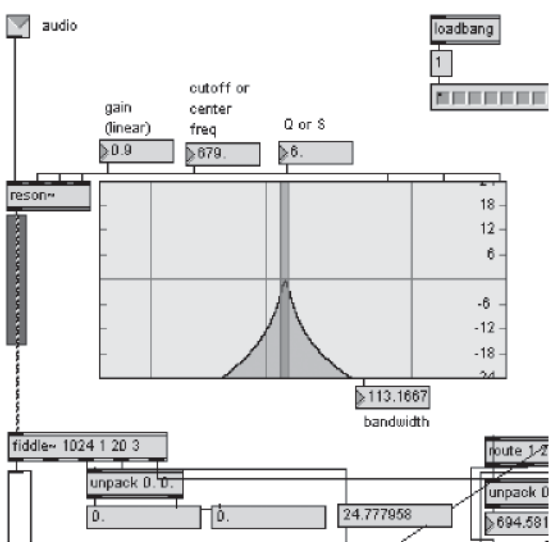

figure 2: Measurement of vocal cavity change using a notched band pass filter

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HumanInput: A Musical Interface to 3D Environments

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Dr. Bruce Naylor, University of Texas at Austin (naylor@cs.utexas.edu)

Abstract: Virtual environments have recently become very popular, being used in applications as diverse as data exploration, scientific simulations, and games. HumanInput is a Pure Data system that allows musicians to interact with a virtual environment by interpreting commands encoded in the performance data. The musician controls movement and interaction in a precise and intuitive manner and is not restricted to any particular style, keys, or motifs. By using HumanInput as an interface, artists will be able to create immersive virtual environments that can interact with and be explored by performing musicians.

1 A New Art Form?

The development of virtual three dimensional environments is one of the great achievements of computer science in the late 20th century. The impact of this technology is widespread, affecting fields from medical science to entertainment. HumanInput is a program developed as part of a digital arts project at the University of Texas at Austin to enable musicians to interact with a virtual environment through the musical performance. In this paper we show the architecture and methodology of the program, and new possibilities of expression it allows. We hope that HumanInput will lead to new avenues of exploration for artists, including virtual sound installations, new types of performance art, and new types of computer gaming environments.

2.1 Background

HumanInput was driven by a desire to create a system by which musicians could interact with a three dimensional virtual environment in a musically meaningful manner. The software is a collection of patches in Miller Puckette's environment Pure Data [Puckette 96]. HumanInput provides a means to navigate through a virtual environment, with limited facilities for interaction. We envision the software being used in performance art situations in which a performer explores an artistic environment while an audience views the musical and virtual explorations. Navigational control, one of the more challenging elements of virtual environments, is thus of paramount importance [Pinho et al. 92]. The current environment backend is a modified version of Unreal Tournament 2004, which was chosen for its flexibility and ease of customization; however, any graphics engine, which allows custom controllers, could be used. Communication between the different components is coordinated by a Java server program called Metronome, developed in conjunction with HumanInput. Metronome synchronizes data between multiple subsystems, primarily between the graphics engine and a custom audio renderer; its impact on HumanInput is negligible. The software reads performance data in real-time, then calculates control signals which are sent to the virtual world via UDP. This project is still in development, and much work remains to be done.

2.2 Control System

The control system is designed to be simple, intuitive, and work with a variety of musical styles. A control pedal is also required to adjust a scaling factor. The system implements the ability to turn left and right, move forwards, and interact with items. Stepping left or right (strafing) and jumping are also possible. The control pedal makes the system much more flexible by allowing the performer greater freedom to improvise.

Several different performance elements can be used to generate different navigational commands. Tempo, volume, melodic contour, tessitura, and difference between successive pitches are some of the most apparent, and most natural. We use tempo to control forward motion; we hope to incorporate volume as well. Leaps between pitches and contour control turns. Tessitura is not currently used, but may be able to control vertical motion if it is implemented in the environment engine.

Tempo, or the time between note events, creates forward velocity relative to a maximum duration that is set in the patcher. Note deltas greater than the maximum duration are ignored, causing no motion. The time between note onsets creates forward velocity with the mapping function:

(1-sqrt(*delta/maxdur*)

This value is then scaled to a range appropriate for the environemental backend.

The foot pedal is a central element of the control scheme. It controls a scaling factor 0-1, which is applied to forward velocity. The use of the pedal allows the performer to finely control navigation and to play without moving by entirely releasing the pedal.

Left and right turns are controlled by a combination of size and direction of melodic motion. Successive pitches which are further apart than a minimum value in semitones create successively larger turns. Values greater than a maximum difference turn the performer 180 degrees. Upward pitch motion turns to the right, and downward turns left. Successive pitches must occur within the maximum note difference set within the velocity controls, or they are ignored. Although turning data is not scaled by the foot pedal, if the pedal is completely released no turns are executed.

The remaining controls are much simpler in both use and implementation. Strafing can be performed by pitch bends, similar to turning. Jumps may be performed by any one of several different actions: repeating a note, playing a set motive or pitch, or playing notes faster than a set threshold. Interacting with objects, such as opening a door, is often done by playing a predetermined motive. Reliance upon motives was avoided as a design principle, but their use for this purpose is often artistically interesting.

The combination of control elements derived from pitch data, with the foot pedal, allows a great deal of freedom to the improviser. When used with the MIDI guitar, control can be relatively fluid once the performer is accustomed to the system. As pitches from each string are sent on different channels, there are many possibilities for style of music. If the system only reads information from one string, such as either the low or high E string, chords may be played without interfering with navigational control. Another possible setup is to derive turn controls from only the lowest string, interaction commands from the highest, and velocity data from all the strings. Monophonic instruments are also well-suited, as range splits created in PD can emulate many of the multi-channel capabilities of the guitar. Keyboards are problematic, unless the performer adheres primarily to monody.

3 A Process of Refinement

HumanInput shows great promise as an interface for artistic creations. The controls are not precise enough for extremely quick responses and fine movement necessary to, for example, play Unreal Tournament (or perhaps we are not proficient improvisers), but are capable of exploring areas and creating meaningful interaction with the environment. There are many improvements we wish to make to the system; these include refinement of mapping equations, streamlining communication with other programs, and adjustments to the control scheme. We believe that the means of interaction provided by HumanInput will generate new works that fuse improvised musical performances with creative virtual environments. We expect these new avenues of artistic exploration to have lasting effects in the world of digital art.

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Sites for media choreography: Where media perform bodies and bodies perform media

Harry Smoak, Topological Media Lab, Sponge (harrycs@harrysmoak.com)

Abstract: Recent work at the Topological Media Lab ("TML") centers on public installations/events designed as phenomenological experiments for exploring the affordances of dynamically shaped computational media in performance contexts. This paper describes Membrane, a site-specific responsive media installation and collaboration with Sponge at DEAF04 in Rotterdam, NL. In this installation, place becomes an immanent collaborator; in the performance of place the transformative possibilities between choreographed media, players, and designers become manifest.

1 Membrane– Van Nelle

Membrane– Van Nelle Ontwerpfabriek (2004) is a site-specific responsive installation created by the international art research group Sponge for the 2004 Dutch Electronic Arts Festival and V2_ Institute in Rotterdam, NL. It is one of a series of experimental performance/ installation projects proposing novel forms of communication through gestural interaction. Players and designers marshal synthesized audio and visual media in real-time using technologies of performance developed at the TML.

Each Membrane is a large suspended screen made from translucent polymer film placed in various locations in the Van Nelle exhibit hall. As you walk along either side of the screen, your body leaves trace in responsive video and sound textures projected onto the screen and into the space (figure 1). The dynamic effects change depending on the activity of passersby, responding to solo and group actions, as well as the surrounding environment. People on both sides of the screen are invited to engage with one another and the exhibit hall through a performative mask.

2 Media Choreography

In performance, the scripted timeline is the normative ordering technique for audio-visual media. (This is the case, too, for many new media formats where fixed timelines and triggers are the dominant means for structuring and developing so-called user experiences.) An author may rigidly define relationships and sequences, or they may be improvisational, even generative. The gestalt produced though the coordination of media and actors or dancers may be unfelt by the performers themselves—who may have rehearsed without it—and only accessible to the audience in spectacle.

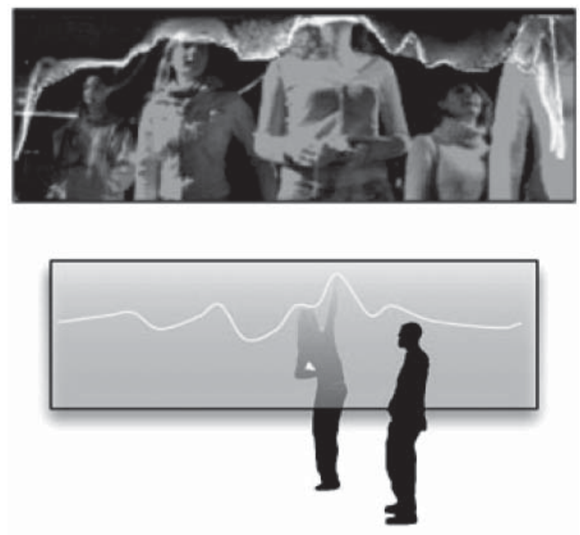

Figure 1: Membrane Van Nelle, Strings

Our approach at the TML aims at supporting the embodied intuitions of players as the engage with media in our responsive installations (figure 2), allowing for contingent activity and gestural improvisation [Sha 2002]. The Membrane projects draw namely on two research veins at the TML– calligraphic video and media choreography [Sha 2003]. Calligraphic video is video synthesized by parameterized physical models and shaped through gesture. Media choreography uses continuous dynamics derived from statistical physics in order to model player activity based on information gathered from sensor channels (in this case, video data from either side of the Membrane). A sample diagram of an early topology drawn from the site illustrates the metaphorical ontology and response logics conceived by the designers for Membrane (figure 3).

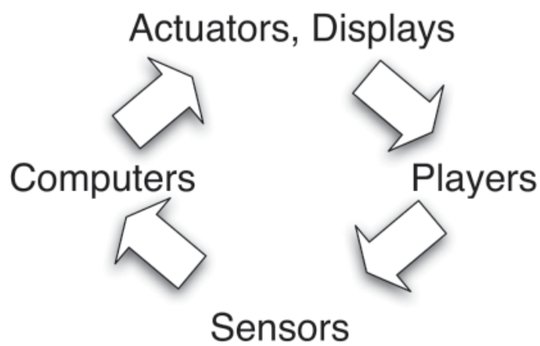

Figure 2: The interaction between players and the installation, where (N) elements may be distributed in the environment

3 Site-specificity and performance

Membrane is a site and techne for performance though mediated *in situ* human-human interaction, where players are co-present in real-time, performing a place. The production team conceived and created Membrane with the electronic arts festival and Van Nelle site expressly in mind. In this sense, Membrane is a site-specific work, sensitive to the contexts and contingencies of latent socialites and spacing it reflects on. Details of the production, from the mode of production– much of the collaborative work was conducted onsite in the months preceding the festival– to the incorporation of historical footage of Van Nelle workers into the video textures the relationship, seem to make this relationship to place explicit.

The site-specificity of the installation emergences in its move into the theatrical and the performative—in how it *is*—rather than a particular work practice or representational nod to history. Referring to minimalist art of the 1960s, Nick Kaye demonstrates "site-specificity can be said to begin in sculpture yet reveal itself in performance, a move which calls into question its formal as well as spatial location [Kaye 2000]."

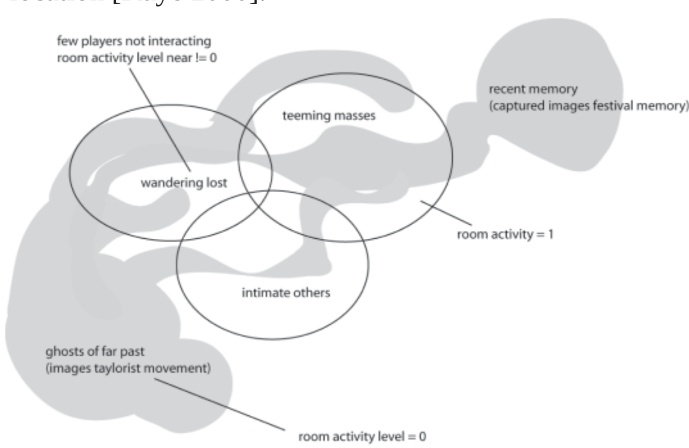

Figure 3: Metaphorical State Diagram

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boomBox: A Low-frequency, High-amplitude Human Motion Controller for Live and Sampled Sound

Jamie Allen, Interactive Telecommunications Program, New York University (jamie@nyu.edu)

Abstract: This paper describes the development, function and performance contexts of a digital musical instrument called "boomBox." The instrument is a wireless, orientation-aware low-frequency, high-amplitude human motion controller for live and sampled sound. The instrument has been used in performance and sound installation contexts. I describe what I have learned from the project herein.

