

SuperConductors: Handbook for a New Democratic Music

by

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Timothy Lenoir

Dissertation submitted in partial
fulfillment of the requirements for the degree
of Doctor of Philosophy in the Department of
Music in the Graduate School
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2011

ABSTRACT

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Abstract

I am interested, broadly, in the relationship of aesthetics to politics. More specifically, I am interested in the importance of aesthetics to leftist political organizing, particularly in regard to music. This interest reflects my goals as a composer and as an activist, or, I should say, as a composer/activist: the project is the same—musical composition is a large piece of a larger puzzle.

SuperConductors explores the (structural) relationships between musical objects, their means of production, and the corresponding social formations. I am especially concerned with how formal aspects of a musical composition (which, for me, include the means of performance/consumption) reflect social relations, but more importantly also forge them. So: is there a way for me to write music that challenges dominant/hegemonic social relationships? Is there a way for me to write a more democratic music?

SuperConductors consists of three divisions. The introductory division discusses the theoretical background of the project and traces historical lineages of other music and art that have been influential to this project. The second division is comprised by a series of musical compositions devoted to exploring the political and aesthetic possibilities that arise from participatory music-making. The final division consists of an article examining the emergence of web-

based interactive music, pieces sometimes dubbed “sound toys”, as well as a series of my own pieces in this genre.

As a result of my work on this project, I have developed a paradigm for the production of democratic musical works through the discerning implementation of dynamically configurable forms; these principles, designed to facilitate the composition of new works in this style, are codified in a section entitled, “Guidelines for a new democratic music”.

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Any project with a strong conceptual component such as this one relies on aesthetic and intellectual input from outside observers; my friends Ignacio

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Preface

SuperConductors is a study of the liberatory political possibilities of interactive music. There are three main divisions. Division 0 concerns analytic aspects of the project. The largest division, Division 1, consists of a series of pieces composed that encourage collaborative music making in group settings. Finally, Division 2 consists of a discussion of and some example compositions of “sound toys”, interactive electronic music piece that can be accessed through a web browser.

Overall, the project includes some 14 musical compositions, with more than six hours of video footage documenting various performances.

Some highlights include:

- Guidelines for a new democratic music (Chapter 0.3)—a brief manifesto.
- Video overviews of the pieces of Division 1 (Chapter 1.a)—only available on the website version.
- “Playing with sound toys” (Chapter 2.1)—an article examining sound toys as a genre and the structural implications of their underlying technologies.
- Sound toys of my own composition (Chapters 2.2-2.6).

The *SuperConductors* project is documented most fully in form of a website; a

limited version appears online, with the full version available either on a set of DVD-ROMs or on the Duke University Libraries servers, as part of the official submission to the Duke University Graduate School. This document is a compilation of the various texts from that documentation; however, many documents associated with this project (listed altogether in Appendix a.2) are only available on the disc version. Please contact Duke University Libraries or Benjamin Crawford (Benito) for access to the additional resources.

0.0 Project overview

I am interested, broadly, in the relationship of aesthetics to politics. More specifically, I am interested in the importance of aesthetics to leftist political organizing, particularly in regard to music. This interest reflects my own goals as a composer and as an activist, or, I should say, as a composer/activist: the project is the same; musical composition is a large piece of a larger puzzle. This project explores the (structural) relationships between musical objects, their means of production, and the corresponding social formations. I am especially interested in how formal aspects of a musical composition (which, for me, include the means of performance/consumption) reflect social relations, but more importantly also forge them. The *SuperConductors* project is animated by this concern: is there a way for me to write music that challenges dominant/hegemonic social relationships? Is there a way for me to write a more democratic music?

To further this goal, I explore ways of developing musical spaces that are “interactive” — that is, dynamically determined in real time, with listeners taking part in the production process. These spaces are meant not only as a critique and a disruption of the traditional production model of Western music but also as an attempt to facilitate the formation of a new mode of production, a new set of

sociopolitical relations. Thus, I am interested in developing a paradigm for the production of democratic musical works through the discerning implementation of dynamically configurable aesthetic forms, which I codify in “Guidelines for a new democratic music” (Chapter 0.3).

The musical compositions of the *SuperConductors* project are organized into two main divisions: one comprised by a series of musical compositions devoted to exploring the possibilities (especially political ones) that arise from participatory music-making; the other a series of web-based interactive musical works in an emerging genre sometimes dubbed “sound toys”, together with an article examining the emergence of that genre.

Division 1 is an examination of the compositional possibilities for real-time audience interaction in group performance settings. Through a series of pieces, I explore different ways of structuring musical material and interfaces for its manipulation by participants. For the most part, these pieces invite audience members, or those who are not in a traditional performance role, to collaborate with live instrumentalists in order to produce a sonic realization of the work. In *Morals* (Chapter 1.1), audience members can move amongst an ensemble that is playing an intricate rhythmic texture; interacting with individual players therefore changes the texture as a whole. In “*You don’t understand—these boys*

killed my dog." (Chapter 1.2), listeners are invited to manipulate the real time processing of live sound with motion-sensing video game controllers; these controllers are used more extensively in two additional projects (Chapter 1.3). In *Checkmate* (Chapter 1.4), three "audience members" — an admittedly liberal use of the designation in this case, as they might be selected well before the performance — are asked to serve as individual conductors for the instrumentalists of a string trio. The final sonic product is thus a product of a distributed collaboration. *A Cookbook for Life* (Chapter 1.5) introduces the possibility of using a web page as an interface for real-time interaction with performers, whereas *Rules* (Chapter 1.6) relies on audience members physically moving cards between different instrumentalists in order to influence what they play. Finally, *SuperConductors Beta* (Chapter 1.7) incorporates aspects of many of these earlier pieces, especially returning to and developing the idea of using a web interface in real time (as in *A Cookbook for Life*).

Division 2 of the *SuperConductors* project is a brief study of "sound toys" — interactive electronic pieces designed to be experienced through a web browser. In an article titled "Playing with sound toys: browser-based participatory music and the categories of new media music production" (Chapter 2.1), I seek to provide an initial description of the genre as well as to analyze and critique its

formal conventions, particularly in their treatment of time. The division concludes with five sound toys of my own creation that explore other modes of temporal structuring: *Twos & Threes*, *The Brightness of Space*, *ExtraVerby*, *War & Peace*, and *Intensified Loops*. The division concludes with a description of Beads (Chapter 2.7), the open-source Java sound library that I used to write my own sound toys (and of which I am also a co-developer); the possibilities of such open-source, platform-independent audio production is demonstrated in a rudimentary browser-based live coding environment.

0.1 Introduction to the problem

Every day we encounter more and more information, via an ever-expanding mediascape. On the one hand we might understand much of this media to be increasingly corporatized: mainstream media sources as well as many newer, internet-based sources are being “monetized” and utilized for the benefit of corporate and state power, whether it is *Fox News*, CNN, or *The New York Times* online. On the other hand, we see that internet technology has prompted a birth of citizen-generated content, in the form of Wikipedia, blogs, and Twitter and other social media. Thus, while capitalist interests are colonizing many media forms, they are at the same time being resisted by a movement that seeks to remind people that they can themselves be the authors of content; that they needn’t passively accept the information they receive; and that all information is produced by humans, and should therefore be interrogated rather than accepted outright.

Concert music (the music of the “classical” tradition), however, and indeed most Western musical production, remains rooted in an archetypal production model that is fundamentally one-way: the composer transmits a work to performers (via a score), who then perform to the passive consumer-listeners. My project seeks to disrupt the linearity of this production model through the

distribution of authorship across people in these various positions.

In disrupting this production model archetype, this project effectively develops a democratically produced music. By “democratic” I do not mean that all participants are equal (since different participants necessarily possess different types of knowledge and skills); rather, I mean that all participants—composer, instrumentalists and audience—actively negotiate their role in this production process. Dialogue about how one participates is thus fundamental to the nature of this music; the specific processes of interaction and participation, and their sociopolitical ramifications are therefore the crux of each piece. In the end I hope to encourage and inspire people to not only think of musical performances as something in which to actively participate rather than something to which to listen passively, but to think of their larger social situation in similar terms.¹

Though this dissertation project should be understood as deeply and fundamentally critical of the way in which Western concert music has been and continues to be produced, I do not wish to dismiss this tradition altogether.

1 “The backdrop against which art now stands out is a particular state of society. What an installation, a performance, a concept or a mediated image can do is to mark a possible or real shift with respect to the laws, the customs, the measures, the mores, the technical and organizational devices that define how we must behave and how we may relate to each other at a given time and in a given place. What we look for in art is a different way to live, a fresh chance at coexistence.” Brian Holmes, “The Affectivist Manifesto”.

Rather, I seek to understand this tradition as an important type of “musical knowledge.” It should be valued highly—but not necessarily to the exclusion of other kinds of musical knowledge that the audience may possess. By “musical knowledge”, I mean the set of musico-aesthetic experiences, values, and skills accrued through an individual’s lifetime. The fundamental challenge of creating a democratic musical space, then, is in finding ways to productively combine these different sets of musical knowledges, valuing and utilizing the potential of refined Western musical training alongside different sets of musical knowledges.

Furthermore, I do not argue that this kind of music-making should altogether replace the traditional model; in fact, I believe strongly that there is much left to be done in the composer-as-auteur mold. However, I contend that the establishment of a democratically produced music tradition, in which listeners are able to take an active role in musical production, will only augment the understanding and appreciation of traditionally produced works, as listeners will become more critically engaged with music and its production in general.

0.2 Lineages and formal techniques

Though I am attempting to develop musical form that contests traditional production models of Western concert music, I have at the same time been inspired by and influenced by many historical precedents. In some instances, these examples influenced my work in general; in other instances, these examples served as specific formal influences on my compositional project. They can then be roughly divided into two groups (though some straddle this division): “participatory” art and music, in which a central concern of the work is the participation of viewers or listeners; and non-linear or indeterminate music, in which key aspects of the musical performance are not firmly determined by the composer.

Participatory Art and Music

I am interested in participatory music because of its role in building community. Thomas Turino, for instance, has demonstrated the strong role that music played in developing a sense of community in both the rise of National Socialism and the American Civil Rights Movement of the 1960s¹. Of course, music has been understood to play a key role in many types of communities in many cultures, such as in the Roman Catholic Church or in Jewish rites, in rock

1 See Chapter 7, “Music and Political Movements”, in Thomas Turino’s *Music as Social Life*.

clubs² or country bars³, or with national anthems at sporting events.

However, some forms of participatory musics are particularly interesting in this light because of the way in which their formal structures reflect a social value placed upon many individual parts contributing collaboratively to a final product. In particular, I have been influenced by West African drumming (primarily from Mandingue groups) and Afro-Cuban percussive practice, both of which I have studied as a performer for some years. Both traditions are highly poly-rhythmic, so that each player has a part that is both independently audible and also necessary for the synthetic whole. Polyrhythm has consequently been a frequently used strategy in my own music, as I have employed it as a means of balancing the contributions of individual actors (whether instrumentalists, computer programs, or audience members) against that of the larger group.

I have also been influenced by non-musical art that is interested in participation. In the work of Bertolt Brecht, the audience is often directly engaged as in his famous “breaking of the fourth wall”; Brecht’s techniques are meant to stimulate the audience to think critically about and ultimately challenge the social relations in which they live.⁴ The ideas of the artist Joseph Beuys have

2 Dick Hebdige, *Subculture: the Meaning of Style*.

3 Aaron Fox, *Real Country: Music and Language in Working-Class Culture*

4 For a good overview of Brecht and his work, see Sean Carney’s *Brecht and Critical Theory: Dialectics and Contemporary Aesthetics*.

also proven influential, particularly his articulation of the concept of “social sculpture”, in which larger social formations are themselves understood as works of art with individuals acting creatively in their constitution.⁵ This notion of Beuys’ can be understood to be of fundamental importance to my project: a statement that the end goal is not some particular configuration of sonic events, but rather a social experience or situation.

Finally, I am indebted to Augusto Boal’s “Theatre of the Oppressed”, a theatrical method he first developed in the 1960s.⁶ Boal’s technique in this practice involves inviting the audience to actively construct the dramatic content of his theatrical works; audience members are given the opportunity to discuss and negotiate how the dramatic narrative will unfold. Of course, music often lacks such explicit narrative connections to sociopolitical issues, so I did not directly adapt Boal’s ideas to my project. However, it serves as an important complementary step to Beuys’ social sculpture: first, we see that sociopolitical relations can serve as a medium for aesthetic production; next, we see that such production should be taken on by the people themselves.

5 For a detailed discussion of Beuys’ work, see Caroline Tisdall’s *Joseph Beuys: We Go This Way*.

6 See Boal’s own book, *Theatre of the Oppressed*. A nice collection of essays on Boal’s method can be found in *A Boal Companion: Dialogues on Theatre and Cultural Politics*, edited by Jan Cohen-Cruz and Mady Schutzman.

Music developed in non-linear structures, indeterminate music, and music with “open form”

There are many composers in the Western classical tradition who have explored the use of indeterminacy and open forms. I am interested in their works, because they suggest musico-formal techniques that allow for audience manipulation of the ultimate sonic result. Ironically, the first encounter that I had with a non-linearly structured work was with Pierre Boulez’s *Third Piano Sonata* (1963)⁷—ironic because Boulez might well be a standard-bearer for a High Modernist auteurship to which I am particularly opposed. In this piece, the pianist is given great latitude to order a collection of modular musical sections so that each performance may be a unique experience. The second “formant”⁸, “Trope”, consists of four sections that may be played in a variety of orders depending on the performer’s preference; meanwhile, the third formant, “Constellation”, is made up of a more elaborate maze of short notational fragments that must be navigated by the player.

Boulez’s work with indeterminacy (he dubbed it “stochastic music”), however, was preceded by that of John Cage⁹. Starting in the 1950s, Cage began

7 In fact the *Third Piano Sonata* has never been properly completed; the two movements cited were published in 1963, while three others remain unpublished.

8 Rather than ‘movement’, Boulez uses the term ‘formant’ to describe large formal divisions in the piece.

9 Famously, Boulez and Cage were friends and artistic colleagues until Boulez at once dismissed indeterminacy in general—indirectly but firmly criticizing Cage’s music—while at the same time claiming it as his own.

exploring musical forms that depended on so-called “chance procedures”; in *Music of Changes* (1951), for example, the performance is determined through “random” decisions made using the *I Ching*. Though each of them opened their work in very different directions—Boulez to the virtuosic performer, Cage to the cosmos—each dealt with the same problem on the level of craft: how can one structure a work outside of a strictly linear specification and still make it “work”? That is, how does one make it so that the work succeeds according to some given aesthetic criteria?

