

Physicality and Feedback:

A Focus on the Body in the Performance of Electronic Music

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Abstract

Musical performance in a cultural context has always been inextricably linked to the human body, yet, the body has played only a minor role in the creation and performance of electronic music. This paper will consider aesthetic and technical issues relating to: (1) the social/cultural construction of contexts for chamber music and dance; (2) our construction of gestural “composed instruments” and integrated sonic display devices; (3) concepts of the integration of the dancing body and the musical body; and (4) new approaches to interactive music and improvisation in a “composed context.” Our approach prioritizes music as “activity” in both instrument design and sonic display. We find physicality, feedback, and gesture—the reintegration of the body in electronic music—are all key to maintaining and extending musical/social traditions within a technological context.

1 Introduction

Musical performance in a cultural context has been inextricably linked to the human body. This includes: the physicality of sound production in instrumental performance; the transmission of interpretive communication between a conductor and an ensemble, or between members of a chamber ensemble; and, the various ways in which the involvement of the body in instrumental performance/dance helps to communicate meaning to an audience.

Historically, the body has played only a minor role in the creation and performance of electronic music. This lack of somatic involvement has led to numerous performance “problems” in various musical/social contexts; it has proved difficult to integrate electronic sound and interactivity into small and large instrumental ensembles and into dance performances. In some cases, the electro-acoustic music composition community has created new social paradigms for listening in technological contexts (i.e. “tape-music concerts” and “tape and...” pieces) rather than address the

lack of somatic/corporeal presence in performance. Here, and in certain popular-music/performance contexts, these performance issues have often led to exaggerated gesture along with extreme amplification to create exciting connections between performers and sound production in high volume contexts (these connections are sometimes real and other times simply choreographed). In both situations, conventional sonic display technologies create a “plane-of-separation” between the source/method of sound production and the intended consumer. This creates a musical/social context that is inherently and intentionally presentation (rather than process) oriented.

In our recent work, we have designed new instruments and sonic display systems with the aim of re-integrating the body into the social context of music and dance performance. The scale of this sonic display is more closely balanced with human performance, and the idiosyncratic physical requirements of the interfaces are more “instrumental” or gestural than conventional human-computer interface devices. We feel that physical gesture and sonic feedback are key to maintaining and extending social and instrumental traditions within a technological context. Without underestimating the value of presentation, we are interested in creating a musical/social context with these instruments that allows for explorations of the “digital-body” that focus first on *process*, expressivity, and communication among musicians/dancers in all performative contexts, without placing a priority on presentation. In this paper, our definition of “performance” will be inclusive and broad, including non-presentational, or non-concert modes where a focus on the social context of music making is a priority.

This paper will consider aesthetic and technical issues relating to: (1) the social/cultural construction of contexts for chamber music and dance; (2) our construction of gestural “composed instruments” and integrated sonic display devices; (3) concepts of the integration of the dancing body and the musical body; and (4) new approaches to interactive music and improvisation in a “composed context.” We conclude with a case study of the

collaborative performance work “Pikapika,” by Bahn and Hahn.

2 Cultural Composition of Musical Contexts: Music and the Body

2.1 The Physical Musician: “feeling sound”

Instrumental “touch,” the sensitivity to a subtle haptic/sonic feedback loop in acoustic instrumental technique, is an essential aspect of the development of a musician. The instrument conducts touch, amplifies it and sonifies physical gesture. In return, the body responds to the “feel” of the instrument and its resulting sound. A resonating feedback loop between touch, sonic result and feel, is formed. Much of the physicality of musical performance is a result of these mediations between feel and ear.

2.2 The Visual Listener: kinesthetic empathy and vicarious performance

Musical contexts form a complex field of sonic, visual, and social interactions. Both in the past and today, much of computer music composition and performance practice has focused on strictly formal and acoustic aspects of musical discourse. The result is often an ethereal music, highly structured, but lacking in its connection with the body and established cultural contexts of musical interaction. As Richard Leppert points out:

Sonoric landscapes are both heard and seen. They exist because of human experience and human consciousness. Music...connects to the visible human body, not only as the receiver of sound but also as its agent or producer. The human embodiment of music is central to any understanding of music’s socio-cultural agency. The semantic content of music—its discursive “argument”—is never solely about its sound and the art of hearing. It is instead about the complex relations between sound and hearing as these are registered and as they mediate the entire experience of being. That experience is physical; intellectual, in the broad meaning of the word; and spiritual, though hardly restricted to the religious or the mystical. But it is especially to be understood as the result of mediations between the ear and the eye. The sonoric landscape is peopled and hence interactive. It is external to the human subject yet internalized by its sight and sound. (Leppert, 1995: 18)

The act of listening/observing in a musical context has been described as “vicarious performance,” (Cone, 1968:

21) and in that sense, listening is ultimately a physical involvement—a virtual performance experience for the audience. The more familiarity the listener has with the musical context, the more vivid the empathetic experience can become. This describes a connection of the body to sound production, a kinesthetic empathy with the act of creating sound and the visceral/gestural interaction of the performers in the musical context. The strength of this connection can be seen in the common mimesis of rock guitar performance, or “air guitar.”