1 Introduction

There have been great advances in both the specificity and sensitivity with which real-time computer music processes can be controlled. Much work has been done to produce real-time software tools which sculpt and mold synthesized, prerecorded and live-captured sound materials down to minute changes in character. A result of this specificity is that hardware interfaces for computer music have necessarily become increasingly sensitive, responsive and consequently somewhat delicate in construction.

This relatively delicate or precarious design of computer music interfaces is frustrating to some performing computer musicians. At times, both in improvisation and composed performance it is desirable to pummel, mash and heave digital audio material in a hands-on way. The boomBox was built to address this desire.

2 Artistic Motivation

2.1 Holistic Design Concept

Many new interfaces for musical expression are designed primarily through the specification of a physical form or gestural property, which is then used to some musical end. Often the physical and/or gestural form of the instrument are intentionally unrelated, or unconcerned with metaphoric or contextual links. Some gesture tracking, reactive environment and other work would appear to employ this approach [1, 2, 3].

As of the present iteration of the device, the boomBox is centered around transient sonorities, often described as 'clanging', 'jostling' and 'jerking' of sampled computer sound buffers. The boxy, bulky form and interaction potential of the device categorically suggest such a musical motivation. Here, the re-mix is most literally interpreted, as sample-based material is jumbled together in exciting ways. The completed instrument, which appears to the casual viewer as a typical equipment flight case, is shown being performed in Figure 1.

Figure 1. Performance of the boomBox.

2.2 Bluetooth® Wireless Link

With due deference to the design principles outlined in 1996 by Perry Cook [4], in the design of the boomBox, wireless was not that bad (compared to wired). Along with a few other recent musical interface designs [5], the boomBox employs the efficient and simple solution of Bluetooth® wireless serial data transfer. Data interfacing is done through PIC microcontroller to a Bluetooth®-to-RS232 is interface. Data is received on a computer running Mac OS X, which creates an emulated serial port accessed in Max/MSP via the serial object.

2.3 Sensor Technologies

The boomBox's main sensors are piezoelectric polymer strips, conditioned with tuned amplification circuitry, and mounted along the interior walls of the superstructure. These signals are provided as input to audio amplification systems from the boomBox. The system is also equipped with three tilt sensors for orientation data and two dual axis accelerometers for motion detection and rotation information. Flex sensors are mounted in the handles of the box, for more subtle, continuous control of musical processes. Finally, a rotation sensor is mounted in the wheel base of the rolling case. Each sensor technology was selected in order to give the overall instrument both coarse and fine control of sonic processes. In particular, the piezoelectric sensor amplification was tuned in a way to allow localized differentiation between areas on surface of the boomBox, and to maximize dynamic range. General functional locations of sensors are diagrammed in Figure 2.

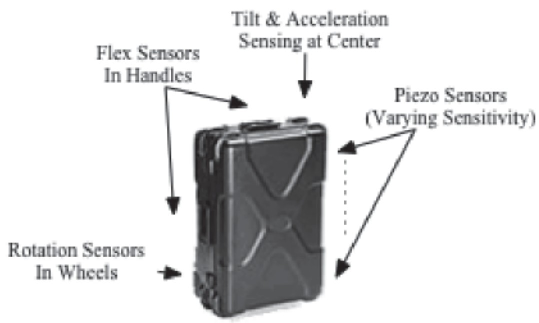

Figure 2. Sensor regions of the boomBox.

3 Performance Contexts

3.1 Improvised Solo Performance

I generally structured boomBox performances very little, and often change the sound material and sensor mappings. As such, the instrument is, at time of performance, always quite new to me, and a narrative has developed on stage based on exploration of this newly discovered device.

3.2 Public Sound Installation

I exhibited the boomBox at the Interactive Telecommunications Program Winter Show 2005. In the installation, a four-channel recording of Grand Central Station in New York was looped in the background, “Please do not leave luggage unattended. Any luggage left unattended will be subject to search and may be destroyed. Thank you for riding the MTA, New York City transit…” In this way, political implications related to fear of terrorism suggested by the boomBox were invoked explicitly. Visitors were left to engage the instrument as they wished, in as forcefully a manner as they chose.

Exhibition of the boomBox as an interactive sound installation was an opportunity to witness the many similarities between improvisational performance public interactivity with sound. The engagement that the boomBox provided children and adults alike was akin to the visceral pleasure I experience in improvising with the instrument.

3.2 Public Sound Installation

A further context for performance I explored with the boomBox was with Pursue the Pulse, a multimedia and dance group. The performance narrative was loosely based on the sound installation presentation of the boomBox. Dance improvisation was done with the instrument, the premise of the performance being that the dancers inadvertently found a piece of left luggage on a subway car.

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Artist Biographies

Jamie Allen

Interactive Telecommunications Program, NYU

I make sound and sound makers with my head and hands.

I have received Honours degrees of highest standing in Music Composition and in Engineering from both Queen's University in Kingston Ontario and the University of Glasgow in Scotland. Computer and traditional instrument composition studies were done with Graham Hair and Nick Fells. I was co-organiser of the experimental music programme broadcast of Sub City radio Glasgow from 2002-2004. I play live improvised electronics, primarily with instruments I build myself. Notable recordings of this kind of activity were done with the trio Age of Wire and String (myself, guitarist Neil Davidson and cellist Peter Nicholson) in the UK. I compose and produce music of my own, as well as for films and theatre. I prepare public art and interactive sound pieces, design digital musical instruments and installation sound art. I've had the opportunity to install works and perform at unique venues throughout New York City over the past year (including an Episcopalian Church with the "Sacred Spaces" installation, the Chelsea Art Museum with "Don't Know" and at the Frying Pan and John Zorn's 'Tonic' with the "boomBox" instrument).

Lately, I'm pursuing a Masters in Interactive Telecommunications at New York University's Tisch School of the Arts. I participate in a lot of interactive technology education initiatives, and visit inner-city high schools and institutions to present my work and methodologies. I'm very interested in the new facility digital instrument design gives improvisers to distance themselves from traditional paradigms of group improvisation.

Mark Applebaum

Mark Applebaum is Assistant Professor of Composition and Theory at Stanford University where he received the 1993 Walter J. Gores Award for excellence in teaching. He received his Ph.D. in composition from the University of California at San Diego where he studied principally with Brian Ferneyhough. His solo, chamber, choral, orchestral, and electroacoustic music has been performed throughout the United States, Europe, and Asia with notable premieres at the Darmstadt summer sessions.

He has received commissions from Betty Freeman, the Merce Cunningham Dance Company, the Paul Dresher Ensemble, the Vienna Modern Festival, the St. Lawrence String Quartet, Belgium's Champ D'Action, Festival ADEvantgarde in Munich, Zeitgeist, MANUFACTURE (Tokyo), and the American Composers Forum, among others. In 1997 Applebaum received the American Music Center's Stephen Albert Award.

Applebaum builds electroacoustic sound-sculptures out of junk, hardware, and found objects. He is also active as a jazz pianist, concertizing from Burkina Faso to Sumatra. At present, he performs with his father, Bob Applebaum of Chicago, in the Applebaum Jazz Piano Duo. His music can be heard on recordings on the Innova, Tzadik, Capstone, and SEAMUS labels. Prior to his current appointment, he taught at UCSD, Mississippi State University, and Carleton College. See also: www.markapplebaum.com.

Christopher Baker

Over the past four years Christopher Baker has been experimenting with new media technologies. With undergraduate and graduate degrees in Biomedical Engineering, Christopher seeks to bridge the gap between his technological expertise and his passion for the arts. Christopher is currently involved several cross-disciplinary artistic collaborations in the Twin Cities and serves as a research assistant to professors in the departments of Art and Music University of Minnesota. Christopher aspires to explore new technologies as an avenue for storytelling.

Ballet Méchanique

Ballet Méchanique was formed in 2003 as a duet project between **J. Anthony Allen** and **Noah Keesecker**. As a duet, they have performed in Baltimore, Minneapolis, Miami, and New York City. In late 2004 Allen and Keesecker found **Liz Draper** playing with the groove oriented improv group "Rickshaw," and through an association with drummer **Jesse Peterson**, transformed the group to a quartet. Ballet Méchanique is an electro-acoustic ensemble that utilizes found video as a significant source of sonic material. Controlled by data gloves, the video serves as an instrument for improvisation within the ensemble.

Michael Berkowski

Michael Berkowski is a native of Detroit, MI, and currently resides and works in Minneapolis. Although primarily a composer of electroacoustic music for fixed media, he also has enjoyed success with the development and performance of new and unique electronic and computer instruments of his own design, as well as creating works in collaboration with artists in other digital media. Most of Mr. Berkowski's compositions utilize the composer's custom software applications for sound organization or synthesis. Mr. Berkowski's computer music compositions and collaborative and intermedia works have been performed or shown on concerts and festivals in the United States and internationally, and also displayed in juried online galleries. He holds a Bachelor of Music degree from the University of Dayton and a Master of Arts degree in composition from the University of Minnesota, where he was a student of Douglas Geers and Alex Lubet.

Visit Michael Berkowski at http://www.berkowski.net.

Heather Barringer

Percussionist/artistic co-director Heather Barringer joined Zeitgeist in 1990. She graduated from the University of Wisconsin-River Falls with a B.Mus.Ed. in 1987 and studied at the University of Cincinnati-College Conservatory, studying with Allen Otte from 1988-90. In addition to performing and recording with Zeitgeist, she is a member of Mary Ellen Child's ensemble, Crash, and has worked with many Twin Cities organizations, including Nautilus Music Theater Ensemble, The Dale Warland Singers, Theatre de la Jeune Lune, and Ten Thousand Things Theater.

Burton Beerman

Composer,clarinetist and video artist Burton Beerman is the director of the MidAmerican Center for Contemporary Music and founder of the New Music & Art Festival at Bowling Green State University. The Village Voice has written, "There is a remarkable clarity in the way Burton Beerman carries out the logic of his materials and he has an excellent ear for sound color…The composer displays an acute sensitivity to the differences between live sound and electronic sound and the music contains extraordinary moments when the sound seems to belong to both worlds." His work has been featured on CNN, CNN International, Live with Regis & Kelly! and its Eastern European equivalent talk show RTL-KLUB Reggeli. He has performed at the week-long Pepsi Sziget Festival at Margit Island in Budapest, Hungary, which annually attracts over 500,000 people, has served in residence at such venues at STEIM Research Center in Amsterdam, Future Music Oregon, LOGOS Tetrahedron Theater in Belgium and neoPHONIA and has toured throughout Europe with the Hungarian-based dance ensemble Gyula Berger and Friends Dance Theater as music director and clarinetist. His video-opera Jesus' Daughter was presented at the Walter Reade Gallery in Lincoln Center, at the Museum of Modern Art in New York City and at venues in Switzerland and Italy sponsored by UNESCO-CIRET. Performances of his works have taken place in such venues as Paris (American Cultural Centre and the Theatre Universitaire), Italy, Town Hall in Brussels, Japan, the Chopin Hall in Mexico City, Netherlands and New York's Carnegie, CAMI, Flea Theater and Dia Concert spaces.

Marcus Alessi Bittencourt

Marcus Bittencourt is a Brazilian composer and pianist based in the USA. A disciple of composers such as Willy Corrêa de Oliveira and Tristan Murail, his music is marked by an extremely varied pallete of musical sound materials and techniques, which reflect his intense investigation in the domains of form, polyrhythm and simultaneities, timbre, sound spatial perspective, microtonality, and orchestration of sound objects. Prolific both as an instrumental and an electroacoustic composer, his list of compositions includes works for orchestra, chamber ensembles, choir, solo instruments (specially the piano), operas, as well as several electroacoustic works.

Among the awards he has received are the first prize at the Projeto Nascente V (1996), a seven-year scholarship at Columbia University, and a residency at the Centro Studi Ligure of the Bogliasco Foundation in Genoa, Italy. His academic credentials include a Baccalaureate in Piano Performance from the Universidade de São Paulo, Brazil, and Master's and Doctoral degrees in Music Composition from Columbia University. He has taught Music at Columbia University and at Lehman College of CUNY, and he currently teaches at the College of William and Mary in Virginia (USA).

Dr. McGregor Boyle

Dr. McGregor Boyle is active as a composer, performer, and music educator with a primary interest in digital media and computer applications to music composition and performance. With a Master's degree in guitar performance and a Doctorate in composition, Dr. Boyle is uniquely qualified to explore the applications of emerging digital technologies to the difficult problems posed by serious music composition, and its presentation to the audience in performance.

The recipient of many prizes and awards for his composition, Boyle is especially interested in collaborations with artists from other disciplines, from work with choreographers and visual artists to his more recent scores for outdoor laser and fireworks spectacles. He was the composer of the music for the pioneering multimedia performance piece *Red Zone* , which combined digital sound with computer-controlled visual images, modern dance, and spoken word to create a seamless integrated whole which was highly acclaimed by audiences and critics in 1987.