Though the techniques of each composer have proven influential to my work, the connection to Boulez’s piano sonata is the most clear. The modular construction of his work is in many ways similar to the way in which I stitch together musical fragments (or rather, allow the audience to do so) in many of these works: *Checkmate* (Chapter 1.4), *Rules* (Chapter 1.6), and *SuperConductors Beta* (Chapter 1.7) all use like techniques.

I have also been engaged by the work Witold Lutosławski, particularly in regard to his works involving chance. *Jeux vénitiens* (1961) and *String Quartet* (1964) in particular were useful demonstrations for how large scale forms could be shaped around an indeterminately asynchronous polyphony. Both *A Cookbook for Life* (Chapter 1.5) and *SuperConductors Beta* (Chapter 1.7) incorporate such an

asynchronous approach. Though they are not known for open forms, I should mention also the work of Krzysztof Penderecki and György Ligeti; each were adept at finding other ways of thinking about larger formal structures. In particular, Ligeti's use of *micropolyphonie* in *Atmosphères* (1961) and *Lontano* (1967), though strictly specific in its notation, raised the potential that the formal structure of instrumental music could focus not on a dependence on individual melodic lines but on the larger amalgamation of sound.

Another strain that has proven influential to my work can be traced to the Fluxus movement of the 1960s.¹⁰ Fluxus often featured musical performances that were defined not by score and traditional notation but by series of written instructions. Furthermore, Fluxus works often emphasized a "do-it-yourself" attitude toward artistic production.¹¹ The legacy of this practice can be traced to the "game pieces" of Christian Wolff and John Zorn. In Zorn's most famous work in this genre, *Cobra*, musicians in an ensemble perform their parts in accordance with instructions written on randomly organized cards as well as in response to one another's decisions. These pieces, both from the Fluxus movement and the later game pieces, are organized primarily by a set of rules rather than a linear score. Studying these pieces has helped me devise new strategies for structuring

10 For a nice overview of Fluxus and its aesthetic interests, see Jon Hendricks' *Fluxus Codex* and Thomas Kellein's *Fluxus*.

11 See Anna Dezeuze's *The "Do-It-Yourself" Artwork: From Fluxus to New Media*.

musical compositions and for giving audience members a chance to participate.

One composer in particular who has been influential on my work has been Pauline Oliveros—especially one of her more striking pieces, *Worldwide Tuning Meditation*. In this piece, each audience member is asked to sing sustained tones according to a few simple rules. The various voices of the audience combine to produce a generative performance which allows individuals to make active, independent decisions while still feeling a sense of group cohesion.

Another strain of musical thought, more prosaic than the previous examples, has been a general move amongst some composers toward simpler and less specific notation; the logic of this mindset is argued articulately, if polemically, in Kyle Gann's "The Case Against Over-Notation: a Defense and a Diatribe"¹². Among other things, Gann argues that a modernist insistence on notational specificity and complexity is reflective of a composer's need to control every aspect of a performance; choosing less specific notation, or simply using less of it, can therefore be a way in which the performer is invited to make useful interpretive decisions about a work's performance. This thinking was something I was interested in well before this dissertation project; the impulse can be seen very strongly in my more recent linear pieces, such as *REEEEEEEEEEMIX* (2010),

¹² Kyle Gann, "The Case Against Over-notation: a Defense and a Diatribe".

Adali, which means justice (2007), and *Most People Talk A Lot; Few are Up for the Moment. Welcome to Anarchy 99.* (2005), but also in nascent form in earlier works like *Incantation: Bound in the Shape of an L* (2004) and *Cello Sonata* (2004).

Finally, I, like many composers of my generation, have been profoundly influenced by minimalism and procedural music. In many cases, this music is based on repetitive musical sections that allow it to change fluidly over long spans of time. This strategy is useful for my project because it allows the possibility of musical “stasis”, which consequently allows for more flexible ways of engaging the audience: rather than having to make decisions based on a strict, linear time structure, audience members make decisions more freely, thereby structuring their own sense of musical time.

The possibility of “translating” existing open musical forms to fit my project

I have explained that the formal innovations of composers writing indeterminate or open musical works has proven useful in developing my own interactive musical forms. It is worth, pointing out, however, that many of these works from which I’ve drawn could be easily altered to fit my own political/aesthetic interests. In essence, one simply needs to offload the mechanism of change (whether programmed, made by the performers

exclusively, or left to chance) to choices made by the audience. Done carefully, such an alteration would result in a highly collaborative and democratic musical experience.

This principle could be generally applied to a large number of minimalist pieces. For instance, I could easily imagine “re-scoring” Terry Riley’s *In C*: the piece is written for an unspecified ensemble; each player progresses through a series of 53 melodic cells that are each to be repeated a number of times determined by the individual player. Because different players change which cell they are playing at different times, a complicated overlapping texture is formed across the entire ensemble, one that nevertheless evolves in a predictable way over the course of the performance. To adapt *In C* to my project, one could simply shift some or all of the indeterminacy from the players’ choice to the audience; rather than having individual performers decide when to proceed from cell to cell, they might do so based on indications from audience members. Other factors, such as dynamics, articulations, tone quality, and perhaps register, could similarly be indicated to individual instrumentalists in real time.

One could apply a similar transformation to other pieces as well. Both John Adams’ *Phrygian Gates*, which modulates slowly through Phrygian modes along the cycle of fifths, and his *China Gates*, which alternates between closely related

modal areas, could be changed so that the music would proceed through its modulations according to audience decisions. Similarly, Steve Reich's *Four Organs* could be altered so that the length of each (near-)repetition would depend on some audience determination. And almost any of Reich's other process-based pieces would also be easily translatable, e.g. *New York Counterpoint* and *Vermont Counterpoint* (in which the normally pre-recorded background parts could be (re-)recorded and introduced into the texture on the fly), *Drumming* (with phasing changes and Reich's additive/subtractive rhythmic processes being initiated from audience input), or even the more austere pieces *Music for Pieces of Wood* and *Clapping Music*.

In each case, the grand formal design that makes the piece powerful—the careful long-term timing of each subtle change—would be sacrificed for the unpredictable results the audience might bring. Depending on how one values these pieces, of course, such a transformation would either be disastrous or appropriate: if one believes that the composer's imposed procedural structure is indeed the heart of the work, then no doubt one will be left disappointed at its removal; however, if one understands instead that the rich possibilities of formal change prescribed by the composer are in themselves to be valued, then one will delight in their (re-)manipulation through group participation.

0.3 Guidelines for a new democratic music

Over the course of the project I have been able to codify a set of principles for making music in this style. A few of these principles were explicit premises from the beginning of the project, but many of the others were developed through the course of writing the various pieces. Some of those in the latter category are explicit statements of approaches that I had been implementing intuitively and came to understand more fully through the process of writing; others, however, are revisions and refinements of techniques that I developed as a result of lessons learned through the process: aspects of works that came up short or, in some cases, accidentally succeeded, prompted me to amend my thinking about how to approach writing music that succeeded both aesthetically and politically.

Many of these guidelines are elaborations of former ones; each is meant to address a particular concern in the general problem of how to make a democratic interactive music. They are stated here as a succinct list; each is explained in more detail afterward.

- Make music that is “interactive”: dynamically configurable by instrumentalists and audience members in real time, during the performance.
- Make sure people know that it’s interactive.

- People should be able to understand a causal relationship between what they are doing and the musical sound that is produced.
- People should be able to understand the mechanism of interaction, the interface, to the point that they are able to make conscious, intentional aesthetic choices.
- People should be able to make choices that have significant musical results.
- Corollary: the possibility of “bad” choices is a good thing.
- Strive to provide choices to the audience that are open-ended rather than constrained to a few set possibilities.
- Explain to people the choices that they are not able to make “within the system” – the structural limitations that the composer has erected to facilitate the performance.
- Ideally, the sonic result should reveal the consequences of choices made both by individual actors and by the larger group.
- Find ways of building on a wide range of musical knowledge, so that people from many backgrounds might productively contribute to the result.
- Corollary: minimize the requirement of any narrow range of musical

knowledge, to maximize accessibility.

- Strive to create welcoming spaces for interaction so that audience members can participate comfortably and freely.
- Do-it-yourself (#1): emphasize reproducibility by capitalizing on familiar, existing materials, in terms of instruments, software and hardware, and possibly even musical genres and styles.
- Do-it-yourself (#2): encourage and inspire others to create dynamic participatory musical experiences.

Make music that is “interactive”: dynamically configurable by the performers and audience in real time, during the performance.

This guideline, of course, is the premise for the entire project. Implementing a system in which the audience plays a role in what musical sound is produced disrupts the traditionally one-way production model of Western concert music (that is, composer-performer-listener). In a world in which the production and distribution of information and media are at once being heavily distributed to the populous (via YouTube, Twitter, etc.) and also being controlled and monetized more insidiously by powerful institutions (increased US government secrecy, Fox or any other mainstream news outlet, etc.), it is of fundamental necessity to remind people that any knowledge, whether political, social, aesthetic, musical,

needn't be accepted automatically, but rather should be engaged, debated, and critiqued.

In the specific case of musical performance, listeners are to be given agency in what sound is made. Ultimately, if people understand that they can have a say in how a piece of music works, why couldn't they then also have a say in how their society works?

Make sure people know that it's interactive.

It would be hard to imagine constructing a piece that depends on people's input and then neglecting to mention it to them, but this guideline is worth stating explicitly, even if just for the sake of completeness. It does raise a couple of interesting possibilities, though. First, what if one didn't tell the audience, or only told them afterward? Could this be done in a critical or satirical way? Second, perhaps the knowledge that a musical performance was interactive could be slowly revealed, *during the performance*. There is a gesture toward this in “*You don't understand—these boys killed my dog.*” (Chapter 1.2), in which I exposed the interactive nature of the piece (using WiiMotes to manipulate live processing) by first demonstrating it myself after the piece had already started; the audience realized what was going on from watching me, and having me explain to them the mechanism as I led them up to the stage to participate. However, another

possibility would be to construct a musical environment where the dependence on audience input would just be discovered autonomously by audience members, and explored without any explicit prompting on the part of those in the know.

People should be able to understand a causal relationship between what they are doing and the musical sound that is produced.

It is not enough for music to be produced from audience input; the audience also has to be able to perceive a connection between what they do and the sonic result. Take, for instance, a hypothetical piece in which a webcam is used to capture images of the audience, and then, after some processing of those images, the resultant data is used to produce complex electronic sounds. It is easy to imagine such a piece being implemented in a way in which the connection between the state of the audience and the produced sound is not particularly apparent.

Such a piece would severely limit its democratic potential. If people cannot discern a relation between their own actions and the musical product, then the sociopolitical implications of the work are only as deep as the audience's trust in the composer's word that their input does, in fact, matter: an intellectual understanding at best, rather than an experiential one. When people can see the

results of their actions they better understand their involvement and are more engaged as actors, emotionally or otherwise.

People should be able to understand the mechanism of interaction, the interface, to the point that they are able to make conscious, intentional aesthetic choices.

If members of the audience can tell that the music is responding to their actions, but cannot understand much beyond, “if I do something, something happens”, then they are not able to make choices that they care about; their choices have no *meaning*. If, on the other hand, audience members are able to reach a point of, “ah, I see, when I do this one thing, I get this result, and if I do this other thing I get another result”, then they are then able to decide what action they will perform according to the sonic results that they desire. At this point, they are truly playing the role of composer: listening, deciding what they want to hear next, and producing that result.

There are two ways to achieve this goal, which may be used independently or in tandem. The first is to tell the audience what the result of certain actions will be. For instance, in *Rules* (Chapter 1.6), the audience voted on the ordering of modular formal sections before the piece began; their decisions were based on written descriptions of the sections on their ballots. Similarly, in the first (and

also last) movements of *SuperConductors Beta* (Chapter 1.7), audience members voted during the performance, through the browser interface, on what they wanted to happen next.

The second approach to fostering an understanding in the audience of the musical results of their actions is to allow them to make the same choices several or many times, and to ensure that similar results correspond to similar input. This approach can be seen in all of my pieces, including other aspects of the pieces named above.

Of course, it may well be the case that using both techniques fosters the best understanding on the part of the audience as to the consequences of their decisions.

People should be able to make choices that have significant musical results.

If an audience member is able, through their input, to produce a planned sonic result, but that result is inconsequential to the overall sound of the piece, then their authorship is superficial, as will be the political import of the work.

The audience must be able to make choices that are musically significant, so that their choices have deeper meaning. Of course, what counts as 'musically significant' depends on one's point of view. But the audience must be allowed to

make such decisions, regardless of which specific kinds of musical changes are ultimately deemed significant.

Naturally, not every significant decision can be made by audience members. But at the same time, large portions of a piece that are strictly set should be avoided. In my own pieces, I usually provide most of the melodic, rhythmic, and harmonic material as a base from which the audience can work, whether they are specifying formal arrangement, orchestration, or combinations of melodic / harmonic material.

Corollary: the possibility of “bad” choices is a good thing.

Composers are naturally interested in producing the best result possible. But for a musical work to be democratic, it must take seriously the decisions of audience members that may differ greatly from the composers’ learned inclinations. There are two major reasons why opening things up the and allowing sonic possibilities that might not be traditionally desirable is in fact a necessity:

First, the notion of what makes a decision “good” or “bad”, while possibly generalizable across a cultural space, should in any case not be assumed to be uniform in your audience. For the audience to have more freedom in their choice

—for them to not be “told” what is good by the composer— they must be allowed to make choices that they think are good ones, even if the composer doesn’t agree.

Second, and perhaps most importantly: *it is acceptable to make bad decisions*— especially when one is making them for the first time. It is reasonable that the composer, who has set up much of the behind-the-scenes technical apparatus of the piece, might have structured it so as to “encourage success”—by structuring the piece so that most orchestrational possibilities are somewhat balanced, for instance. But the more the composer takes away the possibility of failure, the more it cheapens the value of the audience’s decisions: how meaningful is a particular choice if all possible results are “good”?

(Of course, one could argue that many meaningful choices are “only a matter of taste” and not ultimately “good” or “bad”...)

Strive to provide choices to the audience that are open-ended rather than constrained to a few set possibilities.

When there are only few discrete options available, choices between them become simply a matter of preference for one prescribed musical option over another, which in turn lends itself to the “menu-logic” critique of Lev Manovich¹.

