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Fractured Bodies: Gesture, Pleasure and Politics in Contemporary Computer Music
Performance

A Thesis submitted in partial satisfaction of the
requirements for the degree of Master of Arts

in

Music

by

Jason Benjamin Ponce

Committee in charge:

Professor David Borgo, Chair
Professor Jann Pasler
Professor Miller Puckette

2007

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The Thesis of Jason Benjamin Ponce is approved:

Chair

University of California, San Diego

2007

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ABSTRACT OF THE THESIS

Fractured Bodies: Gesture, Pleasure and Politics in Contemporary Computer Music
Performance

by

Jason Benjamin Ponce

Master of Arts in Music

University of California, San Diego, 2007

Professor David Borgo, Chair

A warming critical reception and the appearance of computers within music-making domains that have traditionally been solely occupied by acoustic instruments is evidence that the computer is on a trajectory towards becoming a fully integrated musical instrument within both academic and popular musics. “Fractured Bodies: Gesture, Pleasure and Politics in Contemporary Computer Music Performance” opens the question of whether or not the receptive discomfort computer music performance has struggled against is the result of a conceptual error of function over form, or whether it is simply the result of historical bias and an awkward creative adolescence.

I explore this question by providing a wide perspective on how computer music and post-digital performers are rewriting the well-understood historical role of the musical body, and how this situates the computer as an ideal site from which to critically reexamine the issues of musical gesture, intentionality, reception and cultural capital.

~Introduction

In one especially vivid account of his life as a teacher of philosophy, Pythagoras is said to have delivered lectures to his students while seated behind a screen, hidden from view. It is generally understood that his intention in doing this was to separate in the minds of his students the sound and meaning of his words from the awe and expectations generated by the aura and presence of his person. Aside from his many contributions to the arts and natural science, there is a wealth of such lore and legend surrounding the man and his teachings. The breadth of his ideas and the weight of his historical persona have perhaps made this inevitable. Centuries later, this particular notion of sound, the idea of sound that has been separated from its source, was taken up by those who found a new musical vocabulary in *musique concrète*.¹ It is an interesting historical twist that such an iconic historical representation of Western art music, a music so frequently estranged from the popular, came from a thoughtful arrangement of the sounds of simple everyday life.

The focus of this paper is on another icon of the everyday—the computer—which when used in a musical context is perhaps the most powerful modern example of acousmatic sound. Specifically, I will address the use of the computer as a musical performance tool, and how this unique musical instrument and the musicking practices it facilitates are actively challenging historical formations of both “high” and “low” musics. I will argue that formerly well-understood boundaries are being transgressed

¹ Sound that has been source-separated in this way is usually referred to as *acousmatic sound*. In a modern context this is often taken to mean sound or music that is played through loudspeakers.

by laptop music performance practices, requiring us to reexamine prevailing but incompatible notions about how the body negotiates the dynamics between production, intentionality, reception and cultural capital—formations that continue to be fundamental to the art music versus popular music debate. For better or worse, Western art music has historically been framed as being the pinnacle of musical achievement throughout the world. Accordant with this view has been a lasting tendency to cloister such music within the academy, thus removing it from the spheres of ordinary daily life and inhibiting discussion of its social origins. Popular music, too, has suffered a certain subjugation at the hands of privileged cultural modes of thought, being largely dismissed for inviting pleasure and provoking the body instead of nurturing the intellect in the pursuit of loftier goals.

This paper uses the overarching concept of the body as a framework for discussing the various practices of computer music performance and how these practices are affording us new ways of critically examining the traditional schism between art music and popular music. It begins locally, with the individuated body, and ends with the body corporate and politic, attempting a critical examination of the ways in which one affects the other. In the first half of the paper I will discuss some of the performance issues around computer music production, particularly how computer music performance practices are problematizing the role of musical gesture, interface, cognition and audience reception. Included will be an overview of some of the newest emerging performance practices in laptop music and how these practices are in the process of rewriting standardized codes for the way performers are constructing performative relationships with the body. This includes artists who engage in

geographically distributed realtime improvisation practices (network music) and “post-digital” artists who create software instruments in realtime during live performance (live coding)². As an approach for connecting the seemingly disparate domains of the physical body and the inorganic domain of digital signal processing, I invoke Pierre Schaeffer’s concept of the sonorous object, and discuss how it has been illustrated to great effect by performing laptop musicians. In his book *Traité des objets musicaux*, Schaeffer settles on the definition of the sonorous object as the smallest “intentional unit” of sound. It will be argued that this concept underlies the production of laptop-produced post-digital music, where sonic artifacts are constructed by musicians with great care and manipulated on a very small scale, frequently at the level of the individual sample. Schaeffer’s ideas will be extended to include a discussion of musical gesture in computer music, and the various techniques musicians and artists have adopted to enable a fuller range of embodied musical expression.

The second part of this paper will take this new understanding of the performing body and extend it to include the body of the audience with a discussion of reception and pleasure. I argue that both academic computer music and popular electronic music have an intimate but opposed relationship to the ways in which pleasure and reception are manufactured and employed. Finally, the significance of

² The term “post-digital” was first used by Kim Cascone in his article *The Aesthetics of Failure: “Post-Digital” Tendencies in Contemporary Computer Music* to describe the new techniques and sounds made possible by modern synthesis engines. More than simply a species of sound, post-digital has come to represent an awareness of a certain cultural saturation with regard to the digital experience. While the post-digital sound often refers to those sonic artifacts characteristic of music produced, manufactured and performed with computers, the overarching aesthetic embraces the domains of non-linear process, glitch and digital error as viable musical content.

laptop music within the domain of Western art music will be considered with respect to issues of power and cultural capital. While imagining the mechanics of State power and control, Deleuze and Guattari have famously theorized culture as being “rhizomic”, implying an interconnected yet nomadic and deterritorialized sense of body. These concepts gave a theoretical voice to an international movement already underway by the mid 1990’s, and had a galvanizing effect on the musical politics of the early post-digital music scene. One indication of just how strongly these concepts resonated within this community can be seen in the German independent record label Mille Plateaux, which, named as it was after the seminal Deleuzian text, grew to become one of the earliest and most important proponents of post-digital music.³ While in the context of this theoretical framework it may be tempting to be content with an interpretation of the rhizome as a virtualized body that engages in practices like geographically distributed music-making, or as a new kind of cultural movement resulting from the breakdown of composer-hero and rock-icon, this formulation does not necessarily address the issues of performativity and reception that new computer music practices have brought to bear. By theorizing a new virtual body that connects the physical and the theoretical I hope to show that the laptop is a unique signifier in a growing spectrum of new performance practices, requiring a reformulation of the ways in which the body, power and pleasure are commonly understood, both within the academy and within the popular music world.

³ After Deleuze’s death in 1995, Mille Plateaux released *In Memoriam Gilles Deleuze*, a compilation album in his honor that was accompanied by a booklet of his writings.

~Performance, Gesture and the Sonorous Object

Because the computer is purely logical, the language of interaction should strive to be intuitive. Because the computer removes you from your body, the body should be strongly encouraged. Because the computer's activity takes place on the tiny playing fields of integrated circuits, the encounter with the computer should take place in a human-scaled physical space.

- Interactive artist David Rokeby, creator of the Very Nervous System

In Noise: the Political Economy of Music Jacques Attali writes that no organized society can exist without structuring difference at its core.⁴ Extending this, one way of understanding the experience of receiving pleasure through music is via an understanding of the difference music suggests. Within the academy, difference may be created between composer and performer, performers and audience, intention and reception, the educated and the uneducated. The history of such high-art cultures is full of characters and egos possessing vested interests in representing to the outside world a refuge of learning and sophistication that is separate and apart from the popular.

Popular music takes a different approach to the creation of difference: it structures itself around the production of subculture, a sense of personal liberation or empowerment, and as a site of resistance and change. In this regard, the success of popular music performance depends in part upon a self-conscious negotiation of artificial separation between performer and audience. The history of rock music itself

⁴ Jacques Attali (1985), 5

is almost inseparable from visions of iconic performers with singular stage personas. In his excellent book on popular music production, Jason Toynbee relates the story of how Ian Curtis, leader of the English post-punk band Joy Division, blurred the distinction between his real-life epilepsy and his on-stage theatrics by introducing a new kind of spasmodic dancing to his performances, a spectacle which critics have described as “unbearably intense”.⁵ This interpretive, self-conscious reference to his own body is more simulacra than simulation, as Curtis connected his “real” body with its on-stage representation. In doing so he extended the boundaries of artistic expression while at the same time retaining an allegiance to rock’s angst-ridden aesthetic. Similarly, in her biography of Curtis, his widow Debora relates how later in his career he immersed himself in existentialist texts, especially the writings of Nietzsche and Sartre, for the purpose of affording his lyrics a historical and intellectual weight.⁶ Both Curtis’ stage presence and his crafting of a literate lyrical foundation reveal a cultivated negotiation between artist and audience, and thereby a deliberate manufacture of difference. In using music in this way, Curtis, in effect, constructs himself as a performative agent that has calculated and carefully planned his work to achieve a specific effect, rather than as a performer concerned only with intuitive self-expression; he attempts to *reach out* to his audience from his position on stage, to somehow overcome the implicit (yet manufactured) space between them. Even the title of Debora Curtis’s book, Touching From a Distance: Ian Curtis and Joy

⁵ Jason Toynbee (2000), 34.

⁶ Deborah Curtis (1995), 90.

Division, seems to be a reference to this dynamic, and speaks to a much larger aesthetic within the sphere of popular music production.

Comparing this reading of the role of the popular performing body to scholarly discussions of the performing body in the context of Western art music produces some interesting insights. In his discussion of classical performance practices, Christopher Small argues that these practices are the legacy of a socially constructed process that has been dominant since the Romantic era.⁷ Resulting largely from the characteristic cults of personality surrounding the composers of that era, contemporary music had struggled for inclusion in the canon against a near repertory freeze. As a result, the significance of the performer in Western art music is shifted dramatically away from that of the performer in popular music. Speaking of this difference represented in practices typically observed in modern concert halls, Toyne notes,

In effect the (long dead) composer's intention is re-enacted by a series of performance units: first the score – the mark of the composer's presence; then the conductor – a manager-priest who administers that presence; next the musicians – servile operatives who follow the score as it is interpreted for them; and finally the audience – passive receivers of this doubly reinforced re-presentation.