2.3 Physical Communication

The social context of musical performance is built on shared sensibilities and embodied practices. Seeger observes:

All human communicatory systems produce concrete visual, auditory and/or tactile products that in their own respective forms of transmitting the energy used in their production are models of the act of production on the parts of their producers. (Seeger, 1977: 23)

Movements are mapped into our bodies through our varied training, which differs from culture to culture (Hahn, 1996, 1997). Visual communication in a chamber music context draws upon this training, allowing participants to viscerally “read” off of each other and form a high-level communication in performance. Through the haptic senses, visual and kinetic information—including the dynamic musical qualities of phrasing, continuity, speed/timing, dynamics, pressure, energy and effort—is communicated.

2.4 Musical Gesture

Physical gesture in computer music performance has often been seen primarily as a controlling input to an interactive system, signifying visual and musical intention. François Delalande (1988) describes the division of musical gesture into three levels: effective gesture—that necessary to mechanically produce sound; accompanist gesture—movements associated with effective gesture engaging the whole body but not directly related to the act of sound production; and, figurative gesture—wholly symbolic gestures of the performer. Many interesting studies of musical gesture as it relates to the issue of gestural control in music have focused on effective gesture and only to a lesser extent accompanist gesture (Cadoz and Wanderly, 2000). We find that accompanist gesture is an equally important aspect of physicality in interactive performance; how gesture can *result* from a physical (bodily) relationship with a gestural controller embodying sonic feedback properties; in this sense, gesture is in part the trace of a performer/instrument relationship.

2.5 Social Contexts of Chamber Music

I suggest that they [music and dance] have remained key factors in human life, and are, in particular, means for people to bridge gaps of communication and understanding between their lives in societies that prescribe certain ideas, sentiments, and definitions of experience, and their bodily experiences as individual feeling beings. (John Blacking, 1995: 214-2)

Through empathetic connection, chamber music creates a sense of intimacy between the performers of an ensemble, and between the ensemble and the audience. Electro-acoustic music performance practice has rarely engaged the intimacy of this musical context. The tradition of “tape and instrument” composition creates a certain “tyranny of the tape,” leaving a performer to chase the unyielding progression of the fixed media play-back. Most often, even in more “interactive” contexts, the live instrumentalist’s sound is amplified and drawn into the general stereo or multi-channel field of sound reinforcement creating a sonic “plane-of-separation” between the performer’s location and their physical gesture. In contexts with multiple live performers, general sound reinforcement schemes dislocate the identities of sonic production and their location—this separation often subverts the intimacy of musical performance and prioritizes presentation over process.

A focus of electro-acoustic performance practice has been the drive for larger and more impressive “immersive” multi-channel sound systems—some electronic string quartets play with sound levels equivalent to rock bands, performance excitement often being created through “larger-than-life” sonic displays and choreographed spatialization. Relatively little has been done to create electronic instruments and display systems that engage the tradition, intimacy, and human scale of chamber performance.

Context implies an immersion of body in a culturally constructed environment, a sensually ordered and situated body. In the following sections, we describe the design and musical application of instruments and sonic display systems intended to engage and amplify the kinesthetic empathy and sonic feedback of traditional musical performance contexts, without obliterating them. We maintain that physicality and musical gesture are keys to sustaining and extending social traditions within a technological context, and suggest these systems as one approach towards this end.