Dr. Boyle is on the Computer Music Faculty at the Peabody Conservatory of the Johns Hopkins University, where he teaches computer applications to music and chairs the Composition Department.

Heather Brown

Heather Brown is currently pursuing her doctorate in percussion performance at the University of Cincinnati College-Conservatory of Music. Her studies emphasize the performance of contemporary chamber music and new percussion works. She is currently timpanist and percussionist with the CCM Philharmonia Orchestra. Ms. Brown also performs with the CCM Percussion Ensemble and Steel Band, and the So'Kalid Percussion Quartet, which she founded in 2001. Ms. Brown is a regular performer at the Music X and The Grandin Festivals in Cincinnati, Ohio. In the summer of 2003 she was the timpanist for the Opera Theatre Music Festival Lucca, in Lucca, Italy. She also performs with many local and regional symphonies including the Kentucky Symphony. Ms. Brown graduated with her MM from the University of Cincinnati College-Conservatory of Music in 2003 and her BM in 2001 from Appalachian State University. She is currently studying with Allen Otte, and has studied with Robert Falvo, Christopher Deane, and Massie Johnson.

Zack Browning

Zack Browning is an Associate Professor of Music Composition and Theory at the University of Illinois. He received his Bachelors Degree from Florida State University and his Masters and Doctorate from the University of Illinois. Recent awards include a 2001 Illinois Arts Council Composer Fellowship and a 2002 Chamber Music America Commission for "Back Speed Double Circuit" for the Bang On A Cans All-Stars. Recent performances include the Bonk Festival of New Music in Tampa, the International Society for Contemporary Music (ISCM) Festival in Miami, the Electronic Music Midwest Festival in Chicago and the Three Two Festival in New York City. "Network Slammer" was performed at the 2004 Gaudeamus Music Week in Amsterdam and Browning's recent CD "Banjaxed" on Capstone Records contains eight of his original compositions for voice, instruments and computer-generated sounds. He is presently working on a CD of his music and the music of Sever Tipei for Centaur Records.

Ivica Ico Bukvic

Composer Ivica Ico Bukvic, native of Croatia, has recently finished his residency as a visiting lecturer at Oberlin College and is currently finishing his Doctoral degree at CCM, University of Cincinnati. His compositions encompass diverse media and have been performed at music festivals (MusicX, IEMF, LAC, OCEAn, SEAMUS, ICMC, Spark, EMM), radio stations, concerts, and endless corners of the Internet. His recent accomplishments include national student award by the Croatian National Ministry of Science, Education, and Sports, commissions (Anna Zielinska and NeXT Ens), articles and reviews for the *Array* and *Organised Sound*, software contributions (*RTMix*, *RTcmix* instruments, *Soundmesh*, *Superkaramba*, and the "Borealis" *Superkaramba* theme), papers, panels, and research and academic grants (2001, 2002, 2004). Having designed CCM's first "Linux and Multimedia" curriculum he is a devout open-source advocate. Ico maintains an active performance career playing piano, organ, hyperinstruments, and conducting. His current compositional interest is in interactive multimedia art.

Eric Chasalow

Composer Eric Chasalow (USA 1955) has become most recognized for works that combine traditional instruments with computer generated sound. He has been commissioned by many renowned performers and ensembles, including Guido Arbonelli, Tim Brady, Boston Modern Orchestra Project, Boston Musica Viva, and Bruno Schneider. He produces the biennial BEAMS Electronic Music Marathon, recently featuring over fifty pieces, including works by Babbitt, Dashow, Davidovsky, Risset, Stockhausen, Vinao, and Xenakis among many others. His music is programmed throughout the world, with recent performances in Annecy, Australia, Bari, Beijing, Berlin, Boston, Bratislava, Brno, London, Los Angeles, Milan, New York, Padova, San Francisco, Seoul, Singapore, and Warsaw.

Eric Chasalow is Professor of Music, at Brandeis University, and Director of BEAMS, the Brandeis Electro-Acoustic Music Studio (www.brandeis.edu/departments/music) . He holds the D.M.A. from Columbia University where his principal teacher was Mario Davidovsky and where he studied flute with Harvey Sollberger. Among his honors are awards from the Guggenheim Foundation, National Endowment for the Arts, Fromm Foundation at Harvard University (two commissions), New York Foundation for the Arts, and the American Academy of Arts and Letters (awards in 1986 and 2003). His music is available from G. Schirmer, McGinnis & Marx (New York) and Edition Bim (Switzerland) and on CDs from New World Records, ICMC, Intersound Net Records, SEAMUS, and RRRecords (www.emf.org).

A new CD of chamber, electronic, and orchestral music, *Left to His Own Devices*, was released by New World Records in February 2003.

Joshua Clausen

Joshua Clausen is a composer of acoustic and electronic music with a special interest in collaborative projects and interdisciplinary works.

Clausen has produced many works for solo and ensemble concert performances and several scores for theatre and film, including The Tempest, which was nationally recognized by the Kennedy Center American College Theatre Festival in 2002. At Concordia College, where he earned a B.M. in Theory and Composition, Clausen studied with Liviu Marinescu, Steven Makela and Daniel Breedon, pursued collaborations that yielded projects with Red River Dance Company, Concordia College Theatre, Fargo Moorhead Youth Symphony, and Concordia College Film Arts and received commissions from several schools and churches across Minnesota. At the University of Minnesota, Clausen has presented his compositions in masterclasses by Judith Shatin, Pauline Oliveros, and has recently won the University of Minnesota's call for works for the University's Chamber Choir. Clausen is currently pursuing a Masters degree in composition at the University of Minnesota, where he has studies with Douglas Geers and Judith Lang Zaimont.

Dr. Craig A. Coburn

Dr. Craig A. Coburn was appointed Assistant Professor of Geography at The University of Lethbridge, in Lethbridge, Alberta, Canada in 2002. His primary research interests are in remote sensing science and image processing. Current research involves characterizing image texture, multi-resolution data analysis, image sonification, spatial statistics and remote sensing system development with applications in forestry and terrain modelling.

Anthony Cornicello

Composer Anthony Cornicello (born in Brooklyn, New York, 1964) has been singled out by noted author Joan Peyser (in her book TO BOULEZ AND BEYOND) as 'one of the most gifted composers under 40 in the United States.' Cornicello has received fellowships and awards from the NJ State Council on the Arts, Meet The Composer, ASCAP, Rutgers University, and the American Music Center, as well as commissions from the Meet the Composer, the Scorchio Electric String Quartet, New York New Music Ensemble, Dogen Kinowaki, and the InterEnsemble of Padova, Italy. Recently, he was commissioned to write a work for voice, chamber ensemble, and electronics, which was premiered as part of the Guggenheim Museum's 2001 "Works and Process" series. He has also received commissions from The Auros Group for New Music to write a series of works for instruments and interactive electronics.

Cornicello's works are published by C.F. Peters Corporation and APNM. He is currently an Assistant Professor at Eastern Connecticut State University, where he is Director of the Electronic Music Lab. He also serves as Composer-In-Residence with The Auros Group for New Music (Boston, MA), and Artistic Director of the Studio for Electronic Music, Inc. (Hartford, CT).

Shiau-uen Ding

A native of Taiwan, Shiau-uen Ding is a pianist and the founder and director of NeXT Ens, an ensemble dedicated to commissioning and performing contemporary electro-acoustic music. She is currently a doctoral candidate in piano performance with cognates in theory and electronic music at the College-Conservatory of Music, University of Cincinnati. She is a piano student of Eugene Pridonoff and studies live electronic music with Mara Helmuth.

She specializes in classical music, new music and electro-acoustic music. Several new compositions have been written for her, including works by Mara Helmuth, Christopher Bailey, Margaret Schedel, and Burton Beerman.

In 2004 she performed as a soloist and with NeXT Ens at several major music festivals in the USA, and in 2005 she has been invited to perform at Challenging Performance Series Concert (Cincinnati, OH), and the Spark Festival (Minneapolis, MN).

Kaylie Duncan

Kaylie Duncan, cellist, has been playing cello since age seven. She received her Bachelor's degree from Butler University and is currently working on her Master's degree at CCM, studying under Yehuda Hanani. She has attended the Aspen music festival for three summers, studying with William Grubb and Anthony Elliot. She has won numerous awards and scholarships, including 1998 Ft. Wayne youth symphony concerto competition winner, Anne Starost Memorial Scholarship, Indianapolis women's club, and the WBNI scholarship. She is currently a member of the Queen City virtuosi, a string orchestra, and the newest member of the contemporary NeXT Ens, dedicated to new music.

Ray Dybzinski

Ray Dybzinski grew up near Chicago. In junior high school, he discovered Metallica, started playing guitar, and formed a band that would slowly morph over a decade to become indie rock band The Timeout Drawer. The band released two critically-acclaimed albums on the someoddpilot label, *Record of Small Histories* and *A Difficult Future*, before he quit the band to move to Minnesota.

Ray Dybzinski graduated *magna cum laude* from Northern Illinois University with a BS in Physics and a BA in Philosophy. Neither degree transferred well to the working world, and he is currently pursuing a graduate degree in ecology from the University of Minnesota. His ecological research and his spirographic music both use a lot of math.

John Fillwalk

John Fillwalk is a professor at Ball State University where he teaches Electronic Art including video art, intermedia, 3D animation and digital imaging. Prior to his appointment at Ball State, he has served in various capacities in the media arts, including as chair and faculty in the Film, Video and Digital Arts department at Minneapolis College and as education director and faculty at the Intermedia Arts program at the University of Minnesota. He received both his MA and MFA from the University of Iowa in Intermedia and Video Art, where he studied with Hans Breder, an internationally renowned intermedia artist. Fillwalk works in a variety of time-based and digital media including digital video, installation, digital printmaking, interactive art and animation. As an artist, he has received numerous grants, awards and fellowships. Most recently, he was selected as the artist in residence at the Center for Media Design at Ball State University, as part of the $20 million dollar Eli Lilly Media Design Initiative. His most notable exhibitions include SIGGRAPH 2003 and 2001 International Conference and Art Gallery; InteractivA '03 at MACAY: Museo de Arte Contemporáneo Ateneo de Yucatán, Merida, Mexico; 2003 and 2002 Digital Art Competition: Beecher Center for Art and Technology, Butler Institute of American Art, Digital Sur, Rosalia, Argentina; the Indianapolis Museum of Art, and ASCI Digital '02 Exhibition, New York Hall of Science, NYC.

Henrik Frisk

Since his birth in 1969 in Antibes, France, Henrik Frisk has lived and studied in Sweden, Denmark, France, USA and Canada. As a resident of Malmö, Sweden, since 1994 he is an active performer of improvised and contemporary music and composer of chamber and computer music. After having pursued a career in jazz in the nineties with performances at the Bell Atlantic Jazz Festival, NYC and Montreux Jazz Festival, Switzerland, he is now spending most of his time composing and playing contemporary music with a recent interest in sound installation and sound art. He has worked with musicians and artists such as David Liebman, Gary Thomas, Michael Formanek, Richie Beriach, Jim Black, James Tenney, Luca Francesconi, Cort Lippe and others. Currently he is pursuing his doctoral studies in computer music at Malmö Academy of Music/Lund University.

He has performed in Belarus, Canada, Chech Republic, China, Cuba, Denmark, Finland, France, Germany, India, Mexico, Norway, Poland, Sweden, Switzerland and the United States. As a composer he has received comissions from the Swedish Broadcasting Company, NOMUS, Stockholm Saxophone Quartet, Dave Liebman Big Band, Copenhagen Art Ensemble, Ensemble Den 3. vej, Statens Kunstfond, Ensemble Ars Nova and several big bands, soloists and ensembles in Scandinavia. He has made numerous recordings for Canadian, Swedish and Danish record labels and has a close collaboration with Malmö based record label dB Productions.

Henrik Frisk is also a renowned teacher and was until January 1, 2004 managing the Performers Department for Jazz and Improvised music at the Malmö Academy of Music, when he resigned to focus on his doctorate. He has also been teaching composition, theory, saxophone and ensemble classes at the Rhythmic Conservatory in Copenhagen. As a visiting lecturer he has given lectures at several schools, mainly in Scandinavia.

Lawrence Fritts

Lawrence Fritts was born in Richland, Washington. He received his PhD in Composition at the University of Chicago, where he studied with Shulamit Ran, John Eaton, and Ralph Shapey. He is Associate Professor and Area Head of Composition at the University of Iowa, where he has directed the Electronic Music Studios since 1994.

Katinka Galanos

Katinka Galanos is a BFA candidate in the Department of Art at the University of Minnesota. She will be graduating this May and intends to pursue an MFA in the Fine Arts after a years break. Her work is currently focused on sculpture, drawing, sound and video installation.