In other words, the dominant “body” in the performance of concert art music is less the musicians who interpret the scores on stage than the imagined personality of the absent composer, looming over the proceedings, silently judging every note. This has the effect of shifting attention away from that which moves a popular music forward (strategy, vis-à-vis socialized articulations) to that which is capable of most clearly

⁷ Christopher Small (1987), 75.

articulating the voices of phantoms (interpretive competence, virtuosity, historical sensitivity, representations of authenticity, etc.).

One particularly distinctive manifestation of this kind of bodily cross-construction in an art music context can be observed in the music of Brian Ferneyhough. Ferneyhough's music is commonly grouped with the music of other contemporary composers like Michael Finnissy and Richard Barret in the 'new complexity' movement in contemporary art music. Ferneyhough's music has been described as labyrinthine by music scholars, and has a reputation for representing a level of performative difficulty that prohibits performance by any musician not extremely accomplished on their instrument.

Ferneyhough himself also seems to gravitate towards a mazelike aesthetic. In his doctoral dissertation on Ferneyhough, Ross Feller gives a thorough analysis of the composer in which he uses the labyrinth as central organizing principal for a discussion of not just Ferneyhough's written scores, which due to the density of notation many have likened to art objects themselves, but as a way of describing the musical conundrum his music creates for the performing body.⁸ In connecting so strongly with the concept of the labyrinth, Ferneyhough certainly invokes the body, by referencing the Greek myth of Daedalus and the winding prison he created for the king of Crete; but he also invokes the mind, by reminding us how the labyrinth was ultimately solved by Theseus, and the king's Minotaur slain using only balls of tar and thread. The system of over-notation Ferneyhough employs in his scores – which Feller traces to Boulez's hyper-expressive tradition – has resulted in works composed for

⁸ Ross Feller (1994), 37.

specific, virtuosic performers and ensembles, and which are at times quite impossible to perform as notated. In this the music demands of the performer a kind of embodied communion with the composer that is atypical of Finnissey or other new complexity composers. Feller states that “an adequate performance of [Ferneyhough’s] compositions involves the establishment of audible criteria of meaningful inexactitude”.⁹ Meaning therefore is afforded in Ferneyhough’s music not via precision of the performance and thereby a exaltation of the score—a precision that is in this case both undesirable and impossible to achieve—but via the personal ways in which each performer uses the body to realize a solution to the labyrinth of mental possibilities implicit in the music, and thereby negotiates (or programs) an embodied representation of Ferneyhough’s musical vision. In that control in Ferneyhough’s music is distributed by design and the traditional role of the body implicitly problematized by his processes, this scenario has both practical and political implications for art music production in general, and, as will be discussed in the next section, for computer music performance in particular.

~The Computer and Performativity

Of the numerous perspectives that exist that discuss the particulars of why the laptop has had such difficulties finding a comfortable place in the performance world, most eventually end up passing through a similar place—specifically, that in laptop performance there is an inability on the part of the audience to connect what they see

⁹ Ibid, 6.

on stage with what they are hearing.¹⁰ Moreover, in laptop music, musical virtuosity, that signifier of concert hall legitimacy and rock stage prestige, is no longer made explicit, is hidden from view, or simply transformed into something unfamiliar. Nevertheless, the laptop, in addition to becoming standard equipment in DJ booths, dance clubs and recording studios, is appearing more and more on contemporary music concert stages, in chamber ensembles, improvised music groups, and within other musical provinces that have traditionally been the exclusive domain of acoustic instruments. Opinions may still differ on the issue of legitimacy, but there seems to be less and less doubt that the laptop is now a musical instrument in its own right.

Although the open-ended nature of computer-as-instrument clearly allows for an extremely broad range of sonic possibilities, it also brings with it a certain amount of receptive discomfort. Few would disagree that the history of technology's relationship to art is well established, yet it seems that the use of technology in the context of electroacoustic music has been plagued with a surfeit of misunderstanding. Even as increasing numbers of contemporary composers employ the capabilities of ready, cheap signal processing or algorithmic elements in their work, and even as general audiences have become more accustomed to seeing arrays of speakers accompanying classical instrumental performers on stage, computers and computer performers are still frequently treated as less than full members of performing ensembles. Although recent years have seen some changes in this attitude, an air of illegitimacy remains. As a solo and ensemble performer that frequently uses a computer on stage in both popular and academic contexts, I can attest to the numerous

¹⁰ See Jaeger, Stuart, Turner, Vanhanen etc.

situations where I have been treated more like a “sound guy” than a full participating member of a performing ensemble, and even questioned as to why I need to be on stage at all. This dynamic is revealing, and raises many interesting questions about how different kinds of performance practices are situated in the minds of the public (including other musicians), what may be embedded in our minds concerning those practices already deemed legitimate, and what expectations an audience brings to a performance. What are computer musicians really doing when they are on stage, and do they have a right to be on stage in the first place, i.e. are they really “performing” anything at all? Is there any difference between the role of the laptop in the context of popular music and that of the academic music world? What is the role of the performative body when what the body does during a computer music performance is largely a function of software design? These questions are implicit in the struggle the laptop has undertaken to find legitimacy in the performance world, and reveal the laptop as a particularly interesting site from which to analyze the popular music versus art music debate.

Of the many ways in which the laptop is challenging standardized performance tropes, the frequently invoked question of musical gesture is particularly contentious territory. In some respects, the aesthetic boundaries that place a musician within an art music sphere or within the popular music sphere depend upon the various gestures required to perform the music. It may be easier to see how this can be true at the performative extremes. It is difficult, for example, to imagine tape music, delivered to an audience sans performer, being well-received outside of an artworld context, just as it is hard to imagine a warm reception in an academic setting for the kind of spectacle

characteristic of certain kinds of popular music. In both of these situations notions of culture, or at least what actions are deemed appropriate take on different meanings, and expectations are set accordingly. Christopher Small observes that concert music in the West has long “aspired to the condition of the theater”; that is, just as stage actors convey meaning and contextualize a written text with the body, so do musicians on stage use the language of gesture to communicate to the audience a set of standardized social relationships.¹¹

A music, therefore, (such as solo laptop performance) that retains a performer while minimizing theatricality has to push against a long and well-established history of performance practices and audience expectations. It would seem that at least some of the criticisms commonly leveled at computer music performance regarding a lack of musical gesture or visual content become less about performative content and more about historical expectations and precedent. In this light the quote that opens this chapter, perhaps initially read as a personal creative protocol, takes on an almost cautionary aspect; it is as if Rokeby, first recognizing the importance of the body within digital practice then acknowledges its potential to fracture, to otherwise separate itself from the acts and gestures of creation. He seems to abhor the prospect of the human functionary in art, the disconnected automaton. Because gesture is an innate property of the body, and since, as we have seen, the musical body has been problematized by the computer, I will turn now to some of the issues and methods of dealing with body that confront and even capitalize on this new fractured body, and which are manifesting a newly hybridized musical self.

¹¹ Christopher Small (1998), 144.

~Human-Computer Interaction

Any comprehensive discussion of musical gesture must make some kind of distinction between who is making the gesture and the context in which the gesture is performed. A composer, for example, may have a very different thing in mind when a musical gesture is scored compared to how a conductor uses the body to convey intention, compared to how performing instrumentalists use the body to realize the music, compared to how all three use their bodies to perform the set of social relationships inherent in music-making. With respect to human-computer interaction (HCI), however, the concept of gesture takes on a slightly different meaning. The definition of gesture that I adopt for purposes of this paper is taken from Kurtenbach and Hulteen's paper on HCI design: a motion of the body that contains information.¹² This definition has implications for computer music, since, as Kurtenbach and Hulteen note, due to the open, reprogrammable nature of computer music control interfaces, the small gesture-movements of a person in the process of depressing a keyboard key or clicking a mouse button is not significant to the process of understanding the music, if the gesture is observed by the audience at all.

Such distinctions are certainly important in the process of music making and have a long history of associated codes of conduct, including a well-established link between musical gesture and audience reception.¹³ These codes, however, seem inadequate when it comes to the subject of computer music performance. The lack of a

¹² Kurtenbach, George (1990), 310.

¹³ Theodore Gracyk (1997), 142.

one-to-one sense of intentionality or causality is one frequently cited reason for this, but I would like to suggest two additional possibilities. First, because the computer is a particularly open-ended and evolving musical tool, there can be no real standards for how a performer might choose to physically interact with the music being made. For similar reasons the methods by which meaning is conveyed to the listener also resist standardization. Unlike in acoustic performance, gesture in computer music performance is an arbitrary, fluid concept. It must be, in fact, since control in computer music is ultimately conferred not via the body, but via the arbitrary substrates of software. In other words computer music gestures must be *designed*. A particular piece of computer music might be performed entirely from the computer keyboard or the mouse if the composer/programmer wishes, or the same piece might require large physical interactions with an elaborate customized control interface. But it is possible that the music could sound exactly the same in both cases despite the physical movement required to perform the piece.

The ways in which the body is used in computer music, therefore, takes on a very different meaning than that of a performing body in an acoustic performance: in a manner not entirely dissimilar to cognitive-intellectual process Ferneyhough asks of his performers, the body must in effect be broken down and programmed in advance by the musician, and then having been subjected to that process it must perform itself algorithmically according to the constraints of the system. This kind of radical rewriting of body would seem to violate the comfortable historical relationship concert music has to stage performance practice. To borrow a concept from George's Lewis's theoretical reading of race, culture and music production, it is unclear what the true

cultural location is of the privileged creator/composer/performer during a computer music performance when the body becomes virtualized in this way.¹⁴

Second, computer music has the potential to upset a well-established power hierarchy within the academy. Such structures serve, in part, to uphold the 19th century ideals of the virtuosic player, the composer as hero and the score as the object of worship, and which in part have been purposed to control the well-worn channels by which musical pleasure is granted or denied. Indeed, the movement towards modernism in Western art music has been linked to a renunciation of those qualities in music that were considered “feminine”, pleasure being chief among them.¹⁵ In stripping the performer of overt, demonstrable virtuosity and bringing the role of the body into question (that of the performer certainly, but also the “body” of the composer and the body-text of the written score), the computer is in a way undermining tradition and the socio-political power afforded by it.