1 Manovich argues that interactivity based around a discrete set of possibilities creates the illusion of freedom but in fact forces the user through the cognitive structure of the author.

If, on the other hand, choices are open-ended, then choices involve a much greater degree of creativity on the part of the audience.

“Open” options that I’ve used include textual instructions (in *A Cookbook for Life*, Chapter 1.5), “analog” gestures, whether communicated visually (in *Morals*, Chapter 1.1, and *Checkmate*, Chapter 1.4) or through an electronic input (in “*You don’t understand—these boys killed my dog.*”, Chapter 1.2 or the WiiMote-based pieces of Chapter 1.3).

However, openness can also be cultivated through the complexity of combining multiple simple options. Even if a single decision has only a few possibilities, the overall palate can quickly become quite rich when combined with other elements. For instance, in *Rules* (Chapter 1.6), most of the interaction is centered around dynamic orchestration, in which audience members determine which of four abstract parts each instrumentalist will play. So, for each player, there are only four options. But, since each of the eight players has 4 options, that leaves 65,536 orchestrational possibilities—any of which may be selected at any moment. (It should be noted that in the Duke New Music Ensemble performance of the piece, the options were limited somewhat by a restriction on the number of cards available; in that case, there were something

Lev Manovich, *The Language of New Media*, 128.

more like 1,152 combinations possible.²⁾

As the range of possibilities becomes wider, the creative potential of the audience becomes richer. In the premiere performance of *SuperConductors Beta* (Chapter 1.7), I alluded to the fact that it was Election Day (November 2, 2010) to perhaps draw attention to one of the points of the piece. In *SuperConductors Beta*, the outer movements are driven by simple group decisions in which members voted between a series of two possibilities. In the inner movements, however, the options were much more open. I was aiming to dramatize the difference in quality between the two kinds of decisions, and I found it fitting that the performance would take place on a day in which we were given the opportunity to shape our government, and yet were (for the most part) only allowed to choose between two fairly similar political positions.

Explain to people the choices that they are not able to make “within the system” – the structural limitations that the composer has erected to facilitate the performance.

Consider that much debated formulation of Karl Marx: “men make their own history, but they do not make it as they please.”³ For an interactive musical work,

2 Because there were 3 “melody” cards, 3 “bass” cards, 2 “counter-melody” cards, and 2 “accompaniment” cards. Thus, for eight players, there are (at least) $4 \times 4 \times 3 \times 3 \times 2 \times 2 \times 2 = 1,152$ possibilities.

3 The whole quote is: “Men make their own history, but they do not make it as they please; they do not make it under self-selected circumstances, but under circumstances existing already,

structures put in place by the composer define the conditions of possibility for democratic participation. Thus, these structures should be highlighted for members of the audience in order to foster critical thinking about the implications of those structures.

Structural limitations are a necessary and enabling part of the work, of course; without them, there would be no defined work, strictly speaking. (And remember, too, the potential dangers of completely smooth space: fascism, the heroin addict, etc...⁴) Some may have more drastic political implications than others; but in any case, decisions about limiting material or processes should be explained, even (or perhaps especially) if they are made primarily for aesthetic reasons, for it is these reasons that may prove most insidious and counter to an egalitarian and democratic performance. A democratic work is at once proposing a new sociopolitical formation and reflecting that of its production; the best political works will therefore not only create new democratic spaces but also actively encourage their own critique.

Ideally, the sonic result should reveal the consequences of choices made both by individual actors and by the larger group.

When audience members participate in an interactive musical work,

given and transmitted from the past." Karl Marx, *The Eighteenth Brumaire of Louis Bonaparte*.

4 From Gilles Deleuze and Felix Guatarri, *Milles Plateaux*.

they are at once individual actors with individual aesthetic preferences and members of a larger group. Because of the nature of music—because it is based in sound—the sonic results of an individual’s decision will reach the whole group; similarly, group decisions shape the aesthetic experience of the individual. Critical thinking about this relationship needs to be fostered; people need to be able to negotiate productively between their individual aesthetic desires and that of the larger group. Insofar as the musical structure is concerned, people should feel both as though they have an individual part in the musical production—that some of their individual actions have specific sonic results—but also as though they are making collective aesthetic decisions.

In many of my pieces, I encourage people to talk during the performance, in order that they can share their thoughts about the possibilities of interaction. Further, in the two pieces that use browser-based programs (accessed on laptops) as the primary interface (*A Cookbook for Life*, Chapter 1.5 and *SuperConductors Beta*, Chapter 1.7), I chose to incorporate a chat window directly into the main view of the interface; that way, participants could actively discuss the decisions as they were being made.⁵

5 The audiences differed greatly between the performances. For the performances of *A Cookbook for Life* (Chapter 1.5), chatting was more reserved and more specifically directed at the performance; perhaps this was due to the more complicated interface. The performance of *SuperConductors* (Chapter 1.7), on the other hand, elicited not only lots of passionate remarks about which choices to make, but also an active and ribald side commentary.

Find ways of building on a wide range of musical knowledge, so that people from many backgrounds might productively contribute to the result.

The aim of this project is to democratize musical performance by changing the mode of its production; so in particular, in order to make serious claims about the democratic nature of this music, interactive music must account for those not trained in the classical tradition.

Each person has a different set of musical knowledge, accrued through a lifetime of listening, considering, debating, performing, and perhaps writing, but only some of these knowledges are privileged in the traditional production model of classical music. It is perhaps tempting, then, as this project is also a critique of that production model, to throw away all vestiges of the classical tradition and start anew. But this would be a waste of great talent: surely the violinist who has spent years of her life playing scales, perfecting her intonation, etc., surely her highly refined skills can be used productively.

What is needed is a way to utilize this skill in collaboration with other musical knowledges. A member of the audience that, say, has a deep understanding of Afro-Cuban music but little to no understanding of concert music may still be able to contribute fully to an interactive musical performance; the mechanism of interaction, then, must allow both the useful expression of

non-classical musical knowledges to the classically trained instrumentalist and also the expression of the instrumentalists' knowledge back to the listener, so that a truly collaborative aesthetic product is produced. (And the same would apply vice versa: non-classically trained instrumentalists should be able to interact productively with classically trained audience members...)

Successfully implementing such a mechanism of knowledge transmission has a pleasing side effect: as different musical knowledges are exchanged, participants (including both instrumentalists and audience members) encounter the aesthetic perspectives of those around them, and so gain greater understanding of the larger group. Thus, participating in a collaborative interactive work becomes a pedagogical experience.

Corollary: minimize the requirement of any narrow range of musical knowledge, to maximize accessibility.

This guideline is implicit in the previous one, but worth stating explicitly. It is not enough that rich participation in the musical experience is not exclusive to those with classical training; every effort should be made, in fact, to include people from as many different backgrounds as possible. To facilitate a more general accessibility, the extent to which the interface presumes certain kinds of knowledge must be limited. To this end, a degree of explicit pedagogy might

take place, explaining terms and concepts that may not be understood by all. For instance, in *Checkmate* (Chapter 1.4), the three conductors were shown, during rehearsal, a range of different possibilities for producing sounds on string instruments; they were then able to employ these sounds in their performance. *A Cookbook for Life* (Chapter 1.5) and *SuperConductors Beta* (Chapter 1.7) provide a different example, as each explained concepts both in the browser interface as well as in a choreographed introduction of the instrumentalists—anyone who didn't know what a viola was, say, could find out at the beginning of the performance.

Strive to create welcoming spaces for interaction so that audience members can participate comfortably and freely.

Music that does not encourage participation has limited democratic potential; such cases foreground the participation of those privileged by dint of status or training.

Many factors may contribute to a sense of openness. Some are spatial: the nature of the venue (concert hall vs. rock club vs. street corner), its location (the socioeconomic characteristics of the neighborhood, perhaps), the arrangement of the performance space (is there a stage? is the audience sitting?). Other factors involve audience members' individual lives: the time of performance (will they

have to work the next day?) and the range of audience members present (will your boss see you?).

Of course, there may be many other factors that will determine the welcoming nature of a piece; each performance must be evaluated individually.

Do-it-yourself (#1): emphasize reproducibility by capitalizing on familiar, existing materials, in terms of instruments, software and hardware, and possibly even musical genres and styles.

A do-it-yourself aesthetic demonstrates that this music is not the product of elite privilege but rather something to which everyday people can relate. Using standard instruments, off-the-shelf and standard hardware, and free and/or readily available software emphasizes the democratic nature of this music: because these materials are known and familiar, it lowers the boundary to interaction, which increases the intimacy of the interaction. Furthermore, it drives home the point that it doesn't take rarefied technology to have a democratic experience; it only requires putting together known technologies in the right ways. Similarly, employing musical gestures that are somewhat familiar to the audience may have a similar effect, though it is also reasonable to allow that it could also be accomplished through the musically new.

Several pieces from the first part of the project use Max/MSP for electronic

sound production, which has the advantage both of being fairly familiar to the electronic music community at large and also having a free runtime-only version. However, I decided to move to a Java-based sound solution for *SuperConductors Beta* (Chapter 1.7): the fact that the server program (which also generated the electronic sound) meant that it could, if desired, be run off a flash drive on almost any computer. Java was also the platform of choice for the browser-based pieces of Chapter 2. For audience interfaces that did not need to produce sound, I tended instead to use the Adobe Flash platform; though it is proprietary, its player is free and widely installed, and it is particularly adept at supporting robust user interfaces.

For those pieces that use hardware, I used WiiMotes for motion sensing (a well-known video game controller), a relatively cheap audio interface and mixer, and a Dell laptop running Microsoft Windows. And of course, for *A Cookbook for Life* (Chapter 1.5) and *SuperConductors Beta* (Chapter 1.7), the audience was able to bring their own laptops to access the interface.

Finally, as far as musical materials go, I have often tended toward the fairly conventional. Most textures incorporate melodies and bass lines, in meters with clear (if sometimes complex) rhythmic profiles. Pitch material is often consonant, and the harmony, is related to, if it is not exactly, tonal harmony.

Do-it-yourself (#2): encourage and inspire others to create dynamic participatory musical experiences.

A garment needn't be poorly made to show its seams. Openness and clarity about how a work is made empowers people to build upon it, borrowing its ideas and developing its techniques. It should not be insulting to hear someone remark, "I can do this!" or even "I can do this better!" Rather, it should be understood as a statement of the success of the work: it has spurred that person to imagine her own creative potential. If the goal of the project is to create a democratic music, which might then contribute to a more democratic society—a music in which all are encouraged to take up the mantle of content producer—then instigating others to create similar works, to copy, to elaborate, must be understood as a fundamental success.

1.0 Division 1 summary and first steps

Division 1 consists of a series of pieces that explore ways of creating participatory musical structures that encourage collaborative music-making in group settings. Most of these pieces make use of live instrumentalists, with the exception of the two projects in Chapter 1.3, *Mambo Relacional* and *VocalGraffiti*.

My initial attempt at composing pieces in this vein was titled, *SuperConductors* (though I've since renamed it, *SuperConductors Alpha*.) This piece was composed as part of my preliminary doctoral examination process and was intended to demonstrate my competence in this experimental style of composition.

The harmonic material was specified by the exam prompt, as was the instrumentation. *SuperConductors Alpha* is scored for two pianos, with two conductors collaboratively directing the pianists in order to navigate an open musical form. The piece was first performed by my committee during the oral part of my examination, with Stephen Jaffe and Scott Lindroth playing piano and Tim Lenoir and Louise Meintjes conducting. (Unfortunately, no footage of this performance exists.)

The following compositions, then, are subsequent explorations of the possibilities of this general concept.

Documents

- *SuperConductors Alpha* score (PDF)

Contents

- 1.1 *Morals*
- 1.2 *“You don’t understand — these boys killed my dog.”*
- 1.3 Further experiments with WiiMotes
- 1.4 *Checkmate*
- 1.5 *A Cookbook for Life*
- 1.6 *Rules*
- 1.7 *SuperConductors Beta*

1.1 *Morals*

The full title of this piece is:

“If it’s controlled by moral people, then it’ll be moral.”

“Oh I know I’m not moral.”

“As a matter of fact, I should be arrested for the thoughts I have now.”

Description

This piece allows the audience to interact with an ensemble of acoustic instrumentalists. It is currently scored for a 6-person ensemble, though the piece does not depend on any particular instrumentations. The players are to be spread across the performance space so that the audience may move freely through ensemble while the instrumentalists are playing.

Morals creates a repetitive but constantly varying sonic base; as they make their way through the array of sounds, audience members are able to interact with individual instrumentalists to change details of the musical texture, thus contributing to the whole.

To achieve a constantly (if slowly) evolving sound world, each player reads from a dynamically organized part that was displayed on that player’s laptop. Pitch and rhythmic material is organized into numerous “chunks” that are displayed on the players’ screens in a dynamically determined order. Each

“chunk” allows for several possibilities for realization by the instrumentalists, by offering multiple staves in parallel from which to choose. The players are to vary their realizations of each chunk in response to input from the audience.

All the players’ laptops are networked as part of a LAN. Ethernet cables were used in the performance because the wireless router was dropping UDP packets (as well as because it looked cool). The players’ parts are controlled from a central server that also synced those parts to a variable electronic drum beat. Audience members could also make slight changes to the texture of the drum pattern via another laptop at the back of the theater. Networking and sound were implemented in Max/MSP 4.

Analysis

The instrumentalists started playing before the house opened, so that when the audience entered, there would be a sense of the music being always-already in process. Before they entered, the audience was given a sheet of paper suggesting possibilities for how they might interact with the players. Some audience members gave very detailed input to players, sometimes through gesture, in other cases through verbal instructions. Most, however, were more vague.

By the time the piece reached its midpoint, the biggest problem became clear:

most people were eager to sit down in preparation for the remainder of the concert. Perhaps if the piece had been at the end of the program, or if there were simpler, more discrete ways of interacting with the musicians, they would have continued to actively participate for a longer time. My thinking on how to avoid such problems led me to the formulation of the twelfth of my “Guidelines for a new democratic music” (Chapter 0.3): “strive to create welcoming spaces for interaction so that audience members can participate comfortably and freely.”

Documents

- The paper page given to audience members before they entered the performance (PDF)
- The whole performance (MP4)
- PDF parts for practice purposes:
 - Clarinet
 - Flute I
 - Flute II
 - Piano
 - Violin
 - Viola
- Actual parts (ZIPs) & Max/MSP patches & associated files:

- Clarinet
- Flute I
- Flute II
- Piano
- Violin
- Viola
- The Max/MSP Server

Notes

Thanks to:

- George Lam, Director of the Duke New Music Ensemble for facilitating the performance
- The players:
 - Peter Dong, clarinet
 - Sarah Griffen, violin
 - Alex Kotch, clarinet
 - Dan Ruccia, viola
 - Michael Wood, flute
 - Kirill Zikanov, piano
- And to Jillian Johnson for camerawork.