Doug Geers

Douglas Geers is a composer who works extensively with technology in composition, performance, and multimedia collaborations. Reviewers have described his music as „fascinating... virtuosic... beautifully eerie“ (Jim Lowe, Montpelier Times-Argus) and have praised its „shimmering electronic textures“ (Kyle Gann, Village Voice.) His music has been performed at events such as the annual International Computer Music Conference (ICMC), the International Society for Contemporary Music (ISCM) World Music Days, the Society for Electroacoustic Music in the United States (SEAMUS) conference, the Bourges festival of electronic music, the University of Paris, Humbolt Universität Berlin, The Seoul International Computer Music Festival, the Sonic Circuits festival, the Swiss National Television Network (SF 1), and others. Geers studied via scholarships at Xavier University, the Cincinnati College-Conservatory of Music, and Columbia University. As a Presidential fellow at Columbia, Geers studied composition, theory, and computer music with Fred Lerdahl, Tristan Murail, Brad Garton, and Jonathan Kramer. Geers is also the founder and director of the Spark Festival of Electronic Music and Art, held each February in Minneapolis; he is a co-founder and co-Director of the Electric Music Collective, an internationally-based group of electroacoustic composer-performers; and he is a member of the electroacoustic performance group Sønreel. His works have been recorded on the Innova, Capstone, and SEAMUS labels. For more information, please see www.dgeers.com.

John Gibson

John Gibson's acoustic and electroacoustic music has been presented in the US, Europe, South America and Asia. His instrumental compositions have been performed by many groups, including the London Sinfonietta, the Da Capo Chamber Players, the Seattle Symphony, the Music Today Ensemble, Speculum Musicae, Ekko!, and at the Tanglewood, Marlboro, and June in Buffalo festivals. Presentations of his electroacoustic music include concerts at the Seoul International Computer Music Festival, the Brazilian Symposium on Computer Music, the International Biennial for Electroacoustic Music of Sao Paulo, Keio University in Japan, the Florida Electroacoustic Music Festival, and several ICMC and SEAMUS conferences. Among his grants and awards are a Guggenheim Fellowship, a Charles Ives Scholarship from the American Academy and Institute of Arts and Letters, two ASCAP Foundation Grants, and the Paul Jacobs Memorial Fund Commission from the Tanglewood Music Center. He writes sound processing and synthesis software, and has taught composition and computer music at the University of Virginia and Duke University. He is now Assistant Director of the Center for Electronic and Computer Music at Indiana University.

Steve Goldstein

Steve Goldstein has performed professionally throughout the U.S., Canada and the Caribbean in musical genres and idioms of experimental, jazz, funk, and others. He has performed and recorded with a wide array of artists including Hamid Drake, Douglas Ewart, Joseph Jarman, Nirmala Rajsekar, Jan Gilbert, David Means, Gary Schulte, Marcus Wise, Jocelyn Gorham, Mixashawn and Carol Kaye. In 1997 he was awarded a Minnesota State Arts Board Fellowship to create new works in this new blended medium and to study with percussionist John Bergamo at the California Institute of Arts.

Robert Hamilton

Composer Robert Hamilton (b. 1973) is engaged in the integration of technology and musical performance. Currently studying computer music at the CCMIX studios in Alfortville, France with Gerard Pape, he holds a masters degree in Computer Music Composition from the Peabody Institute of the Johns Hopkins University, where he studied computer music with Geoffrey Wright and McGregor Boyle, as well as degrees in Music and Cognitive Science from Dartmouth College, studying with Jon Appleton, Larry Polanksy and Charles Dodge. Recent composition studies include studies with Michel Merlet and Narcis Bonet at L'Ecole Normale de Musique in Paris. Mr. Hamilton is a recipient of the Prix d'Ete award (first prize, Peabody Conservatory), the Johns Hopkins Technology Fellowship, and a Peabody Career Development Grant, and has had his work featured recently at the Salerno Italy Contemporary Music Festival, the 3rd Practice Festival, the ISMIR international conference, the Smithsonian Institute, and the Dartmouth Electric Rainbow Coalition Festival.

Hellbender Film Projekt

Hellbender Film Projekt is an audio-video duo comprised of multimedia artists Al Griffin and Adam Kendall.

Al Griffin lives in Buffalo, NY, and works in both Buffalo and New York City. He performs live visual improvisations in collaboration with other electronic musicians as well as Hellbender Film Projekt. His work relies on original and found video and Super8 film footage.

Adam Kendall is based in Brooklyn, NY, where he composes and improvises music and video in digital and analog realms. Along with Hellbender Film Projekt, he works solo and in collaboration with other artists. He performs regularly, and his extracurricular activities include co-curating the multimedia series {R}ake and the now defunct F:T:H.

As Hellbender Film Projekt and as individuals, the two have performed and had pieces presented nationally and internationally.

Performance highlights in New York City include: Flux Factory; Roulette/Location One; ABC No Rio; Share; Robert Beck Memorial Cinema/Collective Unconscious; Unity Gain; The Bunker/Phonomena/SubTonic; Halcyon; Dogs Blood Rising; {R}ake; and F:T:H. Other performances include Impulse Response (Troy, NY) and Flywheel (Easthampton, MA).

They've been presented in Mito, Osaka and Nagoya, Japan, and in the festivals: Synaesthesiologists (including The 2004 New York Video Festival and national presentations); T-Minus2 (NYC); Versionfest (Chicago); and X-Fest (NYC).

Their work has been included in compilations including "Eyewash Volume II", a DVD of various New York City-based video-artists and musicians.

More about them at http://www.hellbender.org

Rafael Hernandez

Rafael Hernandez was born in Bethesda, Maryland in 1975, though he considers himself a native of Virginia Beach, Virginia, where he grew up. He earned his Bachelor of Music degree from Virginia Commonwealth University in 1998 and his Master of Music degree from The University of Texas at Austin in 2001. Currently he is a Chancellor's Fellow at Indiana University, where he working towards a DM in music composition. Studies have included Sven-David Sandström, Don Freund, P.Q. Phan, Sydney Hodkinson, Keith Fitch, Dan Welcher, Donald Grantham, Russell Pinkston, Peter Knell, and Allan Blank.

Rafael's music and media has been featured in concerts and festivals around the nation. Notable highlights include a fellowship and residency at the Tanglewood Music Center, participation in the American Composers Orchestra Whitaker New Music Reading Sessions, and a prize-winning showing of LANGUE at the IDEAS Festival in Bloomington, Indiana.

Rafael lives in Bloomington, Indiana with his wife Rachel and his two children, Novlyne and Ulysses. For more information, visit www.thenewstyle.org

Hubert Howe

Hubert Howe was educated at Princeton University, where he studied with J. K. Randall, Godfrey Winham and Milton Babbitt, and from which he received the A.B., M.F.A. and Ph.D. degrees. He was one of the first researchers in computer music, and became Professor of Music and Director of the Electronic Music studios at Queens College of the City University of New York. He also taught at the Juilliard School for 20 years. In 1988-89 he held the Endowed Chair in Music at the University of Alabama in Tuscaloosa. From 1989 to 1998 and 2001 to 2002 he was Director of the Aaron Copland School of Music at Queens College of the City University of New York. He has been a member of the American Composers Alliance since 1974 and was elected President in 2002. He also served as President of the U.S. section of the League of Composers/International Society for Contemporary Music from 1970 until 1979, in which capacity he directed the first ISCM World Music Days ever held outside of Europe. Recordings of his computer music ("Overtone Music," CPS-8678, and "Filtered Music," CPS-8719) have been released by Capstone Records.

Brian Kane

Brian Kane is currently a graduate student in music composition at the University of California, Berkeley. In addition to being an award-winning composer, he is one of the most highly respected jazz guitarists in San Francisco. He has written chamber pieces, vocal works, solo pieces, electronic music, and more. Twice the recipient of the De Lorenzo Prize in Music Composition, for his Clarinet Quintet (2003) and *Three Sonnets of George Santayana* (2001), Kane writes contemporary music that is challenging, reflective, rhythmically charged, and sonically sophisticated. His works are never conventional. Kane often finds compositional inspiration in poetry, philosophy, contemporary art and theory. Kane is also an avid writer about musical aesthetics, and an advocate for contemporary music. His newest article, entitled *That Elusive Elementary Atom of Music*, is published in Qui Parle.

C.R. Kasprzyk

Born in Allegan, Michigan, C.R. Kasprzyk (cory kasp-shick) is a versatile musician committed to the support and development of today's classical music and the saxophone's use in multiple genres. He has worked first-hand with many composers, most recently commissioning four new works for saxophone and live audio processing by emerging composers. Kasprzyk is also the co-founder of the Studio 311 Saxophone Quartet and an active member of the Creative Access Outreach program. As a soloist, he has won several awards, ranging in performances from classical saxophone repertoire to free improvisation.

Offstage, Mr. Kasprzyk's artistic interests lie in his general surroundings being a large influence in the outcome of his new compositions. He is currently working on an orchestral piece, which derives its source material and inspiration from man's effect on nature, primarily dealing with water-based samples, cement mixers, and trains. In 2003, Kasprzyk was the only undergraduate recipient of the Midwest Graduate Music Consortium Composition Contest, which resulted in a performance in Chicago. Most recently he was selected to participate in the Music04' Festival where his work, *The Cry for Solace*, was performed.

Mr. Kasprzyk holds a Bachelor's degree in saxophone performance from Grand Valley State University (Allendale, MI) where he studied saxophone with Laurie Sears and Arthur Campbell, as well as composition with Kurt Ellenberger. He is currently completing two Master's degrees at the Peabody Conservatory of Johns Hopkins University (Baltimore, MD) under the tutelage of Gary Louie (saxophone) and Christopher Theofanidis (composition). www.crkasprzyk.com

Paul Koonce

Paul Koonce (b.1956, U.S.A.) studied composition at the University of Illinois, and the University of California, San Diego where he received the Ph.D. in Music. His music focuses upon issues of representation and perception in electroacoustic sound. A software developer as well as a composer, he has explored the invention of computer technologies for the manipulation of sound and timbre, with a particular emphasis on the synthesis of tools for exploring the parallels between musical and environmental sound phenomena. Recent work has turned to the use of data gloves and their use in the real-time compositional/improvisational control of virtual instruments, and microtonality. He is the recipient of fellowships from the Guggenheim and McKnight Foundations, and has received awards and commissions from the Luigi Russolo International Competition for

Composers of Electronic Music, the National Flute Association, Prix Ars Electronica Electronic Arts Competition, the Electroacoustic Music Contest of Sao Paulo, the Bourges International Competition, the International Computer Music Association, and the Hopkins Center at Dartmouth College. His music is available on CD from SEAMUS, Mnemosyne, ICMA, Panorama, Innova, Einstein, Centaur, Computer Music Journal, and Mode records.

Keith Kothman

Keith Kothman, director of the Music Technology program at Ball

State University, works across the spectrum of acoustic composition to interactive multimedia. Recordings of his music are available on the Capstone, Cambria, and New Albany labels, and his compositions have been widely performed nationally and internationally. His is the recipient of an Honorable Mention at the 31st annual Bourges Electroacoustic Music competition. Recent performances and installations include InteractivA '03 (Mexico), SEAMUS, ICMC, the International Trumpet Guild, and a commissioned installation for the Indianapolis Museum of Contemporary Art. Kothman holds a Ph.D. from the University of California, San Diego, along with B.M. and M.M. degrees from the University of Texas, Austin. He received a Fulbright grant to study electronic music in Stockholm, and has previously been on the faculties of the University of Miami, Interlochen Arts Camp, and California State University, Los Angeles.

Esther Lamneck

Esther Lamneck, clarinetist, winner of the prestigious Pro Musicus Award, has appeared as soloist with major orchestras, with conductors such as Pierre Boulez, and with renowned artists including Isaac Stern. She has performed throughout the United States and Europe in featured appearances at the world's leading music festivals in Spoleto and Siena, Paris, Salzburg, Mexico City and Newport. Ms. Lamneck is a well known chamber musician and has toured internationally with such groups as the Virtuosi Wind Quintet, the New American Trio, Saturn and the Contrasts Trio.

Ms. Lamneck maintains an active career as clarinet soloist and has given recent solo concerts in Boston's Jordan Hall, the Baird Auditorium at the Smithsonian, New York City's Gould Hall, the Orange County Performing Arts Center, the Villa Medici in Rome, the Bing Theater in Los Angeles and the Opera Comique in Paris.

Awarded the Naumburg Scholarship, Ms. Lamneck received her Doctorate from the Juilliard School. She is currently conductor of the NYU New Music Ensemble, director of the New Music Performance Program and director of Instrumental Studies. Ms. Lamneck is also director of the NYU International Music Festival and NYU Graduate Music Program in Italy.

A versatile performer and an advocate of contemporary music, Ms. Lamneck is dedicated to expanding the traditional boundaries of music to create new art forms based on elements of jazz, folk and contemporary music idioms. She is one of the few performers who plays the Hungarian Tárogató, a single reed woodwind instrument with a hauntingly beautiful sound. New compositions written for the instrument explore all the facets of new music performance from improvisation, electronics and interactive computer programs to works which suggest the influence of Slavic and Hungarian folk music.