The growing body of scholarly research on musical gesture and enactive performativity that has appeared in recent years is prompting more and more people from diverse backgrounds to engage with electroacoustic composition and improvisation, and interest in enactive musical instrument design has grown proportionally. It is worth mentioning an example of such an instrument in order to represent the variety of approaches being used to produce physical interfaces. The PebbleBox, an interface produced by Georg Essl and Sile O’Modhrain, is a

¹⁴ George Lewis (1996).

¹⁵ Susan McClary (1989), 60.

particularly interesting approach to bridging the gap between performative gestures and the relatively acousmatic experience of obscure signal processing techniques (granular synthesis, in this case). The PebbleBox is a padded, sound-sensitive box that contains a number of polished stones, marbles or other non-brittle objects. The device allows a performer to manipulate the objects inside the box while the system extracts the salient features of these manipulations from the audio stream, typically onset times, the amplitude of the collisions of the objects, and an analysis of the materials used. Spectral content is also extracted by tracking zero-crossings within a predefined number of samples after onset, which are known to be a correlate of a signal's spectral centroid, or spectral center of gravity.¹⁶ While this implementation is still an approximation, such features analysis is consistent with research by Warren and Verbrugge, Puckette and others to track and catalogue salient perceptual cues in the temporal domain.¹⁷ In the PebbleBox, these features are then mapped to correlating features of the synthesis, allowing for a high degree of complex, realtime spectral shaping. In this way the metaphor of the sound “grain” is maintained by the interface, and afforded an intuitive haptic mapping for the performer.

For many of the same reasons the computer has become a viable live performance tool for musicians (primarily increasing CPU speed, memory and portability), the technology is currently in place to take advantage of techniques being used in computer vision research to track and interpret the physical movements of performing musicians in live situations. Aside from fertile ongoing research projects

¹⁶ Georg Essl and Sile O'Modhrain (2006), 288.

¹⁷ See Warren & Verbrugge (1984); and Miller Puckette (1998).

already dedicated to the study of computational models of musical gesture, a number of video analysis tools exist for common patching languages like MAX/MSP/Jitter and Pure Data/GEM. Jean-Marc Pelletier's jit.cv package, a collection of Jitter objects for the Max/MSP environment, provides a number of computer vision-related tools that handle many low-level feature extraction tasks for video. Also, David Rokebey's SoftVNS package is widely used for the development of realtime video processing and tracking applications. The potential of such technologies to reintroduce natural, intuitive gestures as control source during computer music performance practices is obviously great.

For those who feel a return to old performance tropes is a necessary step for the legitimization of computer music as a stage practice there is ample room for future research and development. There are those that believe, however (and I include myself among them), that attempts at achieving a full, 1-to-1 mapping of instrument to software or body to software are largely missing the point (is it truly useful at this point to have a playable air guitar?). Rather, it is creative hybrids of technology and body that exploit the best capabilities of both that I feel have the greatest potential to expand the spheres of performance practices without either regressing into fruitless debates of authenticity or glorifying technology as content.

~New Performance Practices

A discussion of modern techniques for practicing laptop musicians would be incomplete without mentioning a particularly idiosyncratic branch of the computer

music family tree. Network music and the precocious offspring of network music known as live coding are two music-making practices that deserve special note for their persistent tendency to work against what would seem to be a dominant trend in computer music making—namely, the quest for more and more control over every aspect of the music.

Founded in 1977 at Mills College by Jim Horton, John Bischoff, and Rich Gold, The League of Automatic Music Composers (LAMC) was the first group of musicians to explore the potential of the computer (the Commodore KIM 1, in this case) as a live musical instrument in an improvisational context. The LAMC and The Hub, the network ensemble that succeeded them in the 1980's, created music by using network-enabled computers that were able to share data and modify processes running on the computers of other performers. This distribution of musical intelligence, spread among a group of people and machine processes, detaches these group's aesthetic from that of the historical Western ideal; put simply, the music of the LAMC and The Hub invite accident as process. In a *Leonardo* article titled "The Future of Music", Tim Perkis, one of the founding members of The Hub puts it best:

Musical technology today is largely dedicated to carrying out this project of flight, leading us ever more to believe the music lies in some abstract sound object, whose computer image we polish smooth with ever more fine tools. As technology carries out with greater power and precision the project of crafting these dream-objects, its very success points up the absurdity of the project itself. The heart of music does not lie in this solipsistic quest for perfection. Music is in fact an imperfect and social process. It is not a dream-release from conditionality. What is interesting and powerful in music comes about from accommodation to limitation, the elegant response to the unavoidable, and the

enrichment of the unexpected that inevitably arises in any real situation.¹⁸

The aesthetic introduced by the LAMC and The Hub is one of decentered control and distributed action. While each individual has a certain degree of control over local processes, these processes are subject to change, extension, contraction or even deletion by other performers. Another practice, live coding, is as its name suggests the process of writing code to produce music on the fly, live and improvised in a performance situation. Since the fundamental “object” of a live coding session is process in the form of code, it seems natural that many live coding events take the form of distributed performances employing the Internet, with different musicians from different locations around the world performing a single piece to separate audiences. The text-based domain that such musicians operate within is in direct opposition certainly to the rigid performance interfaces of commercial music production software, and to a lesser degree even to the graphical programming languages now available like PD, Max/MSP, Reaktor, Audiomulch, etc. The programming languages of choice in these scenes tends to be interpreted scripting languages like Perl, Ruby and Supercollider, which allows for immediate sonic results without the need to stop the currently running musical process in order to compile.

There is an awareness within the live coding community of the tendency for audiences to be suspicious of the musician locked behind a laptop screen, manipulating what might be highly automated software, and public discussions of this kind of music making by the artists themselves frequently reveal that the live coding

¹⁸ Tim Perkis (1987), 365.

community is in its own idiosyncratic way reintroducing those displays of virtuosity that computer music performances are often criticized for lacking.¹⁹ The fact that many live coders choose not to be on a stage, but to instead project their desktops, terminal windows and text editors to the audience during performance would seem to support this aesthetic, even if, admittedly, such displays appeal only to a marginal few. Whether the aesthetic appeals or not, however, it would be difficult to argue that the sight of text flying, the resulting soundscapes, and the sense of just how difficult and precarious such a performance situation is does not challenge the stereotypical image of the laptop musician simply hitting the spacebar to play back a precomposed sequence. This kind of display is located in and transmitted from the body certainly, yet instead of carrying the weight of history forward by concerning itself with perfecting the social text of the stage virtuoso, the text is instead being rewritten as we watch.

In these ways the practice of live coding has imbued the laptop with a new sense of authenticity and even performative legitimacy, or is at least challenging tired perceptions of the spotlighted, heroic performer. In their paper introducing the concepts and practice of live coding, Nick Collins, et al, note that although live coding is hardly a solution to the problem of the laptop performer being stuck behind a screen, the practice is interesting along enough aesthetic and cultural dimensions to warrant further attention.²⁰ Live coding's open relationship with glitch and the practice's inherent risk of crash or collapse is consonant with Kim Cascone's reading

¹⁹ The Internet mailing list for Supercollider (sc-users) hosted by the University of California Santa Barbara is a widely used discussion forum among Supercollider users. See <http://www.create.ucsb.edu/mailman/listinfo/sc-users> for more information.

²⁰ Nick Collins, et al (2003), 329.

of laptop culture as firmly post-digital; it is a movement that embraces error as content, and which elevates a new “aesthetics of failure”.²¹ This stands in critical opposition to the elaborate sonic banishing rituals so prevalent in Western studio recording practices and concert traditions, where substantial resources are expended to achieve high signal-to-noise ratios. Additionally, the new aesthetic of the fractured, dereferenced performing body characteristic of both popular computer musics and academic efforts like The Hub and the LAMC are revealing the computer to be a significant site for confronting the traditional power relations characteristic of both worlds. Insofar as such modern musics are able to problematize the European notion of intentionality, stasis and performativity, we are left with a decidedly postmodern approach to a modernist problem.

From a theoretical perspective, the non-hierarchical, internetworked structure of the Deleuzian *rhizome* mirrors both the explicit structure of the Internet, and also the democratic musical practices employed by the LAMC, the Hub and other network music ensembles.²² While the rhizome is usually invoked as a cultural construct in postmodernist literature, it is a fitting metaphor for the experience of working within these virtualized, internetworked spaces, where everything is connected to everything else, and the value of a thing is largely a function of its capacity to lead you away from it. This kind of virtualization is having the effect of creating a new kind of deterritorialized performing body that is compatible with the core aesthetic experience of popular electronic music, and which is helping to critically rewrite the social codes

²¹ Kim Cascone (2000), 12.

²² Gilles Deleuze & Felix Guattari (1987), 21.

of contemporary computer music performance practices, both inside and outside the academy.

~The Sonorous Object and Musical Embodiment

Pierre Schaeffer's book *Traité des objets musicaux* and the ideas it outlines provided new ways of talking about and classifying sound that were, prior to the publication of this book, not present in the Western conceptual apparatus.²³ Central to this work is the concept of the sonorous object. The sonorous object, according to Schaeffer, is a fragment of sound constructed by our perceptive system as whole and intentional, with objective properties that can be studied and measured along multiple dimensions. The kind of reduced listening Schaeffer advocates during the process of making such measurements and categorizations requires the listener to attempt to disregard the origins and various contexts of the sounds in order to train upon the sound object's salient sonorous features. This task is reminiscent of the idiosyncratic musical eco-politics that John Cage advocated, in which he argues for a musical aesthetics that "[lets] sounds be themselves rather than vehicles for man-made theories of expressions of human sentiments".²⁴ The now-mythical anecdote of Cage's visit to Harvard's anechoic chamber in the early 1950's where, seeking to experience true silence, he heard instead the working of his body's own internal processes, is often translated as an observation on the objective condition of the sound-versus-silence debate. But Cage's own words frame his encounter not as one of objective experience

²³ Rolf Godøy (2006), 149.