3 Composing the Instrument

The concept of a generic “composed instrument,” has been described by Wanderley, Schnell, and Rován as:

...an instrument where the gestural controller is independent from the sound synthesis model, both related by intermediate mapping strategies. “Composed instruments” typically use two layers of parameter mapping on top of a more-or-less arbitrary synthesis engine to match various controller devices played by the performer to the sound synthesis result. (Wanderley, Schnell, and Rován, 1998:2)

This two-stage modular approach is useful in conceiving of the mapping of a gestural controller to a body and its movement/instrumental vocabulary, as separate from structuring the abstract connections between performative actions and sound production. In our work, we extend this notion of a composed instrument to include: the design of the gestural controller itself; the choices of sounds, synthesis and digital signal processing methods for a particular performance and the integration of new sonic display systems in the performance feedback loop. Our instruments, described in previous papers, include extended and abstracted traditional string instruments, systems for interactive dance/movement performances, and the invention of distinctive new musical controllers and multi-channel spherical sonic display systems: sensor/speaker arrays. As the name suggests, we find that creating “composed instruments” is very much an act of “composition,” in the traditional sense.

3.1 Sensor/Speaker Arrays: physical conduction of sound and natural localization

Essential to the development of subtle gestural performance interfaces are equally responsive sonic displays; they are of central importance in the feedback loop between physical gesture and sonic response. The sonic display must reinforce the nuance of physical gesture and offer localized sonic feedback for the performers on stage.

Our focus on sonic display designs in the composition of interactive electronic instruments has impacted our personal pleasure and satisfaction in performance, as well as our ability to interact comfortably within an ensemble. In recent developments, this approach has extended to actually holding the sensor/speaker instrument in the lap of the performer reminiscent of a small cello, or, wearing small speakers on the body of a performer. In these cases, there is a direct physical conduction of sound into the body of the performer much as one finds in a traditional acoustic instrument. This direct physical feedback greatly augments the “touch” and intuitive control of the instrument as an extension of the body.

When a family of spherical speaker arrays is used in performance the result is a rich ensemble “mix” taking full advantage of the natural acoustics of the hall, not unlike a

string quartet or other conventional chamber ensemble. The effectiveness of our sound system is often judged relative to the impressiveness and familiarity of large multi-channel surround-sound type sonic display systems from the point of view of the audience, the comfort and communication of the performers, or acoustic blend of the ensemble, being of secondary importance. However, we have found that the use of single-point display systems has fundamentally changed our approach to live electro-acoustic music performance and suggest that the inter-performer communication and subtle sonic nuance they enable is of primary importance in the development of electronic chamber music. Our systems invite the listener to lean forward, listen and look, as with a conventional chamber ensemble, rather than sit back and soak up an immersive, surround-sound environment.

3.2 Individual Instruments for Idiosyncratic Performance

Rather than formulating general, universal strategies for interface design, our approach to creating new instruments for electro-acoustic music has focused on composing idiosyncratic, personal structures that reinforce individual approaches to performance. Our backgrounds, while all including conservatory training on western instruments, derive from such disparate fields as Jazz, Norwegian Hardanger fiddle music, and traditional/contemporary Japanese performance. The instruments we make reflect these varied backgrounds and extend our voices and bodies into a new context of interactive performance possibilities.

Of importance are not only the technical devices and concepts these instruments embody, but also their impact on personal and social aspects of music making, including the musical values they reinforce and the instrumental/dance movements they may imply. In the design of composed instruments, we have attempted to create sensing mechanisms and musical mappings that take into account the enculturated movements and social cues of the performer as well as the performance context. This design focus issues agency to the performer, privileging the social process and context of the musical situation over the technology.

4 Composing the Body

Movements are mapped onto our bodies through our varied instrumental and dance training, becoming an essential mode for artistic expressivity. In technological performance contexts, this embodied cultural knowledge can be amplified and applied to human/computer interaction through various forms of physical sensing.

4.1 Various Violins and the Violinist “Pose”

Musical instruments have a way of defining how their players will look, both in detail and in a general sense. This “pose” is reflective of the expressive nature of the instrument and the player; the image of Anne Sophie Mutter playing Brahms in itself is revealing about expressive intent, as is the image of Hauk Buen playing Hardanger fiddle, or Mark Wood playing electric violin. Subtle differences in instrument design contribute to enormous visual and physical differences in playing style (Trueman, 1999).

This remains true with electronic instruments, to an even greater extent. One example is our use of sensor bows. By themselves, our sensor bows suggest a variety of kinds of physical interaction with electronic sound; moving the frog in various positions, which may require moving the entire body, and simply pressing the bow in various locations, all are effective ways of physically playing the sensor bow. In this way, sensor bows transform the string player into a kind of dancer, and require their players to modify their traditional technique. This often creates an interesting technical conflict—certain techniques, while effective for the sensor bow, may be useless for playing the traditional string instrument, and vice-versa. Finding points of cross-section, where playing both instruments simultaneously is physically and musically fulfilling, is one of the fascinating challenges presented by the technology.