Ms. Lamneck has appeared on major television programs both here and abroad. She has recorded for numerous radio programs such as the ORTF in Paris and RAI in Rome. She has recorded for companies including Musical Heritage, Capriccio Records, CDCM-Centaur, Computer Music, Music and Arts, CRI and Opus One.

Andrew Lange

Andrew Lange is a BFA candidate in the Department of Art at the University of Minnesota. He will graduate in the spring of 2005. Andrew's work is based in sculpture, printmaking and sound installation. He is also currently exploring the process of video.

John Lato

John Lato is a Doctoral Student at the University of Texas, studying composition with Russell Pinkston. His works have been heard at several different venues, including the International Computer Music Conference, the LaTex Festival, and UT's annual Gamma-UT conference, as well as frequent local performances. Through the UT Digital Arts Center, he is involved with creating a collaborative composition system in which the performer interacts with a virtual environment. John is a member ofSEAMUS and ICMA. When not composing, he enjoys reading, swimming, and cooking.

Cort Lippe

Studies: Larry Austin, USA; G.M. Koenig & Paul Berg at Institute of Sonology, Netherlands; and I. Xenakis at CEMAMu & University of Paris. Worked eight years at IRCAM developing real-time applications and giving courses on new technology in composition. Followed composition and analysis seminars: Boulez, Donatoni, K. Huber, Messiaen, Penderecki, and Stockhausen, etc. Composition 1st prizes: Irino Prize, Japan; Bourges Prize, France; El Callejon Del Ruido Algorithmic Music Competition, Mexico; USA League-ISCM Competition, and Leonie Rothschild, USA; 2nd prize: Music Today, Japan, 3rd prize at Newcomp, USA, honorable mentions at Prix Ars Electronica 1993 and 1995, Austria; Kennedy Center Friedheim Awards, USA; Sonavera International Tape Music Competition, USA; and Luigi Russolo Competition, Italy. Performances: International Computer Music Conference, ISCM World Music Days, Gaudeamus, Tokyo Music Today, Bourges, Huddersfield. Recorded by ALM, ADDA, Apollon, CBS-Sony, Centaur, Classico, SEAMUS, MIT Press, Hungaroton Classic, Harmonia Mundi, EMF, ICMC2000, ICMC2003, and Neuma. Associate professor of composition and director of Hiller Computer Music Studios of University at Buffalo, New York.

Tom Lopez

Tom Lopez teaches at the Oberlin College Conservatory of Music; Assistant Professor of Computer Music and Digital Arts. He has been a resident artist at the Atlantic Center for the Arts, the Copland House, Villa Montalvo, and Djerassi. Tom's music has been performed around the world and throughout the United States including The Kennedy Center.

Alex Lubet

Musician, theatre, artist, and author Alex Lubet is currently Morse Alumni Distinguished Teaching Professor and Head of Music Theory and Composition at the University of Minnesota, whose faculty he joined in 1979. He teaches composition and numerous courses in popular music. A prolific composer and multi-instrumentalist, he specializes in writing and performing solo works and multimedia collaborations that utilize the unique timbral resources of the steel-string acoustic guitar. Among the techniques he has developed are a vastly expanded repertoire of natural harmonics, single string multiphonics that enable the instrument to play chords of up to 18 pitches, wider and more refined pitch bends, and the employment of the Doppler effect to frequency modulate open strings and natural harmonics. Lubet is currently recording *Just Guitar*, a solo album of original compositions, produced by multiple-Grammy winner Steve Barnett. He often collaborates with computer musician, composer, and Spark artistic director Douglas Geers and worked for several years with Zhang Ying in the Twin Cities world music fusion group, Blended Cultures Orchestra.

Eric Lyon

Eric Lyon is a composer and developer of computer music software. He is a co-founder and core composer of the Bonk Festival of New Music. His theoretical writing include papers on the music of Aphex Twin and XTC. Lyon has composed a large number of works for various instrumental combinations, computer-generated music, and hybrid works combining pre-recorded or live computer music with live performance. He has taught computer music at Keio University and The International Academy of Media Arts and Science (IAMAS) in Gifu, Japan before joining the faculty at Dartmouth College, where he teaches in the music department and electro-acoustic graduate program.

Ulrich Maiss

Ulrich Maiss is a cellist and electronic musician from Berlin, Germany. His work in the field of experimental music led him to Japan, the US and Canada. Well known as a performer of contemporary European chamber music, he also performed with various rock and folk acts throughout Europe.

Musicians and ensembles he performed with include Lou Reed, Canadian Juno-Award winner Lynn Miles, the Potsdam Chamber Academy, Ensemble Oriol, Element Of Crime, German goth-star Alexander Veljanov, zeitkratzer, vocalist/percussionist Vinx (Sting, Lou Reed) and Maria Farantouri (Mikis Theodorakis).

In 2002 Ulrich started working on a solo program for cello and electronics, *Cellectric* (*www.cellectric.de).* The original program with pieces by composers Mario Bertoncini, John Cage, Giulio Castagnoli, Ulrich Krieger and Joseph Rovan will be available on DVD in the near future.

Ulrich is currently working with Lou Reed to finalize a Cello-Solo version of Lou's *Metal Machine Music* entitled *CelloMachine*. Further projects include his improvisational duo *envyloop* (www.envyloop.com) with composer/performer Joseph Rovan and his new solo project *ZenMan Improvisations (www.zenman.org).*

Ulrich Maiss is endorsed by NS Design (NBE Corp.) and VOX Amplification Ltd. (Korg & More Germany). He plays CodaBow carbon fiber bows and Pirastro strings and rosin.

John Mallia

John Mallia (b. 1968) is a composer / sound artist who has written for diverse instrumental, vocal and electronic forces. Much of his recent work is electro-acoustic and has been performed internationally by organizations such as L.A. Freewaves (California), Gaudeamus (The Netherlands), International Computer Music Association, Society for Electro-Acoustic Music in the United States, Zeppelin Festival of Sound Art (Barcelona, Spain), Festival Synthèse (Bourges, France), Interensemble's Computer Arts Festival (Padova, Italy), Society for New Music (New York), CyberArts, and Medi@terra`s Travelling Mikromuseum (Greece, Bulgaria, Germany, Yugoslavia, Slovenia). He has collaborated with visual artists and poets on several multi-media installations and two recent sound installations and sculptures were included in Boston Center for the Arts' Boombox exhibit and the Electric Arts Alliance of Atlanta's L'Objet Sonore. He is currently a Visiting Assistant Professor at the Center for Experimental Music and Intermedia (CEMI) at the University of North Texas and has taught electro-acoustic music and sound art at the School of the Museum of Fine Arts, Boston, College of the Holy Cross, Northeastern University, Franklin Pierce College, Clark University and Brandeis University.

Philip Manitone

Philip Mantione's music has been described as "austerely impressive" (Paris Transatlantic Monthly Nov. 2000) and Innova Recordings calls his Sinusoidal Tendencies, "a searing study in form and color." His work has been heard internationally on new music radio and the web including live broadcasts on KUSC from the Bing Theater at the Los Angeles County Museum of Art and MNN in New York City. In 2000, his Sinusoidal Tendencies was released by Innova Recordings on the Sonic Circuits VIII compilation CD of electro-acoustic music. The CD-ROM version of Sinusoidal Tendencies was included in the European Media Arts Festival (Osnabrück, Germany). His piece Chant, from his Crowd CD, was recently selected for inclusion in the Zèppelin 2004 Festival at the Centre de Cultura Contemporània de Barcelona in Spain. In February of this year, his string orchestra piece, Traffic for strings, will be performed by the S.E.M. Ensemble under the direction of Petr Kotik at the Willow Place Auditorium in Brooklyn, NY.

He has collaborated with visual artist Alysse Stepanian on numerous projects including performance, experimental video and installations. Their work has been presented internationally including screenings in New York, Los Angeles, Armenia, Paris and Berlin. Upcoming exhibits include shows at the Chameleon Gallery and the Branchville Gallery in Connecticut.

philipmantione.com

Elizabeth Marshall

Originally from California, flutist Elizabeth Marshall has performed nationally with such groups as the San Francisco Symphony, Carmel Bach Festival Orchestra, Ann Arbor Symphony, Chicago Civic Orchestra, Florida Grand Opera, New World Symphony, Wisconsin Chamber Singers, Madison Bach Society, and Utah Festival Opera Company. Elizabeth holds a Bachelor of Music degree from the San Francisco Conservatory of Music, and a Master of Music from the University of Michigan. Currently a Music Theory Teaching Assistant at the University of Wisconsin-Madison, Liz is working toward a Doctor of Musical Arts degree in flute performance with emphasis in orchestral conducting.

Andrew May

Composer Andrew May is currently an assistant professor at the University of Colorado, Boulder. Also a violinist, improviser, and computer musician, May actively performs and presents concerts, including the Atomic Clock Music Events series. His pioneering instrumental works with live interactive computer systems are widely performed. He received his PhD from UC San Diego, where he studied composition with Roger Reynolds and computer music with Miller Puckette. Previous composition teachers include Mel Powell (CalArts) and Jonathan Berger (Yale). May's compositions have been performed in Japan, Korea, Singapore, Germany, Greece, Switzerland, and across the United States. SEAMUS and EMF Media have released recordings of his music.

Mike McFerron

Mike McFerron is founder and co-director of Electronic Music Midwest. McFerron has been a composers fellow at the MacDowell Colony (2001), June in Buffalo (1997), and the Chamber Music Conference of the East/Composers' Forum in Bennington, Vt (1999). Honors include first prize in the Louisville Orchestra Composition Competition (2002), first prize in the CANTUS commissioning/residency program (2002), the Chicago Symphony Orchestra's "First Hearing" Program (2001), honorable distinction in the Rudolf Nissim Prize (2001), Swan Composition Competition (finalist 2002), the 1999 Salvatore Martirano Composition Contest (finalist), and the 1997 South Bay Master Chorale Choral Composition Contest (finalist). For more information visit, www.bigcomposer.com.

David D. McIntire

David D. McIntire was born in upstate NY, and has had some training on the clarinet, studying with Margaret Quackenbush, Stanley Gaulke and Jane Carl. Participation in a small-town band and weekly exposure to Protestant hymnody provided his entry into music. His livelihood has been maintained through several occupations, all focused on the advancement of music. He became fascinated with electronic music while in high school and eventually wore out many razor blades in pursuit of that discipline; studies in electroacoustic music include tutelage under Timothy M. Sullivan, Charles Dodge, Allan Schindler and Paul Rudy. He holds degrees in Music Theory and Composition from Nazareth College of Rochester and Ithaca College. Composition teachers include Albion Gruber, Dana Wilson, James Mobberley and Zhou Long. He also played reeds in a series of eccentric musical groups, most notably the Colorblind James Experience. He is presently a DMA student in composition at the University of Missouri at Kansas City.

Elizabeth McNutt

Passionately devoted to the music of the present, flutist Elizabeth McNutt has become a major force in the world of contemporary music. She has premiered more than 100 works, and has been described as a „virtuoso“ (Electronic Musician), „commanding“ (LA Times), „high octane“ (MusicWorks), „fearless and astounding“ (Flute Talk), and „brilliant, with impeccable interpretations“ (Array). Her CD of works for flute and computer, „pipe wrench,“ was released by EMF Media (www.emfmedia.org). McNutt has recently received awards including Arts International Fund, Astral Career Grant, Rocky Mountain Women‘s Institute Fellowship, and Neodata Fellowships. Her doctorate is from UC San Diego; her teachers include Harvey Sollberger, John Fonville, and Jacob Berg (flute), and Miller Puckette (computer music). She currently lives in Colorado.

David Means

David Means was born on the same day the sound barrier was broken. He studied architecture at the University of Illinois where he participated in the original (1967) "Music Circus" event staged by John Cage. He joined fellow Illinois composer/performers Jim Staley, David Weinstein, Dan Senn and others to help form Roulette Intermedium, a long-standing downtown New York presenting organization and champion of experimental performance. His graphic scores and live performance installations have been exhibited and presented by the Walker Art Center (Mpls), IRCAM (Paris), Documenta IX (Kassel), the Xi An Conservatory of Music (China), Het Stroomhuis (Holland), Logos Foundation (Belgium) and the Arts Council of Great Britain. He coordinates the Program in Experimental Music and Intermedia Art at Metropolitan State University in St. Paul, where he produces the Strange Attractors festivals of experimental intermedia arts. He is currently on a full year sabbatical leave from Metropolitan State to pursue composition projects and touring in Australia, Europe and Texas.

Bonnie Miksch

Bonnie Miksch, a composer and performer whose music embraces multiple musical universes, creates both acoustic and electroacoustic works. She is passionate about music which moves beyond abstract relationships into the boundless realm of emotions and dreams. An avid consumer of musical possibilities, she strives to create coherent musical environments where diverse musical elements can coexist. Her computer music and vocal improvisations have been heard in Asia, Europe, Canada, and throughout the United States. Current activities range from performing as a vocalist and laptop artist with Suddenly Listen, an experimental improvisation group based in Nova Scotia to composing a new work for choir and computer-realized recording. The Atlanta Artists Records recently released man dreaming butterfly dreaming man, a work for violin and piano. Currently an Assistant Professor at Portland State University where she teaches composition, theory, and directs the new music ensemble, she has also held academic positions at Williams College, Colgate University, and Mercer University.