²⁴ John Cage (1966), 10.

but rather as subjective revelation. This discrepancy has been noted before, and has been extended towards a reading of Cage's experience as indicative of a fallacy in the subject-object dialectic, a split which Western music traditions have historically depended upon for the construction of meaning.²⁵

Early efforts at theories of mind produced lasting notions that the external world around us and the internal world of thoughts, feelings and emotions are separate and distinct. These reductionist approaches to the then-nascent field of cognitive science centered on the belief that an examination of the small, that is, of constituent pieces, could accurately produce an explanation for the behavior and properties of the whole. More recently, however, such cognitivist approaches are increasingly being replaced with theories of cognitive embodiment that privilege the role of the body and lived experiences in how we acquire an understanding of and subsequently negotiate the physical world. Among other things, theories of musical embodiment indicate that our perception of musical events is intimately tied to past sensorimotor experiences. Wayne Bowman writes, "in contrast to cognitivist theories, *embodied accounts* construe mind as an activity emergent form, structured by, and never wholly separate from, the material facts of bodily experience."²⁶ Although the role of the body in the creation of schemas of the external world is now relatively well established, the same principals are just beginning to be applied to an understating of musical practices. For example, work by Bowman, David Borgo and others have sought to bring theories of cognitive embodiment to bear on discussions of both musical reception and also the

²⁵ Doug Van Nort (2006), 173.

²⁶ Wayne Bowman (1998), 36.

production of improvised music, and is helping to rewrite the discourse around contemporary music making.²⁷

Considering Schaeffer's recommendation for a "reduced listening" of the sonorous object that attempts to divorce a sound from its context, this would initially seem subject to the same criticisms Cage absorbed for his idea of 'letting sounds be themselves'—that such utopian declarations are exhortations of an elitist avant-garde, or at the very least out of fashion with current theories of embodiment. But a recent paper written by Rolf Godøy, director of the Musical Gestures Project at the University of Oslo, argues that Schaeffer's ideas are not fundamentally in conflict with the principals of embodied cognition. Godøy argues that the sonorous object, by virtue of how Schaeffer defines how they should be explored, have strong gestural components and are in fact linked to the ways our bodies construct our internal experiences. In his words:

...after extensive discussions of what the sonorous object is and is not, Schaeffer ends up with stating that the sonorous object is an 'intentional unit', constituted in our consciousness by our own mental activity...The sonorous object can be inspected, explored, and progressively differentiated with regards to features, features which often evolve or have various envelopes which can be traced, hence in my opinion actually becoming more like what I would call a gestural object. In our present work on musical gestures we suspect that there are gestural components in the recoding of musical sound in our minds...we hypothesize that there is a continuous process of mentally tracing sound in music perception (and in musical imagery as well), i.e. mentally tracing the onsets, contours, textures, envelopes, etc., by hands, fingers, arms, or other effectors, when we listen to, or merely imagine, music. *This means that from continuous listening and continuous sound-tracing, we actually recode musical sound into multimodal gestural-sonorous images based on biomechanical*

²⁷ See Bowman, 1998; Varela, 1991; and Borgo, 2005.

constraints (what we imagine our bodies can do), hence into images that also have visual (kinematic) and motor (effort, proprioceptive, etc.) components. Furthermore, this recoding is conceived of as a bidirectional process, i.e. that gestural images may engender sonorous images as well. (emphasis mine)

Godøy's view, then, is an extension of Schaeffer's sonorous object into what he calls a gestural-sonorous object. The gestural-sonorous object maintains a consistency with Schaeffer's original via Schaeffer's own system of classification: each object has certain morphological properties that constitute a complete object, and these objects are separated from others at natural discontinuities he calls *stress-articulations*. It is this idea that affords Godøy his connection to embodied experience, since just as the sonorous object is grouped naturally out of a sound field into an individual "object", so does the stress-articulation rule correlate to cognitive-ecological principals of sensory stream chunking.²⁸

The practice of producing popular computer music frequently requires the composer to work with and to articulate very small sounds in a macroscopic way. In various cases these can be loops, fragments of sound, or, at the extreme, individual samples.²⁹ Interest in the manipulation of such sounds is a decidedly modern endeavor, as prior to the invention of the phonograph in 1877 there was no technology in place to even imagine the deconstruction of sound in this way. As closed-groove record plates gave way to tape loops and eventually the machine that took us almost single-handedly into the musical postmodern—the digital sampler—there has been a tangible evolution of the ways in which electronic music has used sound. The

²⁸ George Miller (1956).

²⁹ At a sample rate typical of modern recording hardware, the duration of a single sample is about 0.0226 milliseconds.

implications of Schaeffer's contributions to music in this context are far-reaching. By inviting any and all sounds into the compositional process, musique concrète provided a new way of interpreting the world through sound, and thereby a new way of representing culture. Similarly, Schaeffer's desire to dereference the sounds he used prompted him to develop the morphological syntax he employed to categorize his sonorous objects. It is this new focus, a rigorous approach to understanding *the middles of things*—sounds in this case—that predicted a future where electronic music producers would use samplers to shatter language into phonemes, deconstruct jazz drum solos into breakbeats, and ultimately fracture the stage musician into a reconstituted, remixed and remastered version of himself.

The signal processing capabilities computer music producers now take for granted owe at least a philosophical debt to Schaeffer's innovations. Granular synthesis, for example, in which tiny sound "grains" are clustered and manipulated as individual objects, allows for numerous useful musical transformations, including pitch-invariant time stretching; radical reshaping of sound spectra; and arbitrarily long visits to regions of waveforms that could previously only be experienced by the listener in passing, and given musical meaning only by proximity to other sounds. Perhaps not very surprisingly, synthesis techniques like this frequently rely on manipulation of the same morphological characteristics Schaeffer himself used to classify his acousmatic sonorous objects. It may be reasonable therefore to suspect that an examination of Godøy's gestural-sonorous object in the context of computer music may have important implications for the practice of computer music performance. Furthermore, in case it seems that technology is simply obfuscating rather than

problematizing scholarly approaches towards understanding musical embodiment with respect to the new soundworlds of the modern and postmodern eras, there exist contemporary composers who, prior to the arrival of technology that enabled the automation of techniques like granular synthesis, nevertheless engaged them as they were able. Although Iannis Xenakis is well-known for his later compositions that made heavy use of technology and algorithmic processes, some of his earlier works (*Pithoprakta* is a good example) employ sonic processes similar to those of grain synthesis, but using only acoustic instruments.³⁰

With respect to computer music performance practices, the significance of these aesthetic, practical and historical connections to Schaeffer's ideas is unclear, but nevertheless intriguing. The question of what computer musicians actually *do* when they perform on stage is at stake, as is a deeper understanding of the debate about performativity and audience reception. The concept of the gestural-sonorous object provides a starting point for a roadmap of how we might bridge the gap between the textual, disembodied world of computer code, the enactive, performative experience of the stage musician, and the receptive expectations of the audience. In providing us with such a beginning it would seem to provide further support for the central argument made in this paper, namely that what is called for in this case is a reinvestigation of laptop music as a new cultural and performative location, and a new site of resistance within both popular and academic circles.

³⁰ Cort Lippe (1994), 150.

~Personal Perspectives

My own work has sought to address many of the problems of computer music production, the body and audience reception. Acquiring an understanding of the meanings and functions of musical gesture in particular has been an important focal point in my research, and I would like to briefly describe two examples of projects that have their origins in exploring methods for how computer musicians might reintroduce meaningful gestures back into performance practice.

A recent collaboration with composer Nicholas DeMaison produced an 8-channel piece for prepared piano and electronics that uses computer vision techniques to track and interpret musical gestures. The piece involves two performers at the piano, one playing the keyboard and a second performer placing and removing preparations as the piece progresses. A video camera mounted above the soundboard tracks the movements of the second performer, both instantaneously and over time. Instantaneous gestures are used to trigger events within the piece (such as sample recording and playback), the onset of certain kinds of signal processing, and are also mapped directly to the ways in which the amplified sounds of the piano are spatialized throughout the performance space. For example, with a sweep of the arms the performer can “throw” the sounds about the physical space at will via the speaker array which surrounds the audience, with the direction and velocity of the sound projection corresponding to the direction and velocity of the performer’s physical gestures.

This effect is achieved by first converting all color information to luminance values, then dividing the whole video-tracked region into sixteen smaller regions, each of which are analyzed for motion against a static background which is subtracted from each video frame. Each square is then compared against recently activated neighboring regions such that the direction and velocity of movement can be determined. *Figure 1* below shows the motion-captured representation of a sweeping

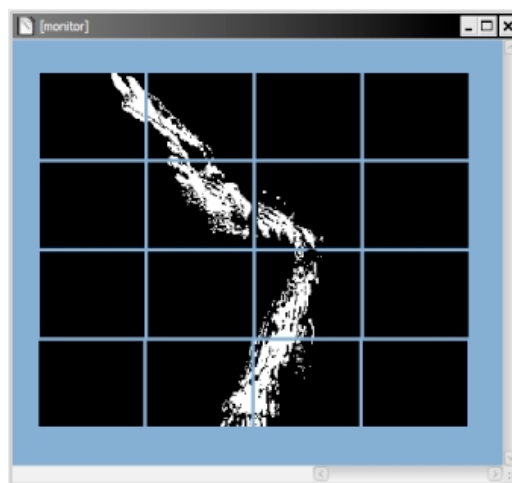


Figure 1: Tracked panning gesture: rear-center to front-left

panning gesture that starts at the bottom of the video frame (representing the sound panned hard rear and center) and moves rapidly through the acoustic center to arrive panned to the front left channel. Such a system affords a direct physical connection to processes that are typically obscured in electroacoustic music, and allows for musical gestures that are both intuitive for a performer and also easily understood by an audience. In addition to instantaneous tracking, the patch also records and keeps “memories” of movements made over time, which allows for the referencing of past

gestures that this particular piece requires. Although in this version of the patch this feature is implemented only to the specifications and requirements of this particular score, the tracking and memory framework could easily be extended to allow for the training of a neural network, Markov process or other systems used for the recognition of more complex, compound gestures this system is capable of tracking, such as the full-body movements of a conductor, depicted in *Figure 2*.