4.2 Dancing Music / Sonifying Dance

One of the differences between dance (in a conventional sense) and instrumental performance is the way they define gesture. In dance, gestures are enacted at least in part for their visual impact, much more so than for musical performers where gestures are (mostly) born out of a physical relationship with their instrument in the process of creating sound.

In our pieces for interactive dance the sensual parameters of sound and vision become fused. While historically (Western art) music has accompanied dance, or the dancer has been bound to the strictures of music, interactive performance environments enable the dancer to simultaneously articulate sound and gesture.

We have found that this multi-modal expression of the body challenges the performer to straddle established boundaries of composer/musician/dancer. The very struggle in this blurred inter-disciplinary context has created a new paradigm, a sensual re-orientation of expressive and structural parameters of performance. Is the instrumentalist “dancing” music? Has the dancer become a musical instrument? Is the music “moving” the dance, or are the movements “playing” the music? In our current work we have found that the body has indeed become an instrument, and, through physical synergism, has subsumed both the dancer and musician.

The nature of our movement and musical expression, as well as our collaborative creative process, has significantly changed as a result of our work in this field. We find ourselves involved in the composition of the sonic geography of a stage or of a dancer's body. This process raises issues involving the negotiation of control and correspondence created by conceptual technological linkages between disciplines.

4.3 The Voice, Breath: affect and affected

The voice, so centrally located in the body, would seem immune to the impact of electronic instruments. The voice is inextricably tied to breath, while breath is tied to sentience, existence, and intension. It can be "felt" via kinetic empathy between performers, implying a lived experience of a mutually created sonic environment. In our work, the voice has served as an instrument and as a model for the construction of composed instruments, both in a literal sense (via sampling) and in a more general musical sense, guiding our improvisations and our mappings of physical input to sonic output. In turn, we have found in the performing of these composed instruments that the instruments themselves deeply impact how we speak and breathe.

5 Composing the Context

We have extended the concept of the "composed instrument" to incorporating the full feedback loop from acoustic sound production, physical interface/sensing design, computer interface (including the sum of the resources for digital sound production/processing), and sonic display. Our solo performance with these instruments often involves the exploration of the resources and structures inherent in the system. The result is the articulation and interpretation of the non-linear musical structure; a composition of compositions or "meta-compositional" structure (Bahn, 1997).

In a group setting, a proving ground has been the integration of composed instruments into the rapid free exchange of improvisational ensembles. In our early experiments, the technologically extended performers were always the slowest to react; having difficulty in adapting to, for example, tempo changes, rapid volume shifts, and gestural musical communication. A common caveat was that an instrument was set up for a particular composition, and was not designed for the more general context of improvisational performance where anything could happen.

Through the continued development of our performance systems, we have successfully incorporated our music into many situations not previously available to us. This witnesses a shift in the performance context of interactive electro-acoustic music—from laboratories, research centers,

and formal academic concerts to smaller, less formal venues such as clubs, galleries and chamber music contexts. This development also relates to a shift in the participants of the genre and the make-up of the audience; numerous "laptop artists" and followers of more popularly based electronic music are now interested in our music.

A particularly rich musical context has been found in our ensemble "interface," where we perform with numerous gestural interfaces and a complete ensemble of spherical speaker arrays. In our performances, great attention is given to the sonic installation, design, and resources of the "instruments," and of the overall ensemble. However, the structure of the music is left open. Most pieces result from previously unvisited sonic combinations of our systems, brought about through free interaction between the players. In this sense, our performance systems privilege traditional modes of human musical interaction over human/machine interaction. Through the design of an ensemble of extended instruments, we are composing the musical context while leaving details of structure and articulation open and the result of our musical interactions.



Figure 1. Hahn as Pikapika.

6 Case study: "Pikapika"

"Pikapika" is a collaborative solo performance piece and composition by Bahn and Hahn inspired by *anime* and *manga*, Japanese pop animation and comics. The word in Japanese means "twinkling," and is also a metaphor for the bright flash of an atom bomb. In our piece, "Pikapika" is the name of the female persona Hahn assumes. In performance, Hahn wears a wireless MIDI control interface as well as a small wireless stereo amplifier and arm-mounted speakers (Figure 1). The wireless technology communicates with a remote computer system running MAX/MSP. This "Sensor-Speaker Performer" (SSpeaPer) interface extends the concept of a Sensor-Speaker Array or "SenSA" (Trueman, Bahn and Cook, 2000) into the realm of performance art.