1.2 “You don’t understand—these boys killed my dog.”

Description

This piece focuses on a mode of interaction in which people from the audience can directly manipulate the sounds of three instrumentalists by using WiiMotes to affect real-time processing of the audio. The beginning of the piece introduces melodic material and harmonic relationships before the audience can participate. After the introduction, the piece settles into a loose song form (the larger structure of which may be determined by the players before or improvised during the performance). The parts are open-ended enough to allow considerable improvisatory freedom to the players, which allows them room to respond to the audience’s manipulation of the audio processing.

Each player’s audio is captured as an individual channel (with a microphone for the clarinet and direct boxes for the guitars) and input to the audio environment, implemented in Max/MSP 4. The main processing that the audience can affect is based on pitch-shifting a highly reverberated version of each player’s audio stream.

There are four WiiMotes in total: three that are each connected to the processing of one of the instrumentalists, and one that affects the electronic drum

accompaniment. The WiiMotes are connected to the computer with Bluetooth. A program called GlovePIE (v. 0.32) grabs the WiiMote data and sends it (in OSC-formatted UDP packets) to Max/MSP.

Analysis

In the performance, I began the audience participation portion by briefly demonstrating how the WiiMotes could be used. Then, I invited members of the audience up to try. The first person I pulled up was Zach Corse, who was a music theory student of mine at the time; next, I got Scott Lindroth. When each participant had tried it for a while, they turned over their WiiMote to someone else in the audience. A nice result of this was that audience members learned how to use the controllers by watching others do it before them and by asking those who had already done it when it was their turn.

Most people that tried the WiiMotes seemed excited at the experience, though some told me afterward that they weren't sure exactly how what they were doing related to what they heard. Of course this is a problem as far as the political goals of the work go: if people do not understand how their input *matters* then the process fails as a democratic enterprise, because their choice will be uninformed. Recognizing this shortcoming led me to codify the third entry of my "Guidelines for a new democratic music" (Chapter 0.3): "People should be able to understand

a causal relationship between what they are doing and the musical sound that is produced.”

Documents

- Parts (PDFs):
 - Clarinet
 - Guitar I
 - Guitar II
- Max/MSP patch
- GlovePIE script
- Whole performance (MP4)

Notes

Thanks to the players:

- Robert Biggers, guitar
- Finn Cohen, guitar
- Alex Kotch, clarinet

And thanks to Jillian Johnson for camerawork.

1.3 Further work with WiiMotes

This chapter consists of two related pieces that use WiiMotes (the acceleration-sensitive controllers of the Nintendo Wii) to alter the production of electronic musical sound. Neither piece uses live instrumentalists, but both can be experienced in group settings, with multiple people collaborating on the performance at once.

1.3a Mambo Relacional

The first piece is titled, *Mambo Relacional*, and allows players to improvise synthesized melodic lines over a re-configurable accompaniment in mambo style by using WiiMotes. Making different gestures with the controllers affects different aspects of the sound synthesis, including register, pitch content, timbre, volume, and note duration.

Furthermore, the WiiMotes can also be used to initiate (and then change) a Latin mambo accompaniment pattern. The melodic notes of the instrument are produced by the software so that they synchronize with the accompaniment, both in terms of rhythm as well as pitch content: the default scale from which notes are chosen changes according to the harmony. This allows a user to easily play a convincing solo over a modulating section, as the software at each harmonic change adapts the melodic contour indicated by the player's gestures

to a consonant (or dissonant, if so specified by the player) scale.

The WiiMotes are connected to the computer with a Bluetooth connection. A program called GlovePIE (v. 0.32) grabs the WiiMote data and sends it (in OSC-formatted UDP packets) to Max/MSP, which was used for audio production. The Max patch generated the synthesized melodic voice and synchronized it with the mambo accompaniment, both of which were controlled via the WiiMotes.

I presented *Mambo Relacional* at the South Central Graduate Music Consortium Conference in September 2008, though I had developed it during the summer of 2007. During my presentation, I walked the audience through the mechanics of the instrument, demonstrating how to create different melodic structures and how to manipulate the accompaniment. After I finished my demonstration, I invited the audience up to try for themselves. There were two WiiMotes, which allowed two people to play at a time. People were generally excited by the piece, though it took them a while to become familiar with the gestures needed to control the sound well.

1.3b VocalGraffiti (*in collaboration with Alex Kotch*)

This piece explores a mode of interaction whereby some participants can contribute to the sonic material by recording short messages over the phone, and other participants can manipulate those recordings, along with samples of a

dynamically configured beat, through the use of WiiMotes. I collaborated on this project with my colleague Alex Kotch. We each contributed to both programming the audio software and producing the beat samples (though I worked more on the former, while Alex worked more on the latter).

We dubbed the piece '*VocalGraffiti*' because of one of the central features of the audio production. Participants can call in and each record a message; conceptually, this is akin to painting on a wall. At first the wall is blank (with no audio recorded), and as additional calls are registered, the "wall" becomes filled with recorded sound clips, which eventually begin to obscure those that were recorded earlier. The audio software then plays back sections of the recorded material according to parameters set by manipulating the WiiMotes. This configuration allows for the control of factors such as clip playback speed (which consequently altered the pitch of the playback), clip length, and number of different clips to switch between.

In order to capture people's voices, a cheap cellphone can be used to receive calls from participants; audio from the phone can be routed into the computer via the phone's headphone jack. As with *Mambo Relacional*, the WiiMotes are connected to the computer with a Bluetooth connection, and GlovePIE is used to send the WiiMote data to Max/MSP.

Max is used to coordinate audio production and processing. The Max patch manages incoming audio from the phone, processes that audio, and combines it with dynamically a configured beat—all in response to input from the WiiMotes.

We invited two friends (Karen Cook and Sarah Griffin) to join us for the “performance”. Others participated by calling in, though they were not physically present. Alex and I gave them a brief tutorial on how to use the WiiMotes, and then we started our improvised performance, which lasted about 25 minutes. Karen and Sarah were sometimes puzzled by what was going on, but they ended up working cooperatively to both better understand the interface and to make aesthetic decisions about the performance.

Documents

Mambo Relacional

- Max patch (ZIP)
- GlovePIE script (PIE)
- Full presentation (MP4)

VocalGraffiti

- Max patch (ZIP)
- GlovePIE script
- Full performance (MP4)

- Tutorial (MP4)

Notes

Thanks to Karen Cook and Sarah Griffin for joining us for *VocalGraffiti*.

1.4 Checkmate

The full title of the piece is:

“It’s like in chess: first, you strategically position your pieces,

and when the timing is right you strike.

“They’re using this signal to synchronize their efforts

and in five hours the countdown will be over.”

“And then what?”

“Checkmate.”

Description

Checkmate is organized so that three conductors interact directly and individually with three instrumentalists, using a system of gestures that they develop themselves. The conductors are meant to be people from the “audience”: they could be selected at the beginning of a concert; or, as was the case in the performance, they could rehearse with the instrumentalists before the concert date.

The piece consists of four movements that are structured to facilitate a progressively increasing degree of interaction. The first three movements each feature one of the instruments as a solo voice, with the other parts playing accompanying roles. In the first movement (featuring the violin), the

instrumentalists' parts are fairly set, which limits the degree to which the conductors might change the performance; in particular, parts are (mostly) synchronized in a regular meter. This setup allows the conductors, who may not be comfortable performing in a formal concert setting, some time to "ease in" to their performances.

The second movement (featuring the cello) is somewhat more free: the parts are no longer metrically synchronized, which allows for greater rhythmic expressiveness. This, in turn, results in a more developed interaction between conductors and instrumentalists, as the instrumentalists take their cues from the conductors on how to navigate the rhythmically unspecified parts.

The third movement (featuring the viola) is in some sense the most open: while the violist proceeds freely through a long solo, the other players (with their conductors) improvise a gestural accompaniment that is entirely ad-lib.

Finally, the last movement has a fugal texture—with no featured "solo" part—that allows all three conductor-instrumentalist pairs to negotiate a distributed, polyphonic texture. This encourages all the performers—both the conductors and instrumentalists—to think of themselves as straddling the divide between the individual actor (soloist) and the larger social group (the ensemble).

Analysis

The performance featured the conductors Melanie Stratton, Tim Stallmann, and Megan Dawson, who worked with Sarah Griffin (playing violin), Brian Howard (playing cello), and Dan Ruccia (playing viola), respectively. Melanie, Tim, and Megan rehearsed twice with Sarah, Brian, and Dan before the concert. This footage is from the first rehearsal. Interestingly, the performers seemed to make much more reserved decisions at the concert than they had during the rehearsals. Perhaps the more reserved tone was a result of a refinement of the conductors' choices: after first experimenting with extreme gestures during rehearsal, they settled on more subtle touches. Or, perhaps it was because they were nervous being in front of the crowd. Certainly, it seemed that Melanie was a little nervous; she in particular was much more restrained in her conducting than she had been during the rehearsals. Recognizing that the comfort level of participants can be crucial to the success of a performance contributed to the formulation of the twelfth of my "Guidelines for a new democratic music" (Chapter 0.3): "strive to create welcoming spaces for interaction so that audience members can participate comfortably and freely."

Documents

- Score (PDF)

- Parts:
 - Violin (PDF)
 - Viola (PDF)
 - Cello (PDF)

- Whole performance by movement (MP4s):
 - I
 - II
 - III
 - IV

- Whole rehearsals (MP4s):
 - Rehearsal #1
 - Dress Rehearsal

Notes

Thanks to the conductors:

- Megan Dawson

- Tim Stallmann

- Melanie Stratton

And thanks to the instrumentalists:

- Sarah Griffin, violin
- Brian Howard, cello
- Dan Ruccia, viola

1.5 A Cookbook for Life

The full title of the piece is:

“I wish there was a cookbook for life, you know?”

With recipes telling us exactly what to do.”

... “You know better than anyone:

It’s the recipes you create yourself that are the best.”

Description

In *A Cookbook for Life*, audience members use laptop computers to influence the music. Using a standard web browser, audience members can load a web page that contains an interface built with Adobe Flash. This interface allows individual audience members both to interact directly with the instrumentalists and to make group decisions.

Using a simple drag-and-drop interaction style, audience members can “send” a specific segment of notated music to each instrumentalist. Each of the players has essentially the same part: any of them can play any of the available lines. Thus, when the piece was performed for the second time, Sarah Griffin (on violin) took the place of Alex Kotch (who had played clarinet in the first performance) with no need for extensive re-scoring.

Additionally, audience members can send dynamic instructions (indicating

how loud to play) as well as customizable textual instructions to players. All three elements—notated segments, dynamics, and textual instructions—are independently specified, so that the instrumentalists' parts are highly variable and constantly evolving. All of this results in a high degree of polyphony in the players' parts; in essence, a massive multi-thematic fugal texture is created.

Furthermore, audience members can vote as a group on large-scale harmonic movement and the "mood", which affects how the instrumentalists' sound is processed by the computer, as well as the character of the digital drum accompaniment.

The interface also displays to the audience the information on the instrumentalists' screens; thus, they are able to be constantly aware of decisions that other people make. Finally, a "chat box" allows the audience members to communicate with each other, both to facilitate group decisions and to encourage a sense of group identity.

This piece was performed twice: first, at a Duke New Music Ensemble concert in Durham, NC, and then a month later at the Bain Project Fundraiser concert in Raleigh, NC. The first performance in Durham was cut short, however, due to a technical failure: I had been using a third-party Max/MSP object to network with the audience members' Flash Players; this object turned out to have a memory

leak. As a result, the whole Max patch crashed after a little more than six minutes into the performance.

After this crash, I spent the time before the second performance developing my own (bug-free) networking solution. I implemented my new server (along with most of the decision logic that had formerly been programmed in Max) as a Java application that both communicated with audience members' Flash Players as well as with Max/MSP. The second performance went off without a hitch.

Analysis

Though *A Cookbook for Life* was performed twice, the reactions of the audience in each case were similar. In both performances, audience members were timid at the beginning, but in each case, there was an "Aha!" moment, when they realized the possibilities that the interface afforded.

In the Raleigh performance, for instance, someone sent the instruction, "stand up and rock out" to both the keyboard players (Paul Swartzel and Tim Hambourger). Because the interface displays the current state for each of the players' scores, the audience saw that text appear on their screens; then they saw Paul and Tim stand up; and finally, they heard the sonic result. After these "Aha!" moments, the audience members were visibly more engaged.

The chat box did not get much use, though in each performance it was used

by audience members to discuss the performance while it was happening.

Perhaps they did not chat more because the interface was rather complex; there were so many details that they could manipulate that they didn't take much time to communicate with each other, perhaps limiting their sense of group decision making.

Documents

- Practice parts (PDF):
 - Clarinet
 - Violin
 - Viola
 - Keyboard
- Whole performances (MP4s):
 - First concert at Duke University
 - Second concert in Raleigh, NC
- The audience & instrumentalists' interfaces:
 - A ZIP archive of both interfaces
- The Max/MSP patch & Java server
- The Java server files:
 - Main class: CookbookForLife.java

- Base class: FlaxMash.java
- Executable JAR file

Notes

Thanks to:

- George Lam, Director of the Duke New Music Ensemble
- Tim Kiernan, Bain Project organizer
- The players:
 - Sarah Griffin, violin
 - Tim Hamburger, keyboard
 - Alex Kotch, clarinet
 - Dan Ruccia, viola
 - Paul Swartzel, keyboard
 - Jonathan Wall, keyboard
- And to Emily Antoon and Jillian Johnson for camerawork.

1.6 Rules

The full title of the piece is:

"We live by the rules, we die by the rules.

"Read your rule book; there's a rule for every possible situation.

"Guard the key to our entry and your rule book as you would guard your own lives.

"Most important, remember:

"Our rules supersede those of the outside world."

Description

Rules is in some ways the simplest and most didactic of the project. In this piece, I used two principle techniques to allow for audience participation: re-configurable form and dynamic orchestration.

Re-configurable form means that there are formal sections that are fixed, but their order is not. (I mean 'sections' like the linear stretches of music you might have in a classical rondo, for instance, traditionally labeled as A, B, C, etc...) The first part of the piece is fixed, as is the end; in the middle, there are three sections that can be played in any order.