Dennis H. Miller

Dennis Miller received his Doctorate in Music Composition from Columbia University and is currently on the Music faculty of Northeastern University in Boston where he heads the Music Technology program and serves on the Multimedia Studies Steering Committee. His mixed media works have been presented at numerous venues throughout the world, most recently the DeCordova Museum, the 9th New York Digital Salon, the 2003 Art in Motion screenings, Images du Nouveau Monde, CynetArts, Sonic Circuits, the Cuban International Festival of Music, and the 2002 New England Film and Video Festival, where he won Best Animation. His work was also presented at the gala opening of the new Disney Hall in Los Angeles (2003) and at the SIGGRAPH 2001 in the Emerging Technologies gallery. Recent exhibits of his 3D still images include the Boston Computer Museum and the Biannual Conference on Art and Technology, as well as publication in Sonic Graphics: *Seeing Sound*, published by Rizzoli Books. Miller's music and artworks are available at www.dennismiller.neu.edu.

Scott Miller

Scott Miller is a composer of orchestral, chamber, electroacoustic and multimedia works. He has had performances of his music and participated in exhibitions at venues throughout North America and Europe, such as at the 12th International Festival of Electroacoustic Music in Brno, Czech Republic, the Leipzig Neue Gewandhaus, at Dvorak Hall, Prague, and at Galerie EXPRMNTL, Toulouse, France. His work is presently focused on integrating technology with live performance and collaborative multimedia works, in particular, the creation of experimental performance pieces in collaboration with poet Philippe Costaglioli and video artist Ron Gregg. Recent honors include a Jerome Composers Commissioning Program commission, a 2001 Minnesota State Arts Board Artists Fellowship, and a 2001 McKnight Composers Fellowship. Miller is an Associate Professor of Music at St. Cloud State University, Minnesota, where he teaches composition, electroacoustic music and music theory. He has lectured on music technology and composition in universities and secondary schools across the United States, Europe and Mexico, most recently co-presenting *My House is Your Breathing: Orpheus the Acousmatic* at HAMU, the Academy of Music in Prague with Philippe Costaglioli. Miller holds degrees from the University of Minnesota, The University of North Carolina - Chapel Hill, and the State University of New York at Oneonta. He has studied composition with Ladislav Kubik (Czech-American Summer Music Institute, Prague), Alex Lubet, Lloyd Ultan, Roger Hannay, Carleton Clay, and at the Centre de Creation Musicale Iannis Xenakis.

James Mobberley

James Mobberley is Curators' Professor of Music at the Conservatory of Music of the University of Missouri-Kansas City. Major fellowships and awards include the Rome Prize, the Guggenheim Foundation, Meet the Composer's New Residencies program, the 2001 Van Cliburn Composers Invitational, and the National Endowment for the Arts. Commissions have come from the Koussevitzky Foundation (Library of Congress), Chamber Music America, St. Louis Symphony Chamber Series, the Kansas City Symphony, Meet the Composer, the Barlow Foundation, Music From China, the Cleveland Chamber Symphony, and numerous individual performers. He has appeared as Guest Composer with the Taiwan National Symphony, the American Composers Orchestra, the Composers Forum at Wellesley College, and over 30 colleges and universities around the world. His music has received more than 800 performances on five continents, and appeared on twenty recordings, including an all-Mobberley orchestral release by Albany Records.

Thea Musgrave

Thea Musgrave was born in Barton, Scotland in 1928. She studied at Edinburgh University, with Hans Gál, and in Paris at the Conservatoire with Nadia Boulanger. Her early works include *The Suite o'Bairnsangs*, a ballet *A Tale for Thieves* and an opera *The Abbot of Drimock*. Her best known works include *The Seasons*, *Rainbow*, *Black Tambourine* (for female voices, piano and percussion) and operas *The Voice of Ariadne*, *A Christmas Carol*, *Mary Queen of Scots*, and *Harriet: The Woman Called 'Moses.'* Her later work, especially, extends traditional boundaries, emphasizing abstract form and dramatic content. A conductor as well as a composer, she has conducted in the United States and Britain. She has taught at London University, the University of California at Santa Barbara, New College, Cambridge, and Queen's University, New York. She is married to Peter Mark, conductor and general director of the

Virginia Opera Association.

NeXT Ens

NeXT Ens, created by Cincinnati College-Conservatory of Music students, is dedicated to performing new works of interactive acoustic and computer music. Although only a little over one year old, its acclaimed performances at Music04 (OH), Electronic Music Midwest (IL), and Third Practice (VA) festivals have already established *NeXT Ens* as a rising star in the new music scene.

Led by director/pianist Shiau-uen Ding, the members of *NeXT Ens* include percussionist Heather Brown, cellist Kaylie Duncan, violinist Timothy O'Neill, technical expert/cellist Margaret Schedel, and flutist Carlos Velez. The group actively seeks out new works by both new and established composers, and encourages experimental works which explore the ways that computers and electronic instruments can interact with acoustic instruments in live performance.

Katharine Norman

Katharine Norman is a composer, sound artist and writer. She received a PhD in composition from Princeton in 1993 and has, since then, pursued a career as a composer, teacher and, increasingly, writer. In 2003 she emigrated from London, England, to one of the Gulf Islands off the coast of Vancouver Island, British Columbia. Prior to this change of direction she was, for five years, Director of the Electronic Music Studios at Goldsmiths, University of London, and, before that, held various academic posts in the UK. She now works freelance, with some recent teaching at Simon Fraser University.

She composes instrumental music, music combining instruments or voices and tape, and purely electronic work. Her music, for both tape and instruments and for purely digital media, makes frequent use of documentary sound conversation, city sounds, birds, etc., in a way that perhaps invites new appreciation both of the "real world" and the concert hall. Her CD of electroacoustic music and soundscape composition, *London*, is available on the NMC label. *Transparent things,* a CD of soundscape music and piano music, was released on the Metier label. Other music is recorded on the Innova, Empreintes Digitales and Discus labels.

Her book of experimental writings on recent electronic music (of many kinds and approaches) entitled *Sounding Art: Eight Literary Excursions through Electronic Music* was published by Ashgate in 2004.

You can find more information on her work at www.novamara.com, where there are also links to other pages on her music and writing. Her work is represented by the British Music Information Centre, at www.bmic.co.uk, and she is also an Associate Composer of the Canadian Music Centre.

Keith O'Brien

Keith O'Brien studied composition,improvisation, harmony, big-band arrangement at Newpark School of Music, Blackrock, Dublin and at Trinity College Dublins Music and Media Technologies postgraduate course. He performs regularily in both solo and group contexts which integrates jazz and electro-acoustic aesthetics with guitar and electronics. He has been extensively involved in electronic programming for musical purposes. He currently employs a diverse range of electronic devices and methods for composition and recording; algorithmic programming - Common Lisp [Stanford], generative synthesis - C-Sound [M.I.T.], real-time interactive processing - Max/MSP [IRCAM]. He has worked with a wide range of artists in both a performance and compositional capacity including Rajesh Mehta,Donnacha Dennehy,John Godfrey,Linda Buckley,Gearoid Ua Laoighre,Oyvind Torvund, Jürgen Simpson,Roger Doyle and Mike Nielsen.

He works under the name 'Amoebazoid' and has released an album– 'autocannibalism' on spitroast records. He also works with Roy Carrol in the electronic improv duo 'Double Adaptor' who have just released their second album 'Live at the Village Vanguard' on osaka records.

Pat O'Keefe

Woodwind player and artistic co-director Pat O'Keefe is a graduate of Indiana University, the New England Conservatory, and the University of California, San Diego. In San Diego, he performed regularly with the new music ensembles SONOR and SIRIUS, as well as with the San Diego Symphony. He is a founding member of the improvisation group Unbalancing Act, and has appeared in concert with such notable improvisors as George Lewis, Wadada Leo Smith, J.D. Parran, Anthony Davis, and Fred Frith. Pat has also performed regularly with the Brazilian ensemble Sol e Mar in San Diego, and Brasamba in Minneapolis. He is currently on the faculty of the University of Wisconsin, River Falls.

Timothy O'Neill

Timothy O'Neill has long been a steadfast fixture at the Cincinnati College-Conservatory of Music, having been involved with the Starling Preparatory String Project for seventeen years. Within the last two years, he completed a Bachelor of Music, obtaining dual degrees in Violin Performance and Composition, and a Masters degree in Violin Performance. He has appeared as a soloist with the Cincinnati Symphony Orchestra and the CCM Philharmonia, and twice has won CCM's violin competition. Tim has a strong commitment to performing modern music: recent performances include a Cincinnati Chamber Music Society Subscription Series concert featuring a variety of new works, including a Violin Sonata he composed, as well as a world premiere performance of Gao Ping's Concerto for Violin and Pipa, written for the Greater Cincinnati Chinese Music Society's annual Chinese New Year concert. His other interest is with computers: he holds several industry-standard certifications and is presently employed as the IT Director of On Location Multimedia, Inc. Tim is currently working on a Doctorate of Music and is in his fifth year of coaching chamber music in the Starling program.

Gabriel Ottoson-Deal

Gabriel Ottoson-Deal has been making up songs for as long as he can remember. His background includes 17 years of classical violin study, 5 years with the Turkish ethno-pop band Tkana (including a CD released in 1999), and assorted fiddling around in other genres. His work, though widely varied in style and medium, is marked by lyricism, humor, and a compulsion to push each piece's aesthetic world to its extremes.

Mr Ottoson-Deal has studied composition privately with Marshall Barnes; at The Ohio State University with Fay Neary, Jan Radzynski, and Don Harris; and at the University of Cincinnati's College-Conservatory of Music with Gao Wei-jie, Joel Hoffman, Frederic Rzewski, and (primarily) Michael Fiday. He has also studied computer music with Tom Wells, Marc Ainger, Mara Helmuth, and Christopher Bailey. He received a BM from Ohio State in 1999, and an MM from CCM in 2004, both in composition.

Tae Hong Park

Tae Hong Park holds B.Eng., M.A., and Ph.D. degrees from Korea University, Dartmouth College, and Princeton University and is Assistant Professor at Tulane University. He has worked in the area of digital communication systems and musical keyboards at the GoldStar Central Research Laboratory in Seoul, Korea (1994~1998). His current interests are in composition and research in multi-dimensional aspects of timbre and DSP. His music has been heard in various locations in Brazil, Canada, France, Germany, Holland, Hungary, Ireland, South Korea, Sweden, UK, and USA; in venues, conferences and festivals including Aether Fest, Bourges, CEAIT, CYNETart, DIEM, Electric Rainbow Coalition, EMM, EUCUE Series, FEMS, ffmup, High Voltage, ICMC, Into the Soundscape, ISMEAM, LACMA, LITSK, MATA, MAXIS, NWEAMO, Pulse Field, Reflexionen Festival, Santa Fe International Festival of Electro-Acoustic Music, SICMF, SEAMUS, Sonorities Festival, Third Practice, and Transparent Tape Music Festival. His works have been played by groups and performers such as the Argento Ensemble, Brentano String Quartet, California E.A.R. Unit, Wayne Dumaine, Edward Carroll, Entropy, Zoe Martlew, Nash Ensemble of London, New Jersey Symphony Orchestra and the Tarab Cello Ensemble. He is currently Assistant Professor at the Tulane University Music Department which has started a new program in Music Science and Technology.

Ronald Keith Parks

Ronald Keith Parks' diverse output includes orchestral works, instrumental and vocal chamber music, choral music, electroacoustic music, and interactive computer music.

His compositions and papers have been included at national and international venues including regional and national SCI conferences, the Florida Electroacoustic Music Festival, the Society for Electroacoustic Music in the United States, the International Computer Music Conference, the National Flute Association Conference, the NextWave~ festival in Australia, the Two Sided Triangle festival in Germany, the International Music Program's European tour, and numerous performers' recitals.

His honors include the Aaron Copland Award, the South Carolina Music Teacher's Association Commission, two Giannini Scholarships plus the Chancellor's Award for Excellence at the NC School of the Arts, three Graeffe Scholarships, and the Presidential Recognition Award at the University of Florida. His music is available on the EMF label and the University of Florida's Society of Composers student chapter CD series.

Dr. Parks received the BA from the North Carolina School of the Arts, an MM from the University of Florida, and a Ph.D. in composition from the University at Buffalo. He is currently assistant professor of music technology, theory, and composition and Director of the Winthrop Computer Music Labs at Winthrop University.