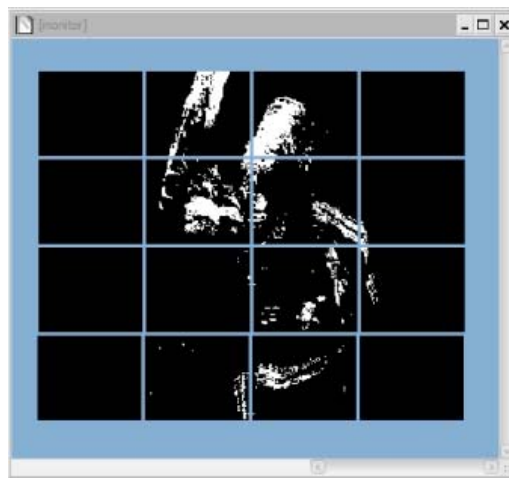


Figure 2: Full body tracking

A very different approach to connecting the body with sound is used within *Flox*, an interactive sound installation. Drawing on the metaphor of spontaneous arrangement and group flocking behaviors observed in many animal species, and also recent models of distributed cognition, *Flox* requires participants to physically associate their bodies with their aural perceptions by coordinating with a group of other visitors to achieve a common goal. Each group that enters the space is presented with a chaotic, spatialized sound field. Each member of the group is asked to select

and carry with them a pod that is tracked within the room by a system that triangulates an active transmitter/receiver within each pod, and which when moved about the space controls some discrete element of the soundscape (see *Figure 3*). For example, if by some arbitrary movements and close listening one participant discovers him or herself

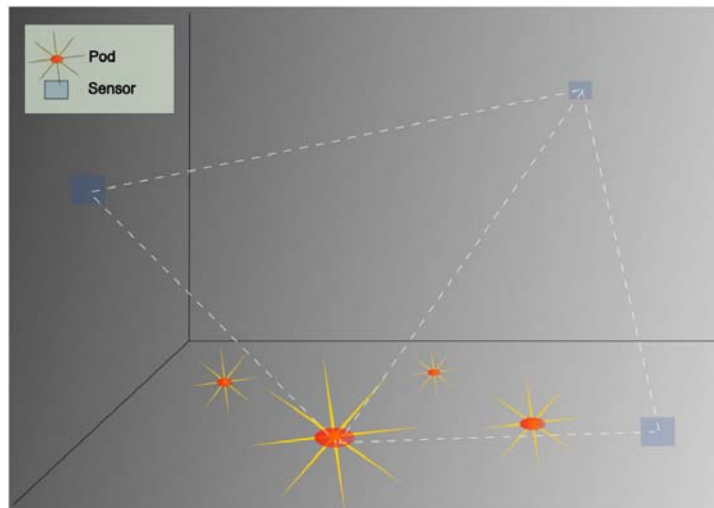


Figure 3: An illustration of the tracking system used in *Flox*

to be in control of a series of thin tones that are harmonically rich in the upper partials they might move about the space until they hear that a violin tone is reconstituted, at which point the person carrying the pod will know they have identified one of many “nodes” within the space. To provide positive feedback, the pod pulses light when the participant has located the correct, “reconstituted” location and remained motionless for a period of time (this delay helps to ensure that nodes are discovered by listening instead of by chance).

Although in this example parametric control of the violin sound's spectrum has been mapped to physical coordinates throughout the space, spectral characteristics are only one parameter that might be controlled with this system. Rhythmic elements or signal processing qualities can be controlled just as easily in fact, since control within the system can be mapped arbitrarily to any sonic or musical characteristic that can be codified in some meaningful and perceptible way.

The ultimate goal of *Flox* is for each visitor to reconstitute their individual piece of the sound field by first identifying their specific sonic components, and then for the group to collectively relocate their pods to their corresponding nodes. The task is complete when all members of the group have managed to successfully move their pods into one of the preconfigured arrangements shown in *Figure 4*.

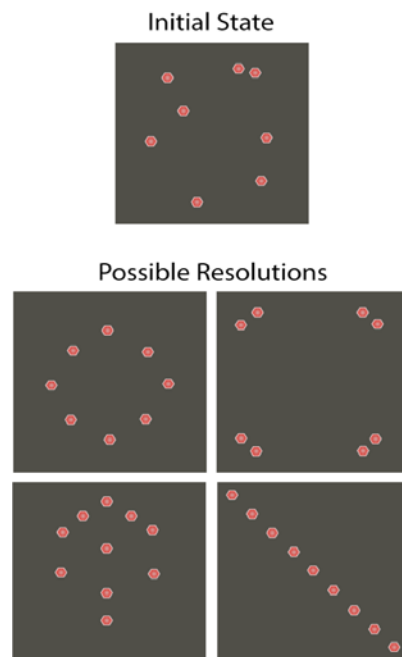


Figure 4: Pod configurations

The implications of the concept behind this installation touch on the cognitive, the musical and the social. First and foremost, in asking such a difficult task of perceptual discrimination of each visitor, *Flox* forces a deep and immediate connection between sound and the body. Body tracking has been used in music production before by artists like David Rokeby and numerous others,³¹ but *Flox* requires not just one body for it to be realized, but many; it is cooperative social organization articulated through the organization of sound. The meaning of individual action is deemphasized, and the collective motion of the group is foregrounded as it self-organizes (flocks) towards an implicit ideal. In this, *Flox* is ultimately a metaphor for my belief that the fractured bodies resulting from the manufactured separation between musician-audience, participant-observer, insider-outsider and body-technology can be meaningfully reconstructed. Furthermore, while *Flox* makes heavy use of technology, it is done in such a way to deemphasize its role in the overall experience and reinforce what is naturally occurring within the body. This kind of hybridized aesthetic experience allows for the focus to shift away from the technology and towards the larger themes and content of the work.

~Pleasure

Music, directly transected by desires and drives, has always had but one subject—the body, which it offers a complete journey through pleasure, with a beginning and an end.

- Jacques Attali

³¹ See <http://homepage.mac.com/davidrokeby/home.html>

Nature creates similarities. One need only think of mimicry. The highest capacity for producing similarities, however is man's. His gift of seeing resemblances is nothing other than a rudiment of the powerful compulsion in former times to become and behave like something else. Perhaps there is none of his higher functions in which his mimetic faculty does not play a decisive role.

-Walter Benjamin

In the previous sections I began my reconstruction of the musical body by attempting to present a new perspective on how the body might be linked in a more meaningful way with computer music performance. I have also tried to decouple the musical body from its historical mandate of timeless fidelity and subjugation to the score by presenting it as something more fluid and programmable than history has heretofore allowed. The following sections now move outward from the individual to the larger body of the receiving audience. Since the prospect of the spectacle is so firmly rooted in the Western cultural imagination, the topics of musical expectation and pleasure are useful starting points from which to launch a discussion about what laptop-based performance practices might reveal about the high vs. low music debate. This is the subject of the next section. Finally, in the last section of this paper my philosophical arc will come to rest upon the final piece of this theoretical fractured body: the body of larger political considerations and consequences. In it I will discuss the implications of digital performance practices with respect to social and political power, and present an example of an artist that creates with these considerations in mind.

The relationship between pleasure and repetition was understood as far back as ancient Greece, with the Aristotelian concept of *mimesis*. Within Western art criticism, *mimesis* generally has dual meanings in terms of aesthetic thought: that of imitation, as in the imitation of nature or natural phenomena, and that of artistic re-presentation. The relationship between the body and pleasure, the establishment of intentionality and gesture, and the imbedded function of aesthetic memory during the perceptive act all seem to indicate a deep connection between pleasure and mimetic repetition. Having addressed in the previous section some of the ways that the physical body has been recontextualized by laptop performance practices, I wish to examine the ways in which laptop music extends outwards and interacts with the larger body of the audience with a discussion of reception and pleasure, and the ways in which pleasure is granted or denied in different musical contexts.

Largely due to its vested interests in the open market and, by extension the conformity of mass appeal, the boundary between popular and high cultures is often defined in terms of pleasure, specifically when and where pleasure is granted. Insofar as market capitalism depends on successful propagation (repetition) of desire through various distribution channels, within the mechanics of popular production there is an intimate link between that which is recognizable and that which is desired. This is one of the main thrusts of the Deleuzian critique of popular culture, and the justification for his ultimately modernist belief that a popular movement can never fulfill the promise of art—namely that the privileging of originality over the popular *refrain* and a renunciation of pleasure can liberate culture from the vagaries and manipulations of

the market.³² This feeling is echoed in Maurice Merleau-Ponty's phenomenological approach to extracting meaning from art. In his essay *Cezanne's Doubt* he writes:

There is...no art for pleasure's sake alone. One can invent pleasurable objects by linking old ideas in a new way and by presenting forms that have been seen before. This way of painting or speaking "second hand" is what is generally meant by culture. Cezanne's or Balzac's art is not satisfied to be a cultured animal but takes up culture from its inception and finds it anew: he speaks as the first man spoke and paints as if no one had ever painted before. What he expresses cannot, therefore, be the translation of a clearly defined thought, since such clear thoughts are those that have already been said within ourselves or by others. "Conception" cannot precede "execution." Before expression, there is nothing but a vague fever, and only the work itself, completed and understood, will prove that there was something rather than nothing to be found there.³³

The resulting high-culture conceit when applied to art music is that musical pleasure, when conceded to at all, ought to be discovered with difficulty, with effort and dispassionate reflection. The musicking traditions of the concert hall and of the academy rely on this kind of intellectualism for the perpetuation of what has become one manifestation of the political subordination of less privileged classes. Historical examples of the cultural elite's efforts to regulate pleasure are easy to come by, and although the history of Western colonialization provides plenty of lurid examples, this trend is hardly isolated to Western societies.³⁴ Characteristic of this trend has been a

³² Gilles Deleuze (1994).