A ballot distributed to the audience before the performance allowed each participant to literally vote on their preferred ordering. This implementation limited the technique in that its execution happened pre-performance. However,

the decision needn't always be made beforehand (and indeed, the instrumentalists in this performance didn't know the order of the configurable sections until they arrived): the drummer signals for each modular section with a specific rhythmic call. Thus, with some differently structured voting process, the piece could easily be modified to allow the group decision to happen in the middle of the performance.

Dynamic orchestration means that the orchestration—which instruments play which part—can be manipulated in real time. Conceptually, the piece is written for four abstract voices that are defined by independent rhythmic and melodic contours: roughly speaking, these are “melody”, “counter melody”, “accompaniment”, and “bass”. Each player's part (except the drummer's) is comprised of four synchronized lines, each a rendition of one of the different abstract voices. Thus, each player could be playing any one of the abstract voices at a given time.

Analysis

For this performance, we used colored cards to indicate to each instrumentalist which part she should play; each color corresponded to an abstract part. The audience could move around the performance space, switching the cards between the instrumentalists while they played. This setup allowed

audience members to decide, in real time, which instrumentalists would play the “melody”, which would play the “bass”, and so on.

Because the performance space was fairly small, without much room to move between performers, we decided to have only two more cards than players. Thus, we’d have only two audience members moving through the ensemble at a time. In a different venue, there could easily be more extra cards, which would result in more rapid orchestrational changes.

Rules is by far the shortest piece in the project, clocking in at just over 8 minutes. However, the simplicity and directness of the interaction—voting before and moving cards during the performance—meant that the piece didn’t need to be as long in order to convey a sense of the potential of dynamic music of this kind.

One issue that arose when putting the piece together was that it was hard for the instrumentalists to learn their parts well; they essentially had four times the amount of music to learn (more than 30 minutes!). Furthermore, it was hard to rehearse effectively: because of the uncertainty of which instruments would be playing which parts at a given time, it was hard to work on traditional ensemble goals like balance and blending.

On these points, there are three things to note. First, the ensemble did a great

job. Second, these problems (balance and blending) are largely ameliorated by the piece's fanfare-like texture. And finally, the possibility that a given orchestrational decision could sound "bad" is actually a good thing for the piece as a whole: after all, if some choices can't be better than others, then what is at stake? (This last realization led me to the formulation in the fifth and sixth of my *Guidelines for a new democratic music* (Chapter 0.3): "People should be able to make choices that have significant musical results", and "Corollary: the possibility of "bad" choices is a good thing.")

Documents

- Ballot for the audience (PDF)
- Short score (PDF)
- Parts (PDFs):
 - Flute
 - Clarinet I
 - Clarinet II
 - Banjo
 - Keyboard I
 - Keyboard II
 - Violin

- Viola
- Percussion / Conductor
- Whole performance (MP4)

Notes

Thanks to:

- George Lam, Director of the Duke New Music Ensemble
- The players:
 - Dave Garner, banjo
 - Sarah Griffin, violin
 - Tim Hamburger, keyboard
 - Alex Kotch, clarinet
 - Alex Kritchevsky, clarinet
 - Yana Lowry, flute
 - Dan Ruccia, viola
 - Jonathan Wall, percussion / conducting
 - Kirill Zikanov, keyboard
- And to Paul Leary for camerawork.

1.7 *SuperConductors Beta*

Note: the original title of this piece was simply, *SuperConductors*.

Description

This last piece is the longest and most complex within the project. Many elements of *SuperConductors Beta* are drawn from the earlier pieces of the project, both in terms of models of interactivity and formal techniques; however, I do not conceive it as a culmination or final synthesis but rather as the most refined work yet in this project.

It also, in my opinion, had the most successful performance: I felt that it created an engaging aesthetic experience that was also definitively social. Part of the success of the performance was no doubt due to the fact that I chose to hold it at Fullsteam Brewery, a comfortable, non-institutional space (that also had the advantage of serving beer).

The interface for audience participation in *SuperConductors Beta* is, like for *A Cookbook for Life* (Chapter 1.5), a Flash-based web page; audience members can bring their own laptops in order to take part. The instrumentalists' parts are also Flash-based and are dynamically created in response to input from the audience. A dynamically synthesized click track played through the instrumentalists' headphones aids in coordination. Networking and sound synthesis are managed

with Java code; I implemented the interface for the server in Processing. Thus, all that is needed to perform the piece is a server computer with Java installed and a LAN—a standard wireless router will do.

The work is scored for seven instrumentalists with minor electronic accompaniment at the beginning and at the very end. I wanted to focus on the human players, and so chose to minimize the prominence of digitally produced sound.

Superconductors Beta consists of four big movements and a denouement. The first movement combines the techniques of re-configurable form and a minor treatment of dynamic orchestration, as used in *Rules* (Chapter 1.6). In this movement, audience members vote in response to questions that both determine what orchestration various sections will have and in what order various sections are played. For instance, the first question asks the audience to decide which instrumentalist will play the opening melody.

It was a nice coincidence that the piece premiered on Election Day in 2010, which heightened the connection between the votes they were casting as participants in the piece and the votes that had been cast that day in government elections. Of course, this scheme for interaction is fairly limited, as all decisions are determined by the majority preference, and there are only two potential

outcomes per question.

In the second movement, however, the possibilities for interaction expand somewhat. In this movement, audience members can, as individuals, give specific players parts to play: each player can be “sent” a melodic line, an rhythmic figure, or a rest. (By default, the players sustain notes from a slowly changing harmonic field.) This technique was used previously both in *Checkmate* (Chapter 1.4) and, also with laptops, in *A Cookbook for Life* (Chapter 1.5).

The third movement concentrates on a computer-mediated implementation of dynamic orchestration. The movement is formally set, but, as with *Rules* (Chapter 1.6), each player could at any moment be asked to play one of five parts: melody, active accompaniment, passive accompaniment, bass, and rest.

The fourth movement is a recapitulation of the first, though shortened a bit. This repetition allows people to reconsider the choices they made the first time and explore the alternative paths. I decided to return to the more limited interaction paradigm in order to dramatize its constrictive nature. (I’m not sure the audience felt constricted, though: they seemed to be having fun regardless. Beer helps.)

Finally, the denouement functions as a “soft ending”: the players keep playing a series of randomly ordered vamp sections, while the audience is free to

go up and talk to them (or to each other).

Analysis

One of the things about which I was happiest was that when the piece “ended”, nobody clapped; instead they immediately began talking to each other and moving around. I had conscripted a couple friends to bring additional instruments and join in to make a loose jam session: Jamie Keesecker brought his electric bass, and Dave Garner brought his banjo, which contributed to the “softness” of the ending. Eventually they just started improvising freely.

Another successful part of the piece was the chat box that was built into the interface. Chatting happened very differently in this performance than in the performances of *A Cookbook for Life* (Chapter 1.5). In that piece, the interface offered so many possibilities for interaction that people didn’t spend much time discussing what was going on. In *Superconductors Beta*, on the other hand, the relatively relaxed possibilities for interaction (particularly in the first and fourth movements) left plenty of time for chatting, of which many people took advantage.

The discussion was sometimes about the piece, or about what choices to make, but it was also a wide-open conversation: ribald comments and internet links were not uncommon. But it didn’t seem to distract from the experience.

Though I can't be sure, it seemed that the lively chat discussion not only fostered engagement with the music and a sense of group identity, but also encouraged discussion and social interaction after the piece concluded.

Documents

- Score (PDF)
- Whole performance (MP4)
- Audience interface (ZIP)
- Instrumentalist part interface (ZIP)
- Server:
 - ZIP archive
 - FlashServer and Server, my own Java classes that handled networking

Notes

Thanks to:

- Dan Ruccia, Director of the Duke New Music Ensemble
- The players:
 - Sarah Griffin, violin
 - Tim Hamburger, keyboard
 - Darren Mueller, alto saxophone

- Dan Ruccia, viola
- Jonathan Salter, clarinet
- Ken Stewart, cello
- Heidi Wait, flute
- Who were joined, at the end, by:
 - Jamie Keesecker, electric bass
 - Dave Garner, banjo
- And finally, thanks to Todd Atlas and Jody Crawford for camerawork.

2.0 Division 2 summary

Division 2 concerns a class of software program, dubbed ‘sound toys’, that generates interactive electronic sound, experienced through a web browser. Early attempts at creating these pieces have relied primarily on the use of Adobe Flash, though more recent examples have used other technologies. “Playing with sound toys” (Chapter 2.1) is an article that outlines the basic parameters of the genre and looks at the temporal consequences of the underlying technologies upon which they rely.

Chapters 2.2-2.6 are sound toys of my own creation that explore the possibilities for employing dynamically synthesized sound, difficult to achieve in earlier versions of Flash Player. I’ve authored these sound toys in the Processing environment, which is built on top of Java. (For more information on Processing, see the Processing website: processing.org.)

Chapter 2.7 provides a discussion of Beads, the open-source Java sound library that I use to author these sound toys; in the course of working on these pieces, I became a contributor to the project and am now “on the Beads team”. The chapter concludes with a preliminary (though fully functional) implementation of a browser-based live coding environment that dynamically interprets JavaScript to manipulate the Java objects of Beads in real time.

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- 2.2 *Twos & Threes*
- 2.3 *The Brightness of Space*
- 2.4 *ExtraVerby*
- 2.5 *War & Peace*
- 2.6 *Intensified Loops*
- 2.7 Beads and live coding

2.1 Playing with sound toys: browser-based participatory music and the categories of new media musical production

Abstract

The development of online interactive media forms has given rise to “sound toys”, minor interactive programs, experienced through a web browser, that focus on the creation of musical sound. This article argues for the consideration of sound toy repertoire in the following ways: as a musical genre, and as an emerging popular medium; as reflective of the social relations around its creation, insofar as the temporal orderings made possible in sound toys mirror more flexible scheduling in everyday life; as potentially critical of those same relations; and yet fundamentally circumscribed within the conditions of possibility defined by their underlying technologies.

Article

The past few years have seen a rapid proliferation of emerging popular media forms; new digital technologies are providing opportunities for new aesthetic formations, including musical ones, that were until recently unavailable on a large scale. And as these formations have become possible, they have brought with them a new range of theoretical problems. This article will discuss a class of

musical objects that have been dubbed “sound toys” — small interactive pieces, accessible through a web browser, that may represent the first stage of an emerging genre of participatory popular music¹. Though the pieces themselves are often minor, and though the techniques and forms of their composition are still very much in a nascent phase—and indeed, though many might not even understand them to be “musical works” in a full sense—they challenge basic categories of musical production that may have far reaching consequences, including how we understand musico-aesthetic value, the location of subjects in musical production, as well as issues of machinic subjectivity and musical temporality.²

Before looking at some examples of sound toys, let's first try to loosely sketch the boundaries of this genre, the range of pieces under discussion. These pieces—for the purposes of this article they will be described as “pieces” or “objects”, though that might strike some as problematic—share the following generic properties:

- They focus primarily on the production of musical sound.

1 The term “sound toy” is used in several sources online, though it is by no means standardized or universally agreed-upon. For archives of these pieces, see the “Virtual Museum of Soundtoys: Web-Native Audio & Music Applications” at: <http://www.squidoo.com/soundtoys>, or Soundtoys.net (<http://www.soundtoys.net/>).

2 Of course, many other art forms have experienced similar crises of definition due to electronic media, and participatory music with open forms has existed in many cultural traditions for a long time. However, sound toys, as minor works “on the fringe” are especially pernicious in how casually they transfer (some) direct control of time to the user.

- They are accessible via the web, meaning that they are consumed through a web browser.
- They are dynamically “interactive” —that is, input from the end user changes what sound is produced, in real-time during the performance.
- They are generally fairly diminutive in scope—meaning both that they depend on a limited range of sonic material and its possible organization and also on a limited amount of data, including code: no more than a few megabytes at the high end, and usually much smaller.
- They generally depend on some plug-in that adds functionality to that provided by the web technologies that are built into browsers themselves; these include the Java Virtual Machine, Adobe Flash Player and Adobe Shockwave Player, and Microsoft's newer Silverlight technology. The choice of which technology to use of course depends upon the capabilities of each. Also, since each of these plug-ins usually require a separate installation from the browser, the market penetration of each becomes an overriding concern. Adobe Flash is therefore the overwhelming favorite for sound toy authoring, as well over 95% of users already have Flash Player installed. (Recently, HTML5 with JavaScript has been able to provide some of the functionality of Flash and other plugins, though the

current implementations of this emerging standard does not provide any advantages over Flash except for accessibility and “openness”, whereas it is considerably less capable in terms of performance.)

In the past few years, we have already seen an expansion of these forms onto other platforms, particularly in the mobile market, the most visible of which are Apple's iOS and Google's Android operating systems. However, this article will examine only the earlier, web-based pieces, leaving more recent developments as second-stage elaborations of genre.

Sound toys: some repertoire

The following examples of sound toys, which are representative and in many cases standouts of the genre, demonstrate the range of techniques, strategies for dynamic interaction, and sonic possibilities commonly employed in sound toy development.

Coactive

The Flash-based *Coactive* by Danny Adler / SGX Music generates interactive techno-like music. The interface allows the user to select which of a set of synchronized loops is playing at a given moment; a cuing mechanism allows for more sophisticated transitions from the current state directly to a completely different configuration. As different layers and sections are activated, the

interface becomes animated with corresponding abstract geometric shapes.

(<http://www.sgxmusic.com/coactive.htm>)

La Pâte à Son

In *La Pâte à Son*, by the French interactive media company Le Ciel est Bleu, samples are triggered algorithmically; the interface allows the user to directly manipulate the algorithm through its visual representation as a re-configurable, modular machine. Additional controls allow the manipulation of pitch content and mode, melodic shape, and other factors. The whimsical visual nature of the interface corresponds to the sound quality of the range of sonic possibilities: the various components that can be deployed in the machine-algorithm produce sounds mimicking traditional acoustic instruments, such as plucked strings, blown flutes and brass, organ pipes, and pitched and unpitched percussion. This sound toy is complicated enough that its processing demands would have been too taxing for the Flash Player of the time; it is authored in Shockwave.