Samuel Pellman

Samuel Pellman was born in 1953 in Sidney, Ohio. He received a Bachelor of Music degree from Miami University in Oxford, Ohio, where he studied composition with David Cope, and an M.F.A. and D.M.A. from Cornell University, where he studied with Karel Husa and Robert Palmer. Many of his works may be heard on recordings by the Musical Heritage Society, Move Records, and innova recordings (including his October 2003 release entitled "Selected Planets"), and much of his music is published by the Continental Music Press and Wesleyan Music Press. In the past few months his music has been presented at the International Symposium of the World Forum for Acoustic Ecology in Melbourne, Australia and the Electric Rainbow Coalition festival at Dartmouth College. He is also the author of An Introduction to the Creation of Electroacoustic Music, a widely-adopted textbook published by Wadsworth, Inc. Presently he is a Professor of Music at Hamilton College, in Clinton, New York, where he teaches theory and composition and is co-director of the Studio for Transmedia Arts and Related Studies. Further information about his music can be found on the web at: http://www.musicfromspace.com.

Christopher Penrose

Christopher Penrose is a music maker who has taken on the habit of making illustrations to help explain his music. He is a native of Los Angeles, born in the Silverlake district of Hollywood. When he frequents the homogenous consumer malls to the east of his new home of Portland, he is often embattled by ghostly bumper stickers and placards which provide the following tall order: "DON'T CALIFORNICATE OREGON". Christopher is often haunted by such failed sentinel sentiments of yesteryear and earnestly seeks your help.

Andrea Polli

Andrea Polli is a digital media artist living in New York City. She is currently an Associate Professor of Film and Media at Hunter College. Polli's work addresses issues related to science and technology in contemporary society. Her projects often bring together artists and scientists from various disciplines. She has exhibited, performed, and lectured nationally and internationally.

She is currently working in collaboration with meteorological scientists to develop systems for understanding storms and climate through sound. For this work, she has been recognized by the UNESCO Digital Arts Award 2003 and has presented work in the 2004 Ogaki Biennale in Gifu, Japan and at the World Summit on the Information Society in Geneva, Switzerland. Her work in this area has also been presented at Cybersonica at the ICA in London and awarded funding from the New York City Department of Cultural Affairs and the Greenwall Foundation. As a member of the steering committee for New York 2050, a wide-reaching project envisioning the future of the New York City region, she is currently working with city planners, environmental scientists, historians and other experts to look at the impact of climate on the future of human life both locally and globally.

Anna Resele

Trained in dance and psychology, Anna Resele has performed with Strike Time Dance Company and Ariel Dance Theater in Western Michigan; Danco II of Philadanco in Philadelphia, PA; Metal Velvet Jacket, Our Own Voice Theater and at Redbirds Baseball games in Memphis, TN; and The Fringe Festival, U of M, Minnesota Opera and various other venues here in Minneapolis. Anna and Christopher performed "Anticipation", a computer-interactive dance at the 2004 Spark Festival.

Neil B. Rolnick

http://www.neilrolnick.com

Neil Rolnick's career since the late 1970s has spanned many areas of musical endeavor, often including unexpected and unusual combinations of materials and media. He has performed his music around the world, and his music has appeared on 11 CD's.

Though much of Rolnick's work has been in areas that connect music and technology, and therefore considered in the realm of "experimental" music, his music has always been highly melodic and accessible. Whether working with electronic sounds, improvisation, or multimedia, his music has been characterized by critics as "sophisticated," "hummable and engaging," and as having "good senses of showmanship and humor."

In 2003 and 2004 he completed *The Shadow Quartet*, for the NYC-based string quartet Ethel, *Fiddle Faddle*, for violinist Todd Reynolds, *Body Work* for vocalist Joan La Barbara, *The Real Thief of Baghdad* for Tyrone Henderson, *Ambos Mundos* for the Quintet of the Americas and *Plays Well With Others* for Paul Dresher's Electro-Acoustic Band in San Francisco. These pieces will be released on CD on the Innova label in early 2005. In 2005 he will also complete new pieces for baritone Thomas Buckner, pianist Kathleen Supove, and Joan La Barbara. Rolnick's improvising band, Fish Love That, released their first CD on the Deep Listening label in 2003.

Rolnick teaches at Rensselaer Polytechnic Institute in Troy, NY, where he was founding director of the iEAR Studios.

Butch Rovan

Butch Rovan is a composer/performer on the faculty of the Department of Music at Brown University, where he co-directs meme@brown (Multimedia & Electronic Music Experiments @ Brown) and the Ph.D. program in Computer Music and Multimedia. Prior to joining Brown he directed CEMI at the University of North Texas, and was a "compositeur en recherche" with the Real-Time Systems Team at IRCAM in Paris. Rovan previously worked at Opcode Systems, serving as Product Manager for MAX, OMS and MIDI hardware.

Rovan is the recipient of several awards, including a jury selection and second prize in the 1998 and 2001 Bourges International Electroacoustic Music Competitions, and first prize in the 2002 Berlin Transmediale International Media Arts Festival. Recent performances include the performance of his "Vis-à-vis" for voice, electronics and video at the 2004 ICMC in Miami, and the premiere of his "Hopper Confessions" at the 2003 Festival Synthèse in Bourges, France. Rovan frequently performs his own work, including performances at the 2000 ICMC in Berlin and the 2002 NIME conference in Dublin. His interactive scores for dance have been programmed in Munich, Paris, Reims, Monaco, the 2001 SEAMUS conference in Baton Rouge and the 2001 ICMC in Havana. *See www.soundidea.org*

Robert Rowe

Robert Rowe received degrees in music history & theory (B.M. Wisconsin 1976), composition (M.A. Iowa 1978), and music & cognition (Ph.D. MIT 1991). From 1978 to 1987 he lived and worked in Europe, associated with the Institute of Sonology in Utrecht, the Royal Conservatory in the Hague, the ASKO Ensemble of Amsterdam, and with IRCAM in Paris, where he developed control level software for the 4X machine. In 1990 his composition Flood Gate won first prize in the "live electroacoustic" category of the Bourges International Electroacoustic Music Competition. In 1991 he became the first composer to complete the Ph.D. in Music and Cognition at the MIT Media Laboratory and is currently Associate Professor and Associate Director of the Music Technology program at New York University. His music is performed throughout North America, Europe, and Japan and is available on compact discs from New World, Roméo, Quindecim, Harmonia Mundi, and the International Computer Music Association, and his book/CD-ROM projects Interactive Music Systems (1993) and Machine Musicianship (2001) are available from the MIT Press.

Margaret Anne Schedel

Margaret Anne Schedel is a composer and cellist specializing in the creation and performance of ferociously interactive media. She is a founding member of the NeXT Ens, an ensemble with the unique mission to perform and support the creation of interactive electroacoustic works. Currently she is serving the International Computer Music Association as a Director-At-Large and Array Editor, as well as co-editing an issue of Organised Sound with the theme "Networked Muisc." A DMA in composition at the University of Cincinnati College-Conservatory of Music is almost within her grasp. Her thesis, *A King Listens*, an interactive, multi-media opera premiered at the Cincinnati Contemporary Arts Center in June 2004 and was profiled by apple.com. Her recent residency at the Sino-Nordic Arts Space was supported by the Presser Foundation.

Barry Schrader

Barry Schrader¹s compositions for electronics, dance, film, video, multimedia, live/electro-acoustic combinations, and real-time computer performance have been presented throughout the world. Schrader is the founder and the first president of SEAMUS (Society for Electro-Acoustic Music in the United States), and has been involved with the initiation and operation of SCREAM (Southern California Resource for Electro-Acoustic Music), the Currents concert series, and the CalArts Electro-Acoustic Marathon. He has written for several publications including several editions of Grove¹s, Groller's Encyclopedia, Contemporary Music Review, and Journal SEAMUS, and is the author of the book Introduction to Electro-Acoustic Music. He is currently on the Composition Faculty of the School of Music of the California Institute of the Arts, and has also taught at the University of California at Santa Barbara and California State University at Los Angeles. His music is recorded on the Opus One, Laurel, CIRM, SEAMUS, Centaur, and Innova labels. His web site is <http://barryschrader.com>.

Dr. Anonymous W. Smith

Dr. Anonymous W. Smith is currently an Associate Professor of New Media in the Fine Arts Department at The University of Lethbridge. With a wide range of academic training in fine arts (music composition and dance) and science (mathematics, chemistry), Dr Smith is keenly interested in the intersection of art and science. He specializes in aesthetic movement in 3-D spaces and creates sound for visuals and visuals for sound.

Harry Smoak

Harry Smoak is an emerging digital media artist and researcher interested in critical studies of performance in responsive media spaces. His work focuses on applying live performance analysis to real-time video, light, and sound displays at various scales through installation-events designed as phenomenological experiments. He has explored the use of continuous dynamics to evolve metaphorical states of responsive play spaces according to pre-designed topologies. Players engage directly in the marshaling of video and sound media using non-timeline methods for interaction, where media become tangible materials shaped through continuous action. Recent public installation works include thick/N (GVU Convocation) with Matthew Warne and Membrane (DEAF04) with Yoichiro Serita, and the international art research group Sponge. Harry is a recent graduate student at the Georgia Institute of Technology where he received a masters degree in Human-Computer Interaction from the interdisciplinary GVU Center. Prior to coming to Georgia Tech he studied theatre and media arts, and spent a number of years working in industry helping to build the consumer Internet, develop online communities, and shape online policy. Harry remains an active researcher and contributor to the Topological Media Lab under the guidance of Dr. Sha Xin Wei.

Allen Strange

Involved with music technology since the middle 1960's Allen Strange has remained active as a composer, performer, author and educator. In 1972 Allen's text, *Electronic Music: Systems, Techniques and Controls* appeared as the first comprehensive work on analog music synthesis. After several editions the text still remains in print as a classic reference and guide for studio synthesis. In the late 1960s Allen and his wife, Patricia, founded BIOME, a pioneering live-electronic music performance. In 1976 they co-founded the Electric Weasel Ensemble with synthesizer designer Donald Buchla. Both ensembles have toured internationally and the Stranges continue to concertize as a duo composer/performer team. Their book, *The Contemporary Violin; Extended Performance Techniques,* has recently been published by the University of California Press. Allen Strange is Professor Emeritus from San Jose State University and is now a full-time independent composer living on Bainbridge Island in Washington.

Jake Sturtevant

Jake Sturtevant has been brought up in a musical family. In fact, he has pictures of himself sleeping in his father's guitar case at a bar gig from when he was about 1 year old. His mother taught him to play piano starting at age six. He has also learned, through his mother, how to play the Hammond B-3 organ. Jake attended the University of Maine at Augusta's Jazz and Contemporary music program from 1999-2003, where he earned a Bachelors degree in Jazz and Contemporary Music Composition, and played in many various local jazz and funk groups.. At UMA he studied Composition with Dr. Richard Nelson and Dr.

Frank Mauceri.

Jake is now pursuing a Masters Degree in Music Composition from the University of Minnesota, where he is studying under the direction of Dr. Judith Lang Zaimont.

Shimpei Takeda

Shimpei Takeda's photographs capture various naturally occurring abstractions of everyday life. Through his work, random exteriors and ordinary objects find a new context. By photographing through existing filters and distortions, Takeda has stumbled upon a previously hidden viewpoint. A street scene viewed through a stained glass panel, a neon lit doorway, a lamp lighting a drink in a bar, all find an otherworldly quality when observed through Takeda's lens and help us to see the subtle and mysterious beauty of the world around us. Beauty that is otherwise overlooked.

Takeda uses analog techniques with digital cameras. The monitor allows him to pre-visualize his pictures, giving him greater compositional freedom, as well as letting him see the subtleties that are often lost in film. His effects are achieved by manually controlling exposure and camera movement. He doesn't alter his work using computer manipulation, as is so often the case in modern photography.

The inspiration for these photographs came from several key sources. Graphic artists, such as Tomato, John Maeda and Stenberg Brothers, all inspired his work. He was also influenced by the 1999 LOMO photo exhibition in Tokyo. His first cameras were gifts from his grandfather, a former photographer. His father, a graphic designer named him after his favorite photographer, Shimpei Asai.

Shimpei Takeda is a young Japanese artist. He currently lives in New York City, where he continues to pursue both.

Benjamin Thigpen

Benjamin Thigpen is a composer of electroacoustic music. He has worked primarily in studios in France and Belgium: GRM (Paris), Recherches et Musiques (Brussels), CCMIX (Paris), and SCRIME (Bordeaux); in April-May 2003 he was a resident artist at Djerassi (California). His work is performed in Europe, North and South America, Australia and New Zealand, as well as on the web; he has received commissions from GRM, SCRIME and the French Ministry of Culture; and has been awarded mentions in various competitions (Musica Nova, Prix Noroit, Métamorphoses, Città di Udine, CIMESP). He studied composition, aesthetics, and computer music with Elaine Barkin, Samuel Weber, Christian Eloy, Curtis Roads, Julio Estrada, and Horacio Vaggione; and has degrees in English Literature, Comparative Literature, and "Aesthetics, Technologies and Artistic Creations." He worked for nearly six years as a computer music instructor at Ircam (Paris), and is currently a Lecturer in Digital Arts at the University of Washington.