³³ Maurice Merleau-Ponty (1964), 9-25.

³⁴ In her discussion of post-World War II enka music in Japan, Christine Yano describes the painfully detailed process by which enka singers are manufactured by Japanese record companies, and then marketed according to idealized Japanese societal norms. She writes:

The images of singers in the enka world reinforce these themes of effort, perseverance, humility, and conservatism. What the audience wants to see in a singer is not something new, as much as something old, familiar, and thereby comforting in

tendency for art and music to reflect an aesthetic that shifts experience increasingly further away from the lived experiences of daily life, and thereby precluding discussions of music's highly social nature. Henry Giroux writes,

...the cultural forms of dominant bourgeois groups can be characterized by the celebration of a formalism, an elective distance from the real world, with all of its passions, emotions and feelings. The social relations and attendant sensibility at work in bourgeois cultural forms are those that often maintain an investment of form—a celebration of stylized detachment. On the other hand there is often a space in cultural forms embraced by subordinated groups that is organized around a sensibility in which the needs, emotions, and passions of the participants largely resonate with the material and ideological structures of everyday life. *Underlying these social relations one often finds a richly textured collective investment of play and affective engagement in which there is no great disjunction/interruption between the act and its meaning. In other words there is an active, communal set of experiences and social practices at work in subordinated cultural forms, including a form of public participation in which the dominant practice of distancing the body from reflection is refused* (emphasis mine).³⁵

a world which has changed rapidly and exponentially. Moreover, what is taken for granted in the enka world is that those comforting images are not born, but wrought. As a Nippon Columbia Records director bluntly states, a singer is "mawari no tsukutta mono," something created by those around him/her...In the Japanese enka world the assumption is that the singer is a product of producers, directors, and managers who shape his/her image to best suit the buying trends of the public. There is a certain faith in and acceptance of tsukutta-mono-things made-as a fact of public life, both on and off the stage. Singers, then, have little control over their image or their products. As one music director puts it, a singer is only a voice and sometimes a face. Even well-established singers sometimes have little say in what they sing or how it will be packaged and promoted. For example, Misora Hibari (1937-1989), the "queen of enka," was at the top of her profession in 1989; according to a music producer, even she had to beg to be given any control in making what was to be her last and biggest hit (Yano, 2002, 54).

See also Walter Kaufman (1976).

³⁵ Henry Giroux (1991), 190.

Here, beyond his interpretation of bourgeois formalism, Giroux presents a possible phenomenological approach to the understanding of meaning-making in music. By connecting popular music to pleasure and the unreflected experience, he suggests a more lived relationship with music-making, and opens the way for a discussion of how musical traditions might be impacted by the forces at work within different levels of the socio-political power hierarchy. Particularly interesting in this regard is the history of rock and its alliance with the working class; and especially punk rock, which is one logical rock-centered extension of how a subordinated group used music to merge “play” with identity struggle in order to formulate everyday meaning.

In her afterward to Jacques Attali’s discussion of politics and music, Susan McClary notes that there is a tendency for theorists to rely on the mathematical and scientific foundations of music at the expense of music’s social origins.³⁶ It is easy to see why this might foster a high-art appreciation of music in the West, one which by virtue of its scientific underpinnings is ultimately accessible only to a trained and specialized group. This perspective also implicitly gives music more prestige within cultures that value post-Enlightenment views of empirical science over cultures that merely “express themselves” with music.

Conversely, the laptop, by virtue of its ubiquity and the vicissitudes of music technology, has empowered a whole new demographic of musicians that is neither isolated by the prestige barriers of the academy nor beholden to the formulaic pop aesthetic of the music industry. Indeed, as noted by many popular music scholars, it is the tinkerers and bedroom programmers that have largely created the new sounds and

³⁶ Susan McClary (1985), 150.

techniques that are characteristic of popular electronic music. A comparison, therefore, of the interactions and flow of cultural capital with respect to these high art and popular music circles might shed new light on the ways in which relatively cheap and available technology is having the effect of democratizing or leveling traditional power structures and empowering otherwise marginalized creative voices.

For this purpose I will refer briefly to the dance cultures of the US and the UK during the late 1980's and 1990's, as well as the classic lowbrow nemesis of art music culture: namely Western rock and roll and its various offshoots. In the case of rock music, it is precisely because rock so loudly proclaimed itself the representation of American desire that it is so interesting to examine in light of its inability to sustain itself in the light of critical inquiry. This has more than a passing connection to the resulting critical proclamations of the so-called death of rock. Barbara Bradby attributes rock's increasing inability to connect with its audience to a breakdown of the illusory umbrella of community and freedom such music professes. She writes,

The subject of rock 'died' for the same reason as other subjects and authors died in the 1970s and 1980s: because the unity it purported to represent split apart under its own contradictions, one of which was the gender contradiction of a masculinity claiming to represent 'collectivity'. Feminine subjectivity was excluded by rock music, and relegated to 'pop'. The women's punk bands allowed a brief outburst of feminist ideas on the debris of the rock scene, while gay and lesbian subcultures deserted rock for disco...The resultant break up of the apparent movement in the monolith of rock masculinity gave way not to the reconstitution of an equally monolithic female or gay subject centre stage, but to a multiplicity of more partial, ironic, sexual subjectivities, celebrating artifice, not authenticity.³⁷

³⁷ Barbara Bradby (1993), 158.

And, as early as 1988 Simon Frith wrote these words about the supposed death of rock and roll: “There is something essentially tedious these days about that 4:4 beat and the hoarse (mostly male) cries for freedom”. For Frith, rock music died the moment punk culture emerged to show the world just how sold out the rock industry really was, and he presents early punk culture as the first popular subculture to reject hegemonic formations of social control by using play to construct meaning out of the experiences of daily life, instead of the outmoded fantasies of power and masculinity that rock music was selling.³⁸ By refusing to engage in a set of social practices defined by the formalism of the dominant culture, and refusing to submit to *difference* as a property that isolates and subjugates, punk succeeds at an actualized *lived appropriation of the everyday*, as Giroux phrases it in his own reading of the movement.³⁹

It is this kind of appropriation of daily experience that I argue has something in common with laptop performance practice in general, and that accounts in part for the degree of receptive discomfort laptop performances experience in live contexts. As argued earlier in this paper, the popular music context relies on the manufacture of difference, so with difference removed, deemphasized or disregarded by a stage presence that obscures virtuosity and unapologetically presents the performer in an unspectacular fashion, there is little to be “entertained” by other than the acousmatic experience of the sounds themselves. Furthermore, laptops in the academy suffer from a similar historical bias, as the audience again looks for overt displays of virtuosity and art world propriety; what is typically found instead is a scene which could

³⁸ Simon Frith (1988), 25.

³⁹ Henry Giroux (1991), 191.

resemble the solitary act of composing, programming, or even *work*, and which ultimately defies classical conventions of performance and upsets formalized, power-mediated boundaries between production and presentation.

Due largely to its unabashed practice of embracing pleasure as a social movement, the burgeoning dance music movements in the US and the UK during the late 1980's and early 1990's provide a particularly vivid angle from which to view the sociopolitical effects of pleasure and repetition in popular music. In his discussion of the political implications of these movements, Jason Toynbee notes that, among other reasons, one of the reasons these musics were exciting was because of their transgressive use of rhythm. Whereas musical precursors like funk and techno relied on distinctive accentual hierarchies within their rhythmic structures, as a musical category house music flattened these structures by eliminating rhythmic emphasis, thereby invoking a musical and experiential stasis and reinforcing a sense of timelessness.⁴⁰ This democratization of rhythm and the emancipatory prospects of dance have been noted by numerous authors on the subject of popular electronic music, including Philip Tagg and Kodwo Eshun, and is echoed again by McClary as she writes about how music has been “silenced” by a bourgeois culture that has renounced an embodied reaction to music.⁴¹

Still, the dance music movements of the 80's and 90's did not fit well into the politically mediated models of rock, pop, rap and bebop and other popular music forms, many of which tended to construct themselves around a sense of cultural

⁴⁰ Jason Toynbee (2000), 136.

⁴¹ See Philip Tagg (1994); Kodwo Eshun (1998); and Susan McClary (1985).

representation or signification.⁴² Instead of becoming a music that oriented itself in relation to the external, Toynbee suggests that the utopic innovation of the dance music scene was to reject the external in order to look inward, constructing itself as an personal practice of uniting mind and body through dance and a cultivated sense of personal abandon.⁴³ The sense of stasis created by the rhythmic patterns was aimed at establishing and then retaining the listener's initial state of pleasure as constructed by the music and the hypnotic culture surrounding it, instead of resisting more institutionalized, commercialized ideals of musical progression. Circulating rhetoric of ad hoc community notwithstanding, the aim, then, was more a personal liberation than a social one, achieved with dance, ecstatic pleasure and sensual abandon, and echoed aurally by the repetition, familiarity and self-reference of the beat patterns. Toynbee also notes that the specific conditions surrounding the rapid production and dissemination of dance music during this era precluded cooption by the record industry, which was unable to successfully deploy its usual rock-centric strategies, specifically the manufacture of highly marketable "star-commodities";⁴⁴ in this respect Jacques Attali's hopes for a social music that is controlled neither by academic institutions nor by the entertainment industry were realized for a brief time.

~Power and Politics

Would those of you in the cheaper seats clap your hands? And the rest of you, if you'll just rattle your jewelry.

⁴² Jeremy Gilbert (1997), 47.

⁴³ Jason Toynbee (2000), 131.

⁴⁴ Ibid, 132

-John Lennon, performing in 1963 before a sold out audience at the Price of Wales Theater, and with Queen Elizabeth in attendance

The reach of institutional politics within art music circles has many implications with regard to how music is produced and consumed. The classical performance world's mandate to preserve and protect, complete with lasting debates on the issue of historical accuracy and performative authenticity is opposed to that of the popular music world, which organizes itself instead around the creation of sites of resistance, individuated struggle and personal empowerment. There is a lasting tendency in popular music to represent an idealized social condition, whether that state is heroic, defiant, futuristic, nostalgic or otherwise entrenched in the wilderness of emotion. McClary theorizes, in fact, that this process of reconstructing notions of self and place are what forwards the social vehicle that is popular music, pushing it forward into the future or steering towards reminiscent visions of the past.⁴⁵ Regardless of what affect (and thereby which lifestyle) is being sold, however, or what cultural codes are being built up or broken down by the exigencies of the music, the channels of distribution tend to remain the same, and cannot be separated from the forces of cultural production that afford this music an audience in the first place.