(http://www.lecielestbleu.org/html/main_pateason.htm)

Pianographique

Another piece authored in Shockwave, *Pianographique* dates from 1993 as a CD-ROM based program, though its web rendering dates only from 2001.³ It is,

³ This date from the main site: <http://www.pianographique.net/>.

in effect, a keyboard-triggerable sampler with several programmed presets. Within each preset, there is a one-to-one relationship between key-presses and the triggering of samples: that is, pressing a letter key on one's keyboard will prompt the program to play the corresponding sonic and visual material immediately, with no temporal alignment.⁴ The sounds are considerably more complex and varied than one might find on, say, a piano: playing a single “note” on *Pianographique* may trigger a sample with a percussive rhythmic pattern, bass, melody, and even voice.

[\(http://www.pianographique.net/\)](http://www.pianographique.net/)

ToneMatrix, orDrumbox, and other drum machine derivatives

These pieces function in the same manner as early step sequencers and drum machines: the programs cycle through a series of time positions at regular intervals; at each position, one or more sampled sounds may be triggered. In the case of *ToneMatrix*, a Flash-based version, there are sixteen possible samples of softly percussive pitches organized in a pentatonic scale. The interface is a 16x16 grid: each column of 16 squares represents a single time position; clicking on a square will toggle whether the program plays the corresponding pitch at that

4 From the *Pianographique* introductory text: “Each letter on the keyboard sets off a sound and an animation underneath the mouse cursor. By typing on the keyboard, pictures and sounds mix together. ... The work is composed and recomposed until the user arrives at his final flourish... The space bar deletes the composition.”

time step. *OrDrumbox*, written in Java, is a more complicated if less elegant rendering, which attempts to be a full-scale drum machine, with samples emulating the sounds of a standard drum kit.

(*ToneMatrix*: <http://lab.andre-michelle.com/tonematrix>)

(*orDrumbox*: <http://www.ordrumbox.com/online2.php>)

The singing horses

The first sound toy this author ever experienced, and one of the simplest, this piece dates from at least as early as 2002⁵. Four cartoon horses appear on the screen; when clicked, each horse begins (or stops) singing, in a loop, one of four vocal “doo-wop” parts: rhythm, bass, baritone, and tenor. Though the loops begin and stop as soon as the user clicks each horse (there is no temporal alignment at all), the piece holds together because the parts outline the tones of a single tonic triad, with some neighboring notes to provide slight harmonic interest.

(http://svt.se/hogafflahage/hogafflaHage_site/Kor/hestekor.swf)

Codeorgan

Flash-based *Codeorgan* takes the URL of a web page as input, the content of which it then uses to generate a (diatonic) musical sequence. The program uses

5 A MetaFilter post from 2002 links to what is apparently the original page, though I believe that piece is at least a couple years older than that. (<http://www.metafilter.com/22039/Singing-Horses-Flash>)

the text on a page to algorithmically generate a key (diatonic major or minor), synthesizer timbre, and accompanying drum pattern. User interaction is limited to specifying the URL.

(<http://www.codeorgan.com/>)

Newer sound toys: *Simple Sound Toy*, *Sound of Color*, and other Processing sound toys

With the advent of the Processing language⁶ and better-performing Java Virtual Machines, some sound toys have more recently been able to employ audio synthesis techniques. *Simple Sound Toy* initiates different sequences echoing tones depending on user clicks on its interface, and *Sound of Color* initiates different tones that are combined with FM synthesis. More of these can be found at Soundtoys.net.

(*Simple Sound Toy*: <http://www.openprocessing.org/visuals/?visualID=11949>)

(*Sound of Color*: <http://www.openprocessing.org/visuals/?visualID=5309>)

The problem of authorship

The disavowal of the unitary author has been a familiar feature of post-structuralist theory, beginning perhaps with Roland Barthes' 1967 essay, "The Death of the Author" and then elaborated in Michel Foucault's response two

6 Processing is actually a combination of a library and simplified syntax for Java, as opposed to a full-blown programming language; a more in-depth discussion of Java and its capabilities appears below.

years later, "What is an Author?"⁷ For Barthes, the notion of the Romantic genius-author was no longer a useful point of analysis; he calls into question the very notion of creativity, and argues that works are better understood as open systems, formed from combinations of derivative material. Foucault's critique, then, examines the way in which works accrue social value: which texts do we consider to be fully works? Further, he demonstrates how much of this valuation is tied to the identity of the author, so that a primary function of the author (in fact he terms it 'author-function') is to signify the authority of a text.

It has been often remarked upon that new media objects in particular, as a result of their openness or "interactivity", result in a complex assemblage of authorship. Sound toys, in particular, demonstrate the usefulness of Barthes' argument: their authorship involves an asynchronous collaboration between different actors, who are responsible for different structural parts of the work; rather than any single moment of "newness", each sound toy is better understood as an accretion of recycled material, each part following from earlier productions.

Of course in music, at least as we often think about it in the Western academy, we already have a slightly more complicated version of authorship, in that we

⁷ See Roland Barthes, "The Death of the Author", and Michel Foucault, "What is an Author?".

have two figures – the composer as well as the performer. However, the additional problematic introduced by interactivity remains. Consider, for example, *La Pâte à Son*. On the one hand you have the author of the program code; on the other, the end user. Surely the former is very much a composer, but the latter, it seems, must be both: the end user's input actively determines what sound is produced. To play *La Pâte à Son* is to both compose and perform it.

The multiplicity of authorship is then passed on to what we consider to be the “work” proper. Of course, where to locate the work has long been a problem in Western music philosophy: is it in the score? Defined by a performance tradition? Or by a specific performance? And so on. And this problem is only heightened in the case of sound toys: *La Pâte à Son*, for instance, doesn't guarantee any particular sonic realization (indeed, the piece begins in a different configuration each time it is loaded); rather, the code specifies a wide range of possibilities.

In “The Work Itself”, the sociologist Howard Becker suggests that works of art in general can “profitably be seen as a series of choices: the choice of which word or note to put next in my poem or song; the choice of which way the plot in my story should go”; and so on⁸. Interactive artworks, then, with their

8 Howard Becker, “The Work Itself”.

distributed authorship, become a series of choices made by different parties at different times. But I would stress also that we think of the choices *unmade*. In the case of sound toys, it is just as important that the programmer made one choice as that she deliberately did not make another: her contribution is a space of possibility from which the end user selects individual solutions. Taken generally, each act of composition is a narrowing of possibility that ultimately arrives at the specific rendering that is the performance.

(Now it may be that we are not interested in the “work” as a category anyway, but many of us find some analytic value in the concept as an abstraction, whether understood as some Platonic transcendent form, possibly related to a score, or rather a Deleuzo-Guattarian-style immanent semiotic micro-regime⁹. So, if we want to worry about the work, let's simply say that it is all or some subset of the various formal contractions provided by each act of authorship.)

Categories in general

Just as sound toys disrupt traditional notions of composer, performer, and work, they also problematize another category that often gets forgotten in musical analysis: the instrument. When one plays *La Pâte à Son*, one makes choices that determine what sound is produced, and thus we might think of the

⁹ From Gilles Deleuze and Felix Guattari's *Capitalism and Schizophrenia* generally, particularly *Milles Plateaux*.

program as an instrument in addition to being part of the “work” — which may seem a bit strange, because we don't usually think of a piano, for instance, as being a part of a piano sonata. But in sound toys, both instrument and work are bound together in one material object. (There are other genres or traditions where such an identification may be understood: music boxes, Zimbabwean mbira music, and the work of Harry Partch or Eddie Van Halen spring to mind¹⁰).

Furthermore, the sound toy program is also responsible for the temporal structuring of the sound, an activity that we usually think of as one of the primary aspects of musical performance. There is a sense, then, that the program has also taken on some of the role of the performer.

Taking this line of thinking even further, we might even observe that, were the sound toy program—the machine-code assemblage—making choices about what sound was produced, we would also understand it to be taking on the role of composer. This last step may be uncomfortable, as we usually think of authorship, especially artistic authorship like musical composition, to depend on some subject formation—which may be hard to see in the case of a program like

10 In the case of the music box, the “composition” is directly inscribed in the hardware: usually a disc or cylinder that, when rotated, causes tuned filaments to vibrate. The musics of Partch, Van Halen, and mbira makers and players all depend heavily on the specific sonic properties (especially tuning and timbre) of their unique instruments. For a discussion of Van Halen's guitar craftsmanship, see Steve Waksman's “California Noise: Tinkering with Hardcore and Heavy Metal in Southern California” in *Social Studies of Science*, vol. 34 no. 5 (Oct. 2004). See also Paul Berliner's *The Soul of Mbira: Music and Traditions of the Shona People of Zimbabwe*.

La Pâte à Son: though the performed sounds are organized by an algorithm, it is one that the end user directly manipulates. Thus we might want to say that the program's choices are actually just an amalgam of those of the programmer and the end user. But it is not too difficult to imagine a time not so far off when legitimate machinic subjects are making choices and making art. At which point, you'd have a single machinic assemblage, the sound toy, playing the part of work, instrument, performer, and composer.

We've observed that sound toys bridge the boundaries of our usual categories of musical analysis – composer, performer, instrument, work—to the point, I'd argue, of analytic confusion. What I propose, then, is a theoretical starting point that jettisons the traditional archetypes in favor of procedural categories: a set of categories that are organized around the processes of musical production and consumption themselves rather than the socially constructed roles of individuals that may have traditionally implemented those processes; the goal being to force our analysis to take account of the relations of musical production. So, instead of composer, we have composer-process; instead of performer, performer-process; instead of instrument, instrument-process.

What do I mean by each of these categories? Let's start with composer-process, which we will take as the process of forming, as a polyvalent

abstraction, the musical work. Next we have performer-process, which we will describe simply as the process of rendering music *in time*. Finally, we have instrument-process, which we will take simply as the process of producing sound during performance. The various relations across categories produce a complex nexus of formal relationships that will be unique to each piece; the first step of formal analysis, then, is to determine how each of the different material entities that are participants in the performance maps on to our new categories.

I chose these terms (and perhaps there are better ones) for two reasons. First, they are gerund-like, in that they are in each case a noun form of an action: this emphasizes that they are to serve as theoretical replacements for our old archetypes. Second, their parallel structure emphasizes that none is to be presupposed to have primacy: since we leaving behind the figures, after all, why not also leave behind all the philosophical baggage, so much of it Romantic or Modernist, that accompanies our social valuation of composers and performers (and instruments, for that matter). By freeing ourselves from the established hierarchies of musical production, we may then form a clearer understanding of the social relations contained in or implied by a particular piece, which in turn gives us a starting point for critique.¹¹

11 The terms were inspired by Foucault's 'author-function', though they could in a sense be taken to be the theoretical opposite of his usage: whereas author-function describes the value produced from the identity of the author, composer-process describes material production

A first analysis

Thor Magnusson has described digital musical instruments as “epistemic tools”, which serve to “enable, produce, maintain, support, augment, but also constrain and limit our cognitive processes and therefore creative output”¹². That is, a digital musical instrument, in that it provides a basis for what sound may be produced, reflects and supports an associated regime of musical knowledge. A digital instrument that only produced pitches in just tuning, for instance, might be inferred to imply some naturalist theory of consonance. Translating Magnusson's notion of the “epistemic tool” into our new categories of musical analysis, we see that, because digital instrument design will always imply some epistemic regime or another, the building of a digital musical instrument is already performing the composer-process. (And of course, this was true of instrument builders always, right?) Thus, we must also understand luthiers to be part of the composer-process.

However, we may extend this approach to all our levels of composer-process. In *The Order of Things*, Michel Foucault develops his concept of *episteme*, by which he means the *a priori* conditions of possibility for speech in a given historical

absent any particular authorial identity.

12 Thor Magnusson, “Of epistemic tools: Musical instruments as cognitive extensions”, *Organised Sound* 14, no. 2 (Aug. 2009).

period¹³. Foucault's analytic method is to read across disciplines in order to deduce the configuration of those conditions.

What I propose, is an approach to thinking about sound toys and interactive works in general as multi-layered, miniature *epistemes*, in which each act of composer-process defines some conditions of possibility for musical realization. And unlike Foucault, many of our layers of epistemic possibility do not need to be deduced, as they can be read directly from the program code.

Some example readings demonstrate this approach. With Danny Adler's *Coactive*, we see immediately that the basic strategy of the piece is to loop different sampled layers in synchronization. Just like the timbral, rhythmic, and pitch content of the samples, that strategy is closely related to the general strategy of electronic dance music. For *ToneMatrix* and *orDrumbox*, the parceling of time into equally spaced and mechanistically traversed divisions follows the metaphor of the drum machine, and therefore bears considerable resemblance to musics that rely on that technology: hip hop and again, electronic dance music. And *La Pâte à Son* also embraces such a parceling of time (all of the machinic “instruments” plays in a uniform pulse-division), though the individual time steps are not directly manipulable: rather, they are determined from the

13 Michel Foucault, *The Order of Things: An Archeology of the Human Sciences*.

configuration of the algorithm, represented visually as pieces of the machine.

So, we see that much of our repertoire (especially the Flash- and Shockwave-based segment) relies on playing layers of sampled sounds in combination, often in loops, as a primary method of generating sound while allowing for user manipulation of the process. Lev Manovich, in *The Language of New Media*, describes sampling and looping as primary strategies for new media objects in general, precisely because they are activities at which computers excel¹⁴. But in the short history of electronic music making, we have become quite familiar with other means of sonic genesis: various ways of approaching synthesis, using machine-specific synthesis like MIDI, applying “effects” to sampled data, and different metric organization. So why, with all manner of techniques for sound generation, did so much of this repertoire decide on the straightforward, repetitive playback of samples?

The technologies of interactive web content

Perhaps it is the medium. Indeed, when we examine the technical capabilities of the software platform in which a piece such as *Coactive* is written it becomes clear that the strategy of using looped layered samples is as much a consequence of the software environment as it is some profound aesthetic choice. Indeed, if we

14 Lev Manovich, *The Language of New Media*.

are to understand the techniques for generating dynamically determined sound in general, we must first inspect the technologies available for music distribution. These technologies have a variety of capabilities, which therefore impact the techniques used by web composers. Thus, the technical capacity of web technologies has direct aesthetic implications for web-based interactive music: that is, the *epistemic* structuring of these technologies fundamentally defines the parameters for interactive music creation in these media. A brief technical rundown for the most commonly employed frameworks follows.