His music is concerned with issues of energy, density, complexity, movement, simultaneity and violence. He works extensively with space as a primary compositional parameter; thinks that music does not exist in time but rather creates it, and considers that music is not the art of sound but the art of the transcendence of sound.

Carei F. Thomas

Carei F. Thomas has been associated for a number of years with the literary, visual arts, dance, music, recovery, neighborhood, and Buddhist communities of the Twin Cities. Thomas is a 1993 Bush Fellowship recipient known throughout the arts community for his creative improvisational music (brief realities), spiritual energy and interdisciplinary vision. His compositions are multifaceted. They encompass an historic range of musical styles, always expressing social and personal experiences and observations.

Carlos Velez

An active flutist and composer, Carlos Velez served as principal flutist for the Stetson University Orchestra and Wind Ensemble (2001-02) as well as the Seaside Music Theater orchestra in Daytona Beach, Florida (1998-2002). He was also a winner of the 2002 Stetson University concerto competition playing Lowell Liebermann's Flute Concerto. He is currently pursuing his DMA in composition from the University of

Cincinnati College-Conservatory of Music where he recently earned his Master's. Mr. Velez is very pleased to continue his work with NeXT Ens as their flutist.

Angela Veomett

Angela Veomett began her explorations into the realm of new media art as an undergraduate music student at the University of Minnesota, Twin Cities. Her studies there focused on both musicology and sound technology, culminating with a senior thesis on the music of Steve Reich. After a year of internships at the British Music Information Centre and the Sonic Arts Network in London, Angela spent a year studying Sound Design for Theater at the University of Missouri, Kansas City. She is now working towards her Masters Degree in Media Arts at the University of Michigan, Ann Arbor.

Most of Ms Veomett's recent art works have been created in the sound and video medium, though she hopes to expand her collaborative projects to involve other art forms as well. Recent collaborative projects include the Parade of Fools, performed in Ann Arbor on December 5th 2004; and the Haptic Theater of Cruelty, a project involving experimentation with physical and sensory methods of learning, funded by GROCS at the University of Michigan and to be completed April 2005.

Robert Voisey

Robert Voisey is a composer and impresario of new works primarily in New York City. He seeks innovative and creative approaches to promote the music of today's composers. Among his many activities, Voisey is the Artistic Director of the "60x60" project, an annual event of worldwide concerts that highlights 60 composers who have composed works 60 seconds or less for an hour-long continuous concert. Voisey is also the Artistic Director of the "Composer's Voice" concert series at Vox Novus. This series features and exposes emerging composers as well as accomplished underexposed composers from other regions. It is designed to display their compositional "voice" in a themed exposition dedicated specifically to promote their music. Voisey is also the Vice-President of Programs at the Living Music Foundation, whose mission is the support of independent, professional and emerging composers and performers of post-modern art music in their struggle for the space and freedom of expression growing out of the need to relate to one's surroundings interactively. His role is to coordinate and raise funds for concert programs, including grant writing and project production. Voisey received his B.A. from Stony Brook University (SUNY), where he studied Computer Science Engineering, Mathematics, Studio Art and Music Performance, and started his composition career in the Upper Galilee of Israel, at the College of Tel Hai. He then returned to the United States to Brooklyn College (CUNY) where he studied composition with Noah Creshevsky.

Matthew Peters Warne

Matthew Peters Warne is a composer, digital media artist, and freelance media production consultant. Having studied composition with Dr. Jonathan Chenette and Dr. Steve Everett, the multimedia version of his award winning electronic music composition *Skipped Stones: A Comparison on Two Seasons* was performed at the Haiku North America 2001 Conference. In the spring of 2004 he co-authored Thick/N, a responsive media social space installed for the 2004 GVU Convocation at the Georgia Institute of Technology. He recently completed his M.S. Degree in Information Design and Technology where his research focused on performers' experience of gestural agency in music and responsive media environments. His M.S. project *With a Wave of My Voice* saw the design of hardware and software instruments for measuring vocal performance phenomena and the composition of *Calling Crick(alerbel)ets* for voice and computer, performed at the Wesley Center for New Media. He currently lives and works in Providence, RI and continues to collaborate with the Topological Media Lab directed by Dr. Sha Xin Wei and with Sponge, an international art research group.

Alicyn Warren

Alicyn Warren, a composer of mainly electronic music, is a graduate of Columbia University and of Princeton University, where she earned a doctorate in composition. She has received grants and prizes from the National Endowment for the Arts, the American Musicological Society, the Mellon Foundation, and the Bourges International Electroacoustic Music Competition. Her works have been performed in the US, the UK, Canada, Asia, and Europe, and are recorded on the Centaur and Le Chant du Monde labels. Alicyn Warren has taught computer music, composition, and film music at Columbia University and the University of Virginia. In 2001 she joined the faculty at the University of Michigan, with a joint appointment in the School of Music and the School of Art & Design. She teaches in the School of Music's Performing Arts Technology program, and offers courses in sound and digital imaging for students in the School of Art & Design.

Jon Welstead

Jon Welstead is Professor and Director of the Electro-Acoustic Music Center in the Peck School of the Arts at the University of Wisconsin-Milwaukee. He served as Chair of Composition and Theory for the past decade. His works include compositions for instrumental ensemble, electronic/computer music, music for dance, over 100 theatrical presentations and films, and has presented both nationally and internationally.

Some of his music awards, performances, commissions and grants include: CINE Golden Eagle and INTERCOM Film Festivals Awards of Excellence, Delius Chamber Music Award, American College Theatre Festival Awards of Excellence, Invitational Bourge Electronic Music Festival, Electronic Music Midwest Festival, Emerald City Classic Performance Award for music in dance, Los Angeles New Music Festival, New Music America-New York, EuCue Festival, Canada, Florida ElectroAcoustic Music Festival, Netherlands International Experimental Theatre Festival, Bessie Schoenberg Theatre Foundation, Baltimore Theatre Project, Kennedy Center for the Performing Arts and (SEAMUS) Society for ElectroAcoustic Music in the United States (for which he also served as Vice President for Programs for two years).

He has been the recipient of both NEA, NEH Grants, Centre Culturel Georges Brassens, France, Arts Midwest, Texas, Iowa, Illinois, Minnesota, Wisconsin, Nebraska and Maryland Arts Boards, and has been published by Rogers and Hammerstein, The Music & Computer Educator magazine, American Theatre Magazine, Computers in Entertainment and the Arts and Samuel French Publishing

His composition may be found in the collaborative CD "*The Ghost In The Machine*" with Yehuda Yannay. The CD may be reviewed or purchased at: http://www.cdemusic.org or http://www.uwm.edu/~jonw

Dr. Shannon Wettstein

Dr. Shannon Wettstein, pianist, has appeared as soloist and chamber musician throughout the United States. A founding member of the Calliope flute and piano duo and Boston's Auros Group for New Music, Dr. Wettstein has premiered countless new works and collaborated with many of the greatest living composers. Dr. Wettstein has given performances in New York's Lincoln Center for the Performing Arts and the New School for Social Research, Boston's Isabella Stewart Gardner Museum and Jordan Hall, the New Zealand Embassy in Washington D.C., the Japan America Theater in Los Angeles and the Aspen Music Festival in Colorado, Yellow Barn Chamber Music Festival of Vermont, and the Sandpoint Music Festival in Sandpoint, Idaho. Her solo CD of music by Chopin, Berg, Brian Ferneyhough and Debussy is available on the Centaur label; performances of the music of Mark Applebaum are on the Tzadik label. She can also be heard on Mode Records and Koch International Classics. Dr. Wettstein joined the faculty of Bemidji State University as an Assistant Professor of Music in 2000.

Frances White

Frances White composes instrumental and electronic music. She studied composition at the University of Maryland, Brooklyn College, and Princeton University. She has received awards, honors, grants, and commissions from organizations such as Prix Ars Electronica (Linz, Austria), the Institut International de Musique Electroacoustique de Bourges (France), the International Computer Music Association, Hungarian Radio, ASCAP, the Bang On A Can Festival, the Other Minds Festival, the New Jersey Symphony Orchestra, the Dale Warland Singers, the American Music Center, and the John Simon Guggenheim Memorial Foundation. She has received resident artist fellowships from the MacDowell Colony and the Djerassi Resident Artists Program. Ms. White's music can be heard on CD on the Wergo, Centaur, Nonsequitur, and Harmonia Mundi labels. Recently, Ms. White's music was featured as part of the soundtrack of Gus Van Sant's award-winning film Elephant.

Ms. White studies the shakuhachi (Japanese bamboo flute), and finds that the traditional music of this instrument informs and influences her work as a composer. Much of Ms. White's music is inspired by her love of nature, and her electronic works frequently include natural sound recorded near her home in central New Jersey.

Marcel Wierckx

Marcel Wierckx (Canada 1970) studied instrumental and electronic music composition in Canada (BMus. University of Manitoba, MMus. Composition McGill University) before moving to the Netherlands in 1999. Since then he has been active as a sound and video artist as well as composing instrumental and electronic music for concert, film, theater and dance. Currently Marcel divides his time between creating and performing multimedia stage productions with MorphoDidius (Rotterdam), creating interactive soundscapes for theater performances with Shade Interactive (Netherlands, Ireland, U.S.A.) and teaching music technology and composition at the Utrecht School for the Arts.

Diane Willow

Diane Willow is Assistant Professor in the new media area of Time and Interactivity within the Department of Art. Her recent appointment to the University of Minnesota faculty follows a multi-year residency as artist and researcher at the MIT Media Lab. She exhibits nationally and internationally and enjoys interdisciplinary contexts that expand contemporary notions of the artistic.

Diane is a multi-modal artist. Working at the intersection of art, science and technology, she experiments with hybrid media to explore the dynamics of nature, technology and community. Her public installations, interactive environments and evocative objects involve media as eclectic as bioluminescent organisms, embedded computers and time-lapsed video. She invites people to engage in multi-sensory explorations as participants and choreographers rather than as viewers. She is interested in exploring the subtle ways that we express empathy with one another, with other life forms and in relation to responsive objects, immersive environments and interactive media.

Currently, she is also in the process of developing an experimental media studio to engage students in new forms of artistic expression through the interplay of transmedia work that relates the sensuousness of the physical domain and the digitally reconfigurable nature of the virtual.

Zhang Ying

At age12, Zhang Ying was apprenticed to a traveling flute master in China. After more than 40 years as a professional musician in China, he has been recorded in the Register of Great Musicians, been awarded the title of First Class Composer, and has received the Wen Hua prize, China's highest national arts award. Since moving to the U.S., he has received a Bush Fellowship, McKnight Composer's Fellowship, Minnesota State Arts Board Fellowship, Cultural Collaboration grant, and two commissions from the American Composer's Forum. He has performed throughout China, Asia, and the U.S. He plays traditional Chinese music on a variety of woodwind instruments: xun, hulusu, bawu, qu di (bamboo flute), band di, kou di, xiao, mabu, pili, and gu di (turkey bone flute dating back 9,000 years), music that comes from China's historical dynasties, and also music from the minority peoples of China with whom he has studied and lived. I also play Peking Opera percussion, and the fo, a clay bowl percussion instrument with a 2,000 year history. His performance can include chanting and singing of ancient Chinese stories, as well as recitation of poems of the great masters of China.

Noel Zahler

Composer Noel Zahler is Director of the University of Minnesota School of Music, Minneapolis, Minnesota. Dr. Zahler's compositions include a wide range of vocal and instrumental works, as well as electroacoustic, interactive and multi-media works. He studied music composition with Milton Babbitt, Jack Beeson, Chou Wen-chung, Franco Donatoni, and Henry Weinberg. Dr. Zahler has earned degrees from Columbia University (DMA), Princeton University (MFA), L'Accademia Musicale Chigiana (Certificato di Perfezionamento) Siena Italy, and C.U.N.Y. Queens College (BA/MA). His compositions are published by Associated Music Publishers (G. Schirmer, Inc.), American Composers Edition, and APNM music publishers. Recordings of his musicare available on the OPUS ONE, Centaur recording labels. His compositions have been performed by the American Composers Orchestra, The Arden Trio, The Charleston String Quartet, the Meridian String Quartet, the League of Composers/ISCM, the Center for New Music at the University of Iowa and other ensembles throughout this country, in Europe and Asia. In addition, Dr. Zahler is the co-author of three computer software programs including the Artificially Intelligent Computer Performer, Score Follow and Music Matrix. His writings on and about music include three articles in the New Grove Dictionary of Music and Musicians, six articles in the New Grove Dictionary of Music in the United States, a critical edition of Charles Ives'The Unanswered Question(Peer Southern Music Publishers, 1986), and numerous articles on music theory and composition, artificial intelligence and music, and computer music. Dr. Zahler was recently elected Vice President of the American Composers Alliance, and is listed in Who's Who in the United States.