An examination of what it means to engage with the avant garde produces different narratives within different kinds of musicking, but there are surprising similarities between the ways in which power manifests when the avant garde is

⁴⁵ Kodwo Eshun (1998).

approached from the popular music world and when it is approached from the world of contemporary art music.

One classic example of the ways institutional power politics can impact the musical avant garde can be found in the history of the prestigious Institut de Recherche et Coordination Acoustique/Musique (IRCAM) in Paris, still one of most important European music technology and art music institutions. In her book Rationalizing Culture, Georgina Born provides an in-depth ethnographic examination of IRCAM during Pierre Boulez's tenure as director in the 1980's, and outlines many of the difficulties IRCAM researchers faced with respect to both internal power struggles and external pressures resulting from government funding. In one particularly salient passage, Born includes an interview with one unnamed researcher who relates his discomfort with IRCAM's sources of governmental funding and the resulting research agendas that put his work uncomfortably close to the production of technology for military applications.⁴⁶

Of course not all manifestations of institutional power are so heavy-handed. It has been noted that in a manner that seems to echo the intentional acousmatic obfuscation of electronic sounds used by computer musicians who produce music outside the academy, the academic avant garde has been known to retain a similar aesthetic bias. Arnold Schoenberg was known to take a certain pleasure in the knowledge that his audience found his music incomprehensible, and John Cage's notorious koan-like musical presentations reveal these composers as rather comfortable exiles in the landscape of the popular imagination. The kind of artistic

⁴⁶ Georgina Born (1995), 160.

authority and expansive cultural capital afforded to these composers by dominant cultural institutions have resulted in conditions such that contemporary composers, sustained as they are by the funneling of resources through the academy and other high-culture institutions, feel their survival (indeed the survival of all music) is threatened by commercialization and the whims of the open market. This kind of terminal prestige, as McClary would put it, is not exclusive to contemporary music, but is rather an extreme manifestation of the arrival of the composer-hero resulting from the breakdown of 19th century systems of aristocratic patronage.⁴⁷

Laptop performer, DJ and new media artist Terre Thaemlitz (an early Mille Plateaux artist, incidentally) is one example of a digital musician working outside of the academy who is challenging the performative boundaries of the musical avant garde, and whose practices provide a model for discussing the receptive disparities between computer musicians and their audiences that have been outlined in the previous sections. Thaemlitz is a transgender performer known for introducing elements of abstract theatricality into his/her performances, and implementing them in such a way as to intentionally disrupt the avant garde's historical roles of performer and audience. He/She is, in fact outspoken against the tendency for musical performance to raise the self as spectacle before the audience. It is worth quoting Thaemlitz at length here:

It's quite common for me to start a show by announcing my dislike for "live performance." I really am not interested in improvisation, or the conventions of the stage. However, the economics of the music

⁴⁷ Susan McClary (1989), 60.

industry require that I perform. In order to try and make this a bit more interesting for me, I try to find ways to break the distance between stage and performer (such as talking with the audience, which is quite unusual for electroacoustique performers. The ambient movement of the early '90s contained a good deal of rhetoric about the DJ as someone who decentralized the spectacle of the stage and rock performance. But, as we all know, ambient ended up in hypocrisy with the rise of superstar DJs like DJ Spooky and the Orb doing rock stage shows with drummers and guitarists. It was total bullshit. Out of this emerged the current laptop-orchestra scene typified by boys sitting on dark stages, illuminated by the glow of their laptop screens. Again, there was little to no questioning of the relationship between audience and stage. Academic and corporate sponsorship around high-tech events also contributed to this complacency. So, I really think it is important to call all of this into question. While the language of my projects tends to focus on their role as commodities in the audio marketplace, several of them have performances that very specifically serve as “performances about deconstructing performance.”⁴⁸

Timothy Jaeger, in his article *The (Anti-)Laptop Aesthetic*, connects Thaemlitz's performance practices to the concept of *self media* forwarded by art critic Pascal Beausse, and theorizes it as a viable strategy to overcome the receptive difficulties presented when musical performance becomes “virtualized” by the computer, and managing the corresponding density of the human experience.⁴⁹ I would suggest further that laptop music has the potential to disrupt not just the receptive traditions inside and outside the academy, but also sociopolitical formations of pleasure and control that are becoming increasingly problematized by a growing digital culture that is claiming the manifestations of self media as a fundamental right. Beausse writes, “An artist wishing to function as more than an extra within the real might very well find that the information infrastructure, a veritable locus of world power, is a strategic

⁴⁸ Terre Thaemlitz (2004).

⁴⁹ Timothy Jaeger (2003), 54.

place to launch an attack.”⁵⁰ Thaemlitz, the prototype of the deterritorialized electronic artist, is aware of this infrastructure and upsets the performance of gender as readily as he/she upsets the act of performance itself.

Electronic music’s resistance to providing the audience with a highly formalized stage icon, its rejection of performative strategies that distance production from presentation, and its tendency to avoid traditional, well-understood roles of the musical body, uniquely situate laptop music in the middle of many of the debates on body, authenticity and power. Today, the DJ or electronic music producer remains a fractured, fluid entity, and while frequently engaging the individuated body of the musical recipient, resists the performing body as a central point of focus. It is important to note that even during the early days of live electronic music before the computer became a viable stage tool, the performative aesthetic of computer music was already being forwarded due to rapid changes in technology. Reliance on hardware sequencers, analogue synthesizers, mixing boards and other electronic gear was already widespread by the time the dance music scene broke out. Thus proficiency at manipulating signal processing networks and electronic gear became a new standard of virtuosity, and reinforced an unapologetic aesthetic of knob twiddling and stoic remove on the part of performers. The receptive discomfort computer music performance pushes against in art music and popular music contexts may owe to the unique cross-pollination of tools, practices and aesthetics shared by both: the performative tropes of the popular electronic music world, the rigorous and

⁵⁰ Paul Ardenne, Pascal Beausse & Laurent Goumarre (1999).

unglamorous scientism of the academy, and the tendency in both to blur the boundaries between both performer and audience, and production and reception.

~Final Thoughts

In this paper I have argued for the existence of a dominant social text surrounding musical performance practice that is both practically and aesthetically anachronistic, and which has ultimately proven incapable of reconciling itself with the postmodern moment. This text implies the body (perhaps it is better to say *its* body), and the body in turn elevates the text. Yet when viewed with the light modern music making has shed on the scene, this body is revealed to be a rather pale and fractured form. It can play to us with skill and conviction, but only if we regard it through the lens of history. It can impress us with the force of its presence and the power of its immediacy. But it cannot withstand the diffusion of multiplicity or the distribution of intention. Although still a relatively young field and still very much limited by the current state of the art, computer music and digital performance practices have already forwarded important questions regarding many aspects of the music making process. This essay has used the image of the body to frame these questions in a way that both validates their localized relevancy to the performer and promotes a larger social view with respect to how music is used to represent culture.

The idea that sonic content can be separated from presentation is an idea that has long been received with a certain degree of discomfiture, and certainly with curiosity too. This essay opens with an unusual anecdote about the Acousmatics of

antiquity. And how strange and wonderful it must have been to experience for the first time the phonographs, telephones and radios of modernity. Over time, these innovations have been absorbed into the collective soundscape and it is now difficult to imagine a world without them. This is also true with the computer. Yet unlike the computer, none of these other technologies were positioned to directly challenge the authority of the various musical bodies that have been outlined and discussed in this paper. I have argued that the aesthetics of solo computer music performance and particularly the performance of post-digital music inherently fractures the well-understood, historical sense of the musical body. In a larger, more philosophical sense however, the new physicality of the computer performer, the gestural conversation between performer and the public body, and the sociopolitical body that situates a given music as high (worthy of status) or low (worthy of sales)—all of these are entwined such that we become obliged to ask what it really means to be high or low, avant garde or popular, virtuosic or perfunctory, physical or virtual. If over time these binaries should become less culturally volatile or even altogether meaningless I will not be disappointed. Hybridity seems always close to innovation. It is in my interest—and I believe in the interest of all whom engage creatively with this kind of technology—to help inscribe a new chapter in the dominant text of contemporary musicking, and to keep a critical focus trained on what we produce as artists and musicians. The unfortunate alternative will be a musical landscape that thrives on its own self-reference, that feeds but never grows, that will remain, to use the words of Jürgen Habermas, dominant but dead.⁵¹

⁵¹ Jürgen Habermas (1998), 6.

Bibliography

- Appadurai, Arjun, "Disjuncture and Difference in the Global Cultural Economy", in *Modernity at Large* (Minneapolis : University of Minnesota Press. 1990).
- Attali, Jacques, *Noise, The Political Economy of Music*, trans. Brian Massumi (Minneapolis : University of Minnesota Press. 1985).
- Auslander, P. "Performance analysis and popular music: A manifesto", *Contemporary Theatre Review* 14 (2004): 1-13.
- Bodinger-deUriarte, C. "Opposition to Hegemony in the Music of Devo: A Simple Matter of Remembering", *Journal of Popular Culture* 18(4) (1985): 57-71.
- Borgo, David, *Sync or Swarm : Improvising Music in a Complex Age* (New York : Continuum. 2005).
- Born, Georgina, *Rationalizing Culture: IRCAM, Boulez, and the Institutionalisation of the Avant-Garde* (Berkeley : University of California Press. 1995).
- Bowman, Wayne, *Knowing Bodies, Moving Minds: Towards Embodied Teaching and Learning*, Liora, Bresler (ed.) (Boston : Kluwer Academic Publishers. 2004).
- Bradby, Barbara, "Sampling Sexuality : Gender, Technology and the Body in Dance Music", *Popular Music* 12(2) (May, 1993): 155-176.
- Cage, John, *Silence* (Middletown: Wesleyan University Press. 1961).
- Cadoz, C., and Wanderley, M., "Gesture-Music". in *Trends in Gestural Control of Music*, M. Wanderley and M. Battier (eds.) (Paris: Ircam. 2000).
- Carroll, John M., *HCI Models, Theories, and Frameworks : Toward a Multidisciplinary Science*. John M. Carroll (ed.) (San Francisco : Morgan Kaufmann. 2003).
- Cascone, Kim, "The Aesthetics of Failure : 'Post Digital' Tendencies in Contemporary Computer Music", *Computer Music Journal* 24(4) (Winter, 2000): 12-18.
- Cascone, Kim, "The Laptop and Electronic Music : Shapeshifting Tool or Musical Instrument?", *Contemporary Music Review* 22(4) (2003).