Flash

Adobe Flash Player is a program (for Windows, Mac, and Linux operating systems) that is designed to present interactive “rich media” content. Because Flash is available on major operating systems, it offers near-platform independence. It has two distinct advantages. First, market penetration: Adobe claims that the Flash Player is installed on 99% of systems in “mature markets” (which “include US, Canada, UK, France, Germany, Japan”)¹⁵. Second, a quick start-up time: even if a particular Flash document may take time to load (due to data size and/or data transfer speed), the player itself loads into memory nearly instantaneously. Furthermore, Flash has been designed to allow dynamic loading

15 See http://www.adobe.com/products/player_census/flashplayer/ and http://www.adobe.com/products/player_census/flashplayer/version_penetration.html.

of document data, so that a document can be set to initially load only that which is needed for the start-up interface, allowing the user some interaction while the remainder of the needed data is loaded in the background, if at all.

Originally developed to provide two-dimensional vector-based animation, the first version of (Macromedia) Flash (1995-6) did not even offer support for sound, although although some support for sound was added soon after in Flash 2 (1997). However, Flash is severely limited for the purposes of interactive music composition. First, and most egregiously, it provides no *official* support for dynamic sound generation. Not only is the sound buffer not accessible in the Flash programming model (meaning, one cannot generate sample data and simply send it to the audio output device), but neither is the sample data of audio samples stored in memory (meaning, one can neither load sample data to be manipulated nor prepare sample data on the fly into a buffer which would then be played at once).

(In fact, dynamic sound generation *is* possible in Flash Player version 9 through a hack: the Flash document is made to load into memory another Flash document containing a sound object, the data of which is then manipulated appropriately to change the available sound data. Philosophically, of course, there is no distinction between a 'hack' and any other programming technique,

assuming of course that it is as reliable as the officially supported programming model. In this case, however, that criterion fails, as major issues arise under different platforms, including Windows Vista. Furthermore, because the hack exploits a programming configuration that was not designed for the purpose of dynamic sound generation, its performance under even the best case scenarios is poor; capable of only a few calculations per sample, using this method with Flash Player will produce little more complicated than combinations of some simple tone generators and filters, more proofs-of-programming-concept than works of art.)

The second major limitation to programming interactive music documents in Flash is that its timing is unreliable enough to cause major synchronization issues. Flash has retained the frame-based programming model developed to service the needs of vector animation. What this means is that the player is optimized for rendering visual data at some (author-determined) frame rate, for example 30fps. The precise time of code executed during the rendering period is hard to determine with accuracy, and it is similarly difficult to execute a particular bit of code at a precisely specified time.¹⁶ Nor does simply attempting to play two different clips concurrently (executing the 'play' method on one

¹⁶ See <http://www.actionscript.org/resources/articles/159/1/Advanced-Flash-MX-Sound-Timing/Page1.html> for one technique. As with the generative sound hack, this technique requires both a fair amount of skill to implement and may produce unreliable results.

sound object immediately after another) regardless of start-time result in the proper sample alignment. What all this means is that even an application as conceptually simple as a drum machine implementation (where clips of snare and bass drums, etc., could be triggered at regular intervals) becomes unworkable: the timing imprecision is great enough that the rhythm is audibly unsteady.

A third limitation of Flash is that its audio engine, while up to the task of providing audio for website interfaces, animations, and even streaming video, is not particularly powerful. It is only capable of mixing 16 audio channels at once; of course, any combination of audio channel data besides additive mixing is out of the question. Each channel can be gain-scaled and panned to a stereo mix, but the parameters for scaling and panning cannot be changed very smoothly, with the result that dynamically changing those parameters as a clip is being played results in audible jumps in sound output.

A fourth limitation of the Flash environment for the purposes of interactive music programming is its lack of support for raw audio files (like WAV or AIFF). Loading sound data into memory is supported only from MP3 files (although rather high quality files are supported, up to 256kbps); as a result, even if sample-precise audio synchronization could be achieved, attempting some clever

additive synthesis with multiple audio clips is subject to whatever error is introduced in the MP3 compression/decompression process.

Finally, even the more recent versions of Flash player that allow for direct manipulation of audio samples (which would allow a programmer to correct all the limitations of earlier versions mentioned thus far) are relatively slow due to the way Flash Player handles numerical data. The programming language of Flash, ActionScript, is dynamically typed and stores all numbers as 64-bit float values; as a result, the highly repetitive numerical processing required by custom audio synthesis is slow relative to other technologies, meaning that the range of complexity for synthesis-based solutions is somewhat limited.

Shockwave

Adobe Shockwave might be thought of as a beefed up version of Flash. Designed in part to provide 3D graphics rendering, it is capable of rather more intense data-processing than Flash. However, the extra muscle also weighs it down: it has a noticeable start-up time, and (perhaps due to the previous fact) its market penetration is significantly less than the Flash Player.¹⁷ Also, there is no

¹⁷ See again http://www.adobe.com/products/player_census/flashplayer/ and http://www.adobe.com/products/player_census/flashplayer/version_penetration.html. Developers may well have avoided Shockwave because of its startup time (as well as, of course, the fact that Flash is suitable for the majority of rich web content), thereby disincentivizing Adobe to develop it further: though the company released a new version (11) of Shockwave Player in 2008, the last major version change (to 10) was in 2004. Indeed, prior to the latest release, many suspected that Adobe would discontinue the product and fold its features into the ever-more powerful Flash player.

native Linux version of Shockwave Player (though it is possible to run it in a Windows emulator, with significantly decreased performance), which may make it less attractive to developers interested in platform-independent content.

Though it is indeed more powerful, and does include a somewhat better timing model, Shockwave's sound handling is essentially the same as that of Flash. Dynamic sound generation is out, timing is not great, and accessing and manipulating sample data is not possible.

Java and Processing

Java is a programming language developed to be "architecture-neutral". Whereas Flash documents are rendered by the Flash Player, Java code is executed by the Java Virtual Machine (JVM), which runs on any number of platforms. Though it debuted in 1995, support for sound in Java was not even introduced until Java 2, specifically Java 2 Standard Edition version 1.3, released in 2000.

Unlike Flash, the JavaSound API allows direct output of audio sample data, thus making dynamically generated music possible. However, there are some distinct limitations to Java as an interactive music medium. Most notable is performance. Though Java now runs much faster than Flash (and indeed, Java partisans claim it runs nearly as fast as platform-specific compiled code), it has long had a reputation for sluggishness. Part of this may be related to its long

startup time (several seconds at least, during which time the user's browser locks up). Market penetration is also significantly less advanced than that of Flash, owing to a more complicated installation process. Also, unlike Flash, Java has to load an entire sound clip before it can begin playback; this means that the wait time can be significantly longer than with Flash.

One nice feature of Java (and by extension, Processing) is that it can be extended with third-party libraries. JSyn, for example, is a package developed to provide a bridge between low-level sample calculations and a higher level manipulation of audio available with pre-programmed objects that do common tasks (like output a variable-frequency sine wave), as one has available in common electronic music programs like Max/MSP. However, a third-party library like JSyn requires a separate (and potentially confusing) installation process.

On the other hand, there are several publicly available, open-source sound libraries that can be used and re-distributed freely for a higher-level manipulation of sound in Java/Processing, including Ess, Beads, Tritonus, and SoundCipher¹⁸. As these libraries become more developed, and as Java Virtual Machines become more powerful, more complicated ways of synthesizing and manipulating sound are becoming more commonplace in web-based interactive audio.

The introduction of Processing in the mid '00s—called a “language”, but essentially a library/wrapper for Java—has drawn more widespread use to Java-based interactive browser art in recent years, because it simplifies the process of developing browser-viewable Java programs or “applets”. Pieces (especially simpler ones) can be written and published much more quickly in Processing, and the language itself is more accessible to and less verbose. As a result, an online community that exchanges short programming experiments has sprung up, organized around sites like OpenProcessing¹⁹.

“Media Player” Plug-ins: Windows Media Player, Quicktime, and Real Player

Media players were the first web technologies to provide sound output, and as such they are the simplest. Originally, they would simply offer playback of a

18 Find Ess at: <http://www.tree-axis.com/Ess/>; Beads at: <http://www.beadsproject.net/>; Tritonus at <http://www.tritonius.org/>; and SoundCipher at <http://soundcipher.org/>.

19 Located at: <http://www.openprocessing.org/>.

sound file (WAV, MP3, or other), which the user could control with a simple tape-player-style interface. One standard feature now available in media player plugins, however, is the ability to handle streaming audio, audio data that is on-demand or potentially “live”. One interesting possibility for interactive music composition, then, is to have the user's input sent to a server; the server (with a predictable and customizable audio-processing architecture – it could be running Max/MSP, for example) then generates the audio, which it then compresses and streams back to the user's computer. While audio synthesis is now limited only by the technical capacity of the server, we face the downside of the rigors of audio streaming. First, the audio is compressed (though it can be done at fairly high quality). Second, the bandwidth needs are high, which may preclude use by many internet users, and which may introduce drop-outs across even the most reliable of connections. And finally, because of the nature of the streaming protocol, there is a fairly high latency from user interaction to sonic result: the best results achieved using IceCast2 (a streaming server) on a local intranet produced a three second delay. Such latency, while insignificant for many applications, may prove prohibitive for others.

MIDI

In theory, MIDI would be the ideal technology for many web-based

interactive musical applications. Because it relies on control data, its bandwidth needs are extremely lightweight. However, the MIDI standard provides for no particular sound quality, and its implementation on consumer sound cards is typically terrible and uneven, if it is supported at all; as a result, using MIDI provides no guarantee as to the audible result for the end-user. Of course, MIDI is not a programming platform in itself, but rather simply a way generating sound: a program sends instructions to MIDI hardware (or, increasingly, a software emulation of MIDI hardware) that takes parameters like note number, velocity, and volume, and renders audio as though the specified notes were “played” on a particular instrument. Thus, programs using MIDI must also employ another technology such as Flash or Java; and yet Flash doesn't even include a native MIDI interface (though it is possible to send and receive MIDI data in Flash with a third-party package, FlashMIDI).

Summary: Flash as the dominant choice

Because earlier versions of Java and the various “media player” plug-ins are unwieldy and/or limited in their interactive usefulness, the vast majority of early sound toys were authored in Flash or Shockwave (though Java-based sound toys are now becoming more common). However, until recently, neither Flash Player (the platform of *Coactive* and *ToneMatrix*) or Shockwave Player (the platform for

La Pâte à Son) provided the ability to synthesize audio, through hardware or software, until recently. As a result, the primary technique for generating audio for sound toys as a genre has been to employ the dynamic combination of sampled audio. Because of the capabilities of Flash Player before version 10, anything more than volume scaling and panning was out of the question; other techniques that we take for granted in dedicated synthesis environments like Max/MSP were just not possible. And since audio samples are fairly large, in terms data size, bandwidth considerations tend to limit the amount of sampled audio that can be effectively employed. Furthermore, the timing mechanism of Flash Player is precise enough only for synchronizing samples to a fixed, regular tempo, hence the reliance on equal-length loops that are synced together (as in the case of *Coactive*) or not (as in the singing horses), or samples that are triggered either in a fixed pulse like a drum machine (as in the case of *La Pâte à Son*, *ToneMatrix*, and *Codeorgan*) or individually and independently (as in *Pianographique*). Thus, the *epistemic* conditions of possibility for temporal ordering in Flash-based sound toys strongly favor a regular and fixed division of time, or no ordering at all.

A further reaching composer-process

However, the larger issue is that the inability of Flash and Shockwave Players

to implement audio synthesis techniques until recently was very much a programming decision. Certainly Flash Player developers have been implementing for years sophisticated graphics processing routines that take just as much computing power as audio processing; but there is simply little incentive to add the capacity for audio synthesis when the types of content that generate revenue—ads and most video games—have little need for those capabilities.

The German media theorist Friedrich Kittler has in many of his works sketched the fundamental ways that technologies of information distribution have shaped discourse²⁰. For Kittler, writing code and designing circuits, because they shape the way we are able to think, are forms of “writing” in the same way that producing an essay is “writing”: the writing of hardware and software in fact descends directly from the writing of traditional forms of literature²¹.

In the case of sound toys like *Coactive*, we can observe that the hardware-software matrix that makes them possible also has a profound effect on formal developments within the pieces themselves and the genre as a whole. Following Kittler, and using the theoretical framework established earlier, we must acknowledge commercial software developers, just as digital instrument

20 See, for instance, Friedrich Kittler, *Discourse Networks, 1800/1900*.

21 Friedrich Kittler, “There is no software”.

designers—however distasteful this may be to us—as a rudimentary part of the composer-process. In order to adequately evaluate sound toys as an emerging genre, then, we must acknowledge not only that their existence has been enabled by commercial media companies, but that their very forms have been co-authored by the same.

Time, Value, and Subjectivity

This article has made the case for a theoretical framework that is better equipped to address the distributed production model of interactive musical pieces. But one might be tempted to dismiss sound toys as a minor genre, safely ignored. However, it seems likely that sound toys and their descendents, and interactive musical works in general, will only become more prevalent in popular music. As more advanced machinic platforms proliferate, in the form of smartphones and tablets and so on, and as listeners and content producers become more comfortable with interactive art, so will there be an explosion of the form. And as a result, understanding the social implications of this genre (and of interactive media in general) is crucial. Because sound toys, and interactive music systems in general, make possible a relationship between the listener and time that is fundamentally different from traditional linear music, we are prompted to begin our investigation of sociopolitical consequences of these

works with musical time as a starting point.

In classic Marxist analysis, one of the fundamental critiques of capitalism is the critique of abstract labor. Under the capitalist system, labor becomes abstracted from the worker, in the sense that it is valued no longer in relation to the worker who performed the labor but in relation to the measure of time it took to perform the labor: a quantitative valuation replaces a qualitative one.²² Thus, all labor becomes comparable.

In “Time, Work-Discipline, and Industrial Capitalism”, E.P. Thompson chronicles how the concerns of factory owners drove the development not only of accurate chronometers (to measure the labor of workers), but also the establishment of rigid work schedules—what in today's post-New Deal society we (in the US) experience as the eight-hour day²³. What results, then, is a fundamental shaping of our experience of time and the ways in which we can conceive its structuring: factory life, then, serves as an *epistemic* foundation for our temporal experience²⁴. Thompson also points out that some people—indeed, perhaps most people—do not function this way “naturally”: pre-industrial

22 Karl Marx, *Das Kapital* volume 1, ch. 1.

23 E.P. Thompson, “Time, Work-Discipline, and Industrial Capitalism”.

24 See also Sylviane Agacinski's *Time Passing*. “Since the nineteenth century, the world's technical development has constituted the primary referential field for describing and organizing the whole of human societies... Globalization is the unification of the world's rhythms, all adjusted to the Western clock, that is, to contemporary chronotechnology.”

workers had much more flexible schedules, switching between work and leisure frequently, and tended to work in condensed bursts of productivity as opposed to long, regular work hours.