- Cascone, Kim, "Grain, Sequence, System: Three Levels of Reception in the Performance of Laptop Music", *Contemporary Music Review* 22(4) (2006).
- Collins, Nick; Alex McLean; Julian Rohrhuber; Adrian Ward "Live coding in laptop performance", *Organised Sound* 8(3) (2003).
- Cox, Christoph and Daniel Warner (eds.), *Audio Culture: Readings in Modern Music* (New York : Continuum. 2004).
- Curtis, Deborah, *Touching From a Distance: Ian Curtis and Joy Division* (London : Farber. 1995).
- Dean, Roger. T., *Hyperimprovisation : Computer-interactive Sound Improvisation* (Middleton : A-R Editions. 2003).
- Deleuze, Gilles, *Difference and Repetition* (New York : Columbia University Press. 1994).
- Deleuze, Gilles and Felix Guattari, *A Thousand Plateaus: Capitalism and Schizophrenia*, trans. Brian Massumi (Minneapolis : University of Minnesota Press. 1987).
- Dutton, Denis. "Authenticity in Art" in *The Oxford Handbook of Aesthetics* (Oxford : Oxford University Press. 2003).
- Dutton, Denis. 'Tribal Art and Artefact'. *Journal of Aesthetics and Art Criticism* 51(1) (1993): 13-22.
- Erlmann, Veit, (ed.), *Hearing Cultures : Essays on Sound, Listening, and Modernity* (New York : Berg. 2004).
- Eshun, Kodwo, *More Brilliant Than the Sun : Adventures in Sonic Fiction* (London : Quartet Books. 1998).
- Essl, Georg and Sile O'Modhrain, "An Enactive Approach to the Design of New Tangible Musical Instruments", *Organised Sound* 11(3) (December, 2006): 285-296.
- Feller, Ross. "Multicursal Labyrinths in the Work of Brian Ferneyhough", Diss. University of Illinois at Urbana-Champaign, Urbana-Champaign (1994).
- Frith, Simon, *Popular music: Critical Concepts in Media and Cultural Studies* (Routledge : UK. 2004).

- Frith, Simon, *Music For Pleasure* (London : Oxford. 1988).
- Gilbert, Jeremy, "Soundtrack for an Uncivil Society: Rave Culture, The Criminal Justice Act and the Politics of Modernity", *New Formations* 31 (1997).
- Giroux, Henry A., *Border Crossings : Cultural Workers and the Politics of Education* (New York : Routledge. 1992).
- Godøy, Rolf Inge. "Gestural-Sonorous Objects: Embodied Extentions of Schaeffer's Conceptual Aparatus", *Organised Sound* 11(2) (2006): 149-157.
- Gracyk, Theodore, "Listening to Music: Performances and Recordings", in *The Journal of Aesthetics and Art Criticism* 55(2) (1997): 139-150.
- Habermas, Jürgen, "Modernity—An Incomplete Project", in *The Anti-Aesthetic: Essays on Postmodern Culture*, Hal Foster (ed.) (New York : New Press. 1998).
- Hickey, Dave, *Air Guitar : Essays on Art & Democracy* (Los Angeles : Art Issues Press. 1997).
- Jaeger, Timothy, The (Anti-)Laptop Aesthetic, *Contemporary Music Review*, 22(4) (2003): 53-57.
- Kahn, Douglas, *Noise, Water, Meat : A History of Sound in the Arts*, (Cambridge, Mass. : MIT Press. 1999).
- Kaufmann, Walter. "Musical References in the Chinese Classics", (Detroit: Information Coordinators). *Detroit Monograph in Music* (1976): 31-41.
- Kurtenbach, G. and Hulteen, E.A.. "Gestures in Human-Computer Communication", in *The Art of Human-Computer Interface Design*, Brenda Laurel (ed). (Reading : Addison Wesley 1990).
- Lippe, Cort, "Real-time Granular Sampling Using the IRCAM Signal Processing Workstation", *Contemporary Music Review* 10(2) (1994): 149-155.
- Loubet, Emmanuelle, "Laptop Performers, Compact Disc Designers, and No-Beat Techno Artists in Japan: Music from Nowhere", *Computer Music Journal* 24(2) (2000): 19-32.
- Merleau-Ponty, Maurice, "Cezanne's Doubt" in *Sense and Non-Sense*, trans. Hubert L. Dreyfus and Patricia Allen Dreyfus (Evanston : Northwestern University Press. 1964): 9-25.

- McClary, Susan, "Terminal Prestige : The Case of Avant-Garde Music Composition", *Cultural Critique* 12 (Spring, 1989): 57-81.
- McClary, Susan, "The Politics of Silence and Sound", in *Noise, The Political Economy Of Music* by Jaques Attali, trans. Brian Massumi (Minneapolis : University of Minnesota Press. 1985): 149-158.
- Miller, G. A., "The Magical Number Seven Plus or Minus Two: Some Limitations on Our Capacity for Processing Information", *Psychological Review* 63(2) (1956): 81-97.
- Minsky, Marvin, "Music Mind and Meaning", *Computer Music Journal* 5(3) (1981): 28-44.
- Nyman, Michael, *Experimental Music: Cage and Beyond* (New York: Schirmer. 1974).
- Peeters, G., and Rodet, X. "Automatically Selecting Signal Descriptors for Sound Classification", *Proceedings of the International Computer Music Conference* (Sweden, 2002): 455–8.
- Perkis, Tim, "The Future of Music", Larry Polanski (ed.) *Leonardo* 4 (1987): 365.
- Puckette, Miller, Apel, T. and Zicarelli, David, "Real-time Audio Analysis Tools for PD and MSP, In *Proceedings of the International. Computer Music Conference*, Ann Arbor, (1998).
- Ribowsky, Mark, *He's a Rebel: Phil Spector Rock and Rolls Legendary Producer* (Cambridge : De Capo Press. 2006).
- Richard, Dominique, "Computer Music and the Post-modern: A Case of Schizophrenia", *Computer Music Journal* 18(4) (Winter 1994): 26-34.
- Schaeffer, Pierre, *Traite´ des Objets Musicaux* (Paris : Editions du Seuil. 1966).
- Stuart, Caleb, "The Object of Performance: Aural Performativity in Contemporary Laptop Music", *Contemporary Music Review* 2(4) (2006): 59-65.
- Small, Christopher, *Musicking : The Meanings of Performing and Listening* (Hanover : University Press of New England. 1998).
- Small, Christopher, "Performance as Ritual: Sketch for an Enquiry Into the True Nature of a Symphonic Concert", in *Lost in Music: Culture, Style and the Musical Event*, White, A. (ed.) (London : Routledge. 1987).

- Thaemlitz, Terre, Comatonse Recordings, "Comatonse Recordings: Articles & Reviews", <http://www.comatonse.com/reviews/liquidarchitecture061604.html>, Accessed on 8 Sep 2007.
- Tagg, Philip, "From Refrain to Rave: The Decline of Figure and the Rise of Ground", *Popular Music* 13(2) (May, 1994): 209-222.
- Toop, David. *Ocean of Sound* (London : Serpent's Tail. 1995).
- Toynbee, Jason, "Technology: the Instrumental Instrument", in *Making Popular Music : Musicians, Creativity and Institutions* (London: Arnold. 2000): 68-101.
- Toynbee, Jason, *Making Popular Music : Musicians, Creativity and Institutions* (London : Arnold. 2000).
- Théberge, Paul, *Any Sound You Can Imagine : Making Music/Consuming Technology* (Hanover : Wesleyan University Press. 1997).
- Théberge, Paul, "The 'Sound' of Music: Technological Rationalization and the Production of Popular Music", *New Formations* 8 (Summer, 1989).
- Thornton, Sarah, *Club Cultures: Music, Media and Subcultural Capital* (Hanover : Wesleyan University Press. 1995).
- Thompson, Emily Ann, *The Soundscape of Modernity : Architectural Acoustics and The Culture of Listening in America, 1900-1933* (Cambridge : MIT Press. 2002).
- Turner, Tad, "The Resonance of the Cubicle: Laptop Performance in Post-digital Musics", *Contemporary Music Review* 22(4) (Philadelphia : Taylor & Francis. 2006): 81-92.
- Van Nort, Doug, "Noise/Music and Representation Systems", *Organised Sound* 11(2) (December, 2006): 173-178.
- Vanhanen, Janne, "Virtual Sound: Examining Glitch and Production", *Contemporary Music Review* 22(4) (December, 2003): 45-52.
- Varela, Francisco J., *The Embodied Mind : Cognitive Science and Human Experience* (Cambridge : MIT Press. 1991).
- Warren, W. H., and Verbrugge, R. R., "Auditory Perception of Breaking and Bouncing Events: a Case Study in Ecological Acoustics", *Journal of Experimental Psychology* 10(5) (1984): 704-12.

Windmer, Gerhard, “Computational Models of Expressive Music Performance: The State of the Art”, *Journal of New Music Research* 33(3) (2004): 203–216.

Yano, Christine, *Tears of Longing : Nostalgia and the Nation in Japanese Popular Song* (Cambridge : Harvard University Press. 2002).

Zadel, Mark and Gary Scavone, “Different Strokes: a Prototype Software System for Laptop Performance and Improvisation”, *Proceedings of the 2006 Conference on New Interfaces on Musical Expression* (2006).