Recent changes in the structure of the American economy, however, have resulted in some changes in workers' relationship to time: so-called "flextime" and the ever-more-frequent working from the home. Although the authors of "The Post-Work Manifesto" could argue as recently as 1998 that a fundamental restructuring of the workday remained a unaccomplished dream of liberal labor reform²⁵, what could only be portrayed in a fantasy sequence in *9 to 5* is now a reality for a quarter of the US workforce²⁶. Further, more and more workers are able to "work from home" for at least some portion of their jobs. A corporation like Google stands as a view of what future work may look like for more and more workers: not only are Google engineers' schedules flexible, their corporate headquarters features a free cafeteria, lots of "leisure" facilities (gyms, couches, televisions), and day care. Most innovatively, their engineers are actually required, under the so-called "20% rule" to spend a fifth of their work time working on *whatever projects they want*. It is not particularly cynical to suggest

25 Stanley Aronowitz, Dawn Esposito, William DiFazio, and Margaret Yead, "The Post-Work Manifesto".

26 *9 to 5*, directed by Colin Higgins and starring Jane Fonda, Lily Tomlin, and Dolly Parton, was released in 1980.

that Google's approach represents a capitalist appropriation of labor reform — they were just smart enough to see that such a setup would only increase the corporation's bottom line as a result of keeping its workforce happy.

There is a connection, however, between the temporal organization of music and the organization of society — per Adorno, “just as the temporal form of every music, its inner historicity, varies historically, so this inner historicity also always reflects real, external time.” For Adorno, music's relationship to time — that is, the temporal relations between musical elements in a given work — is to be understood in counterpoint to the socio-temporal relations of society. Critically engaging the temporal structures of traditional musical form is therefore an act of critical engagement with the social relations from which that form sprang; conversely, affirming traditional temporal relations affirms the status quo. (On the other hand, engagement was necessary, as opposed to outright dismissal: one of Adorno's reasons for detesting integral serialism was that it failed to invoke history, and in doing so lost its social import; it became asocial.)²⁷

Looking at the history of Western Art music, we can see a development in the treatment of time that parallels the development of the capitalist workday. It was Beethoven who famously attempted, at the end of his life, to revise his whole

²⁷ The quote is from Adorno's “The Relationship of Philosophy and Music”. See also Adorno's “The Aging of the New Music” (1955), or Robert Winston Witkin's *Adorno on Music* (1998).

catalog by instituting quantified tempo markings, thanks in part to new, reliable metronomes. The 19th century saw forms stretch and grow more complex, and only a few years after depictions of the factory in Fritz Lang's *Metropolis* and Charlie Chaplin's *Modern Times* came the serialists' first serious attempts to rigidly parcel time²⁸. It seems no accident then, that as we see the introduction of a new, flexible attitude toward time in capitalist work, we should also see such a development in popular music.

On the other hand, we might also understand sound toys to be potentially critical of time in everyday life. However flexible newer capitalist labor schedules may be, workers still structure their lives around industrial temporal needs. If, following Adorno, the experience of musical time permits a critique of history, and by extension, the temporal organization of daily life, to leave at least some elements of the structure of musical time to listener determination is to consequently propose that listeners take control over the very schedule of their lives in general. But whatever radical challenge to capitalist authority becomes possible in sound toys must at the same time be expressed within the epistemic conditions of possibilities for temporal organization in their underlying media; and just as the strategies for structuring sound in time have been, the political

²⁸ *Metropolis* dates from 1927; *Modern Times* from 1935.

possibilities of the genre have been fundamentally circumscribed by the capabilities of web technologies.

Last year, *Wired* magazine published a short article titled “The Album is Dead, Long Live the App”²⁹. It argued that the interactive application may well come to be a dominant mode of music distribution, both because of enhanced monetization opportunities, but also because of the new multi-media possibilities of the interactive form. Meanwhile, newer applications like *RjDj* and Brian Eno's *Bloom* have continued to push the possibilities of interactive music making. And as the socio-political implications of music of this nature are fundamentally different from traditional linear music, as a result of their relations of production, then it would most certainly behoove us to reconsider how we think about music in the midst of this changing aesthetic landscape.

²⁹ Van Buskirk, Eliot. “The album is dead; long live the app”, *Wired* (Aug. 4, 2009): <http://www.wired.com/epicenter/2009/08/the-album-is-dead-long-live-the-app/>.

2.2 Twos & Threes

Description

Twos & Threes gets its name from the fact that it allows the player, using the keyboard, to play a variety of short melodic figures that divide time into short segments of two or three pulses. Melodic gestures are rendered with a synthesized “marimba” instrument of my own devising using Beads (discussed in Chapter 2.7). A variable drum accompaniment shifts to match the metric changes, as does a generative bass line.

2.3 The Brightness of Space

Description

The Brightness of Space allows the player to initiate different “sound points” using the keyboard. Each sound point initiates a long sustained tone; as different points are combined they interact to create a complex harmonic field.

2.4 ExtraVerby

Description

ExtraVerby creates a sonic environment defined by extremely persistent reverberations. (The reverb is of my own design; see the Beads page (Chapter 2.7) for more information.) Players can produce detuned pentatonic notes of different

timbral qualities (depending on mouse placement), blasts of filter noise, or a booming bass drum sound. This piece, while fun on its own, also serves as a prelude to *Intensified Loops* (Chapter 2.6).

2.5 War & Peace

Description

War & Peace searches Twitter posts (“tweets”) and generates musical material based on the content of the results. It does a simple search through each returned tweet to see if it contains “happy” words or “sad” ones—words having do with war, violence, and death. The program then produces a generative musical texture that reflects that analysis.

Users are able to specify what search term the program sends to the Twitter server; because I wrote the piece in the midst of the Gaza crisis in the summer of 2010, the default search is for “Gaza”. Users can choose other preset search terms or enter their own.

Different temporal cycles overlay in a way that would be impossible using a tool like Adobe Flash, as the texture ebbs and flows with the speed of the Twitter queries, and the “intensity” of the results (i.e. how many known words the program finds in them). *War & Peace* was instead implemented in Beads (Chapter 2.7)

Though the sound palette is limited, it is engrossing to try out different search terms in order to hear the sonic result.

Twitter4j and JSON.org

War & Peace uses the Twitter4j library (available from twitter4j.org) to send Twitter queries; it is released under the Apache License 2.0. Furthermore, Twitter4j makes use of software from JSON.org that is licensed under The JSON License.

2.6 Intensified Loops

Description

Intensified Loops uses the same initial sounds as *ExtraVerby* (Chapter 2.4), but rather than creating a highly reverberated sonic environment, it processes those sounds through a highly variable looping scheme.

Players use both the keyboard and the mouse cursor to manipulate the piece: keystrokes generate the initial sounds, while cursor placement on the square affects the loop processing. Both loop length and loop speed are customizable, with the result that the simple palette of initial sounds can be shaped by the user into a wide range of sonic possibilities.

2.7 Beads and live coding

Beads is an open-source sound library for Java. When I began researching audio solutions for programming sound toys for the Java Virtual Machine, Beads was the one library that was powerful, flexible, customizable, and reliable. At the time, however, it was undeveloped in some areas that are *de rigueur* for synthesis technologies: in particular it lacked powerful filters and basic higher-end processing units like a compressor or a reverb object.

Because of the flexible nature of Beads, I was able to develop these software objects for my own purposes by extending Beads code with my own. After I had amassed a fair amount of useful code, I contacted Ollie Bown, who had initiated the Beads project, and offered to contribute it. Shortly thereafter, I was made an official part of the team.

Beads is used in all of the sound toys in this project (Chapters 2.2-2.6). More information on its use can be found on the Beads website (beadsproject.net).

Because Beads is a collaborative, open-source effort, I cannot claim authorship for most of it; however, the following classes, which I developed as preparation/research/preliminary work for sound toys of Division 2, are mostly or completely my own production (almost all are in the “UGens” section):

- AllpassFilter

- BiquadCustomCoeffCalculator
- BiquadFilter
- CombFilter
- Compressor
- CrossoverFilter
- DelayEvent
- Delta
- IIRFilter
- LPRezFilter
- MonoPlug
- OnePoleFilter
- Phasor
- RandomPWM
- RMS
- Throughput
- TrapezoidWave
- UGenChain
- WaveShaper
- ZMap

- ZeroCross

I also had a significant hand in revising and reshaping some of the fundamental Beads classes, including:

- Clock
- TapIn
- TapOut
- UGen
- WavePlayer

From the Beads website:

Beads is a software library written in Java for realtime audio. It was started by Ollie Bown in 2008. It is an open source project and has been developed with support from Monash University in Melbourne, via the Centre for Electronic Media Art's ARC Discovery Grant Project "Creative Ecosystems", and a Small Grant for Early Career Researchers from the Faculty of Information Technology. The Beads team includes Ollie Bown, Ben Porter and Benito.

Live coding

Live coding is a genre of artistic production (sonic and/or visual) in which the artist improvises the work in real time by specifying it with code. Many early efforts in the genre relied on custom-built software environments (such as Fluxus, Impromptu, and Usine).

Using Beads, I set out to develop a cross-platform, browser-based live coding

solution that used pre-existing technologies. My live coding environment uses the Rhino JavaScript engine (more information at the Rhino page) that runs in Java to interpret JavaScript code entered by the user in real time.

I chose JavaScript because of its ubiquity (it may well be the most popular programming language in the world) and its flexibility. However, JavaScript code—necessarily slower than compiled Java bytecode—is used only to script events; Beads objects, running faster Java code, take care of the hundreds of thousands of calculations per second needed to synthesize audio.

The environment is at this time a fairly basic treatment, though it is extremely powerful: anything one can accomplish with pre-compiled Beads objects is possible.

Documents

- The live coding environment (Processing applet)

a.1 Tools & technologies

Programming technologies

- Sound toys were created with Processing.
- Networking and sound synthesis code was written in Java, using the Eclipse IDE.
- Web-based interfaces not requiring sound were produced with Adobe Flash CS4, written in ActionScript 3.0.
- GlovePIE (v0.32) provided an easy way to get WiiMote data into Max/MSP, by sending OSC-formatted UDP messages.

Sound

- Sound synthesis was achieved with Java code, using the Beads library, as well as my own code extending it.
- I also used Max/MSP (versions 4.5 and 5) extensively.
- Some sound samples were produced with Cakewalk Sonar; much audio editing was done in Adobe Soundbooth CS4.

Video

- Videos were edited with Adobe Premiere CS4. Video files were encoded with H.264 and WebM.

Graphics

- Music notation was rendered with Finale (versions 2007-2010).
- For paper documents and other images, I often used Adobe InDesign CS4, Photoshop CS4, and Illustrator CS4.

Web development

- Notepad++ was a super-useful text/code editor.
- Google Chrome and Mozilla Firefox were used for web testing.

Hardware

- The vast majority of this project was composed and compiled on a Dell Inspiron 1720 laptop running Microsoft Windows (first Vista, then 7).
- I used an Edirol UA-101 audio interface for pieces that required audio input or more than two channels of output.
- WiiMotes, originally designed for use with the Nintendo Wii, were used as motion-sensing inputs for several pieces.

a.2 List of project documents

Following is a complete list of project documents, organized by category.

Videos

1.1 *Morals*

- Video overview (MP4)
- The whole performance (MP4)

1.2 *“You don’t understand—these boys killed my dog.”*

- Video overview (MP4)
- Whole performance (MP4)

1.3 Further experiments with Wiimotes

- *Mambo Relacional* overview (MP4)
- *Mambo Relacional* full presentation (MP4)
- VocalGraffiti overview (MP4)
- *VocalGraffiti* full performance (MP4)
- *VocalGraffiti* tutorial (MP4)

1.4 *Checkmate*

- Video overview (MP4)
- Whole performance by movement (MP4s):

- I
- II
- III
- IV
- Whole rehearsals (MP4s):
 - Rehearsal #1
 - Dress Rehearsal

1.5 A Cookbook for Life

- Video overview (MP4)
- Whole performances (MP4s):
 - First concert at Duke University
 - Second concert in Raleigh, NC

1.6 Rules

- Video overview (MP4)
- Whole performance (MP4)

1.7 SuperConductors Beta

- Video overview (MP4)
- Whole performance (MP4)

Scores & parts

1.0 SuperConductors Alpha

- *SuperConductors Alpha* score (PDF)

1.1 Morals

- PDF parts for practice purposes:
 - Clarinet
 - Flute I
 - Flute II
 - Piano
 - Violin
 - Viola

1.2 “You don’t understand—these boys killed my dog.”

- Parts (PDFs):
 - Clarinet
 - Guitar I
 - Guitar II

1.4 Checkmate

- Score (PDF)
- Parts:

- Violin (PDF)
- Viola (PDF)
- Cello (PDF)

1.5 A Cookbook for Life

- Practice parts (PDF):
 - Clarinet
 - Violin
 - Viola
 - Keyboard

1.6 Rules

- Short score (PDF)
- Parts (PDFs):
 - Flute
 - Clarinet I
 - Clarinet II
 - Banjo
 - Keyboard I
 - Keyboard II
 - Violin

- Viola
- Percussion / Conductor

1.7 *SuperConductors Beta*

- Score (PDF)

Other paper documents

1.1 *Morals*

- The paper page given to audience members before they entered the performance (PDF)

1.6 *Rules*

- Ballot for the audience (PDF)

Program code & archives

1.1 *Morals*

- Actual parts (ZIPs)—Max/MSP patches & associated files:
 - Clarinet
 - Flute I
 - Flute II
 - Piano
 - Violin

- Viola
- The Max/MSP Server

1.2 “*You don’t understand—these boys killed my dog.*”

- Max/MSP patch
- GlovePIE script

1.3 Further experiments with Wiimotes

1.3a Mambo Relacional

- Max patch (ZIP)
- GlovePIE script (PIE)

1.3b VocalGraffiti

- Max patch (ZIP)
- GlovePIE script

1.5 A Cookbook for Life

- The audience & instrumentalists’ interfaces (ZIP)
- The Max/MSP patch & Java server
- The Java server files:
 - Main class: CookbookForLife.java
 - Base class: FlaxMash.java
 - Executable JAR file

1.7 SuperConductors Beta

- Audience interface (ZIP)
- Instrumentalist part interface (ZIP)
- Java server:
 - ZIP archive
 - FlashServer and Server, my own Java classes that handled networking

2.7 Beads and live coding

- The Beads classes

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Biography

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