6.1 The “SSpeaPer” Interface

Considered to be a significant aspect of the “composition” of the work, Bahn’s interface design was based on the particular movement vocabulary and body architecture of the performer. Hahn, whose background stems from traditional Japanese dance, has unique subtle arm motions developed as an aspect of the often mimetic gestural language of her training—where delicate motions of the hand often “tell the story” of a piece. While desiring to capture these refined movements, it was important not to obscure or encumber the grace and beauty of her fingers with a glove or other device. A simple approach was chosen where the palm of each hand conceals a bi-axial accelerometer in a small box. Mounted on the outside of each box is a force-sensitive-resistor (FSR) which can be touched or squeezed discreetly to communicate with the computer. We have found this interface extremely responsive, robust and inexpensive, and have also used it in the performance composition “Streams.” Recently, we have expanded it to include accelerometers on each foot.

The desired appearance for Pikapika’s character factored into the interface design. A wireless audio receiver/amplifier and body-mounted speakers were designed as an aspect of her costume. Adding to her “high-tech” look, a clear plexiglass box housed in a leather backpack was created to reveal flashing lights and seemingly complex circuitry. Black speakers (co-axial drivers for car sound systems) are overtly wired and strapped on her back and arms to blatantly display technology.

The “SSpeaPer” interface naturally locates and spatializes electronic sounds to emanate from the speakers mounted on Hahn’s body, creating a new audio “alias” for her character; a sonic mask. Pikapika embodies movements from *bunraku* (Japanese puppet theater), a movement vocabulary Hahn studied while learning Japanese traditional dance pieces derived from the puppet theater. The concept of the sonic punctuation of Pikapika’s movements is drawn directly from the *bunraku* musical tradition, though the actual sounds derive from machinery and technology. The body-mounted speakers add a strong theatrical element as well as providing Hahn with direct physical feedback about the nuance of her sonic performance.

In performance, Pikapika enters from the rear of the hall and strolls through the audience, emitting a variety of “clanks,” “hisses,” and “whirs” directly from her body. She is able to navigate and transform numerous composed sets of these sampled sounds as well as control signal processing, and the extension of her sounds into the main sound system.

As with other Bahn/Hahn collaborations, the form and musical texture are under the complete control of the dancer. Each “run” is a unique instantiation resulting from the dancer’s “improvisation” and exploration of the virtual sonic body. The mapping of the body is the result of a long

process of observation, analysis, practice, trial and error. In works of this kind, the full possibilities of the composed instrument are not apparent until one gets inside the interface and “drives” it. The result of living with the interactive structure and exploring the sonic environment for a period of time has created a feeling of freedom in gesture for Hahn. The piece has grown with each performance and will continue to transform in the future.

6.2 The *Pikapika* Persona

Our dance pieces have involved the realization of female performance personas—“wired” female agents, who can address cultural stereotypes regarding gender and technology. Unless theoretical qualities of embodied cultural and gender expressions are established in the conception of a work, these sensibilities are often not obvious within the performance context. In this way, our collaborative creative process is inextricably linked with critical theory.

One of our aspirations for this piece was to evoke a strong “wired” female character who skillfully controls technology for her sensory pleasure-bound immersion within a virtual sonic space. Pikapika is a character that straddles several theoretical lines. She is a Haraway cyborg of the integrated circuit, a Judith Butler *Gender Trouble* “girl”, and a Gamman and Makinen female fetishist. Let us explain. In *Gender Trouble* Butler speaks to the construction of gender and meaning through performance:

Consider gender, for instance, as a corporeal style, an “act,” as it were, which is both intentional and performative, where “performative” suggests a dramatic and contingent construction of meaning. (Judith Butler, 1990: 139)

Pikapika, while a dramatic “act,” also breathes corporeality as an embodiment of Hahn’s own experiences, mapped through her circuits, her desires, her pleasure. This newfound body essentializes a liberating construct of femininity that Haraway affirms in “A Cyborg Manifesto”:

Our bodies ourselves; bodies are maps of power and identity...Intense pleasure in skill, machine skill, ceases to be a sin, but an aspect of embodiment. We can be responsible for machines; *they* do not dominate or threaten us. We are responsible for boundaries; we are *they*.” (Haraway, 1991: 180)

In *Female Fetishism*, Gamman and Makinen question stereotypes of female passivity; acknowledge women have fetishes; and identify three categories: anthropological, commodity, and sexual fetishism. Pikapika, while taking pleasure in her sensuality, thrives on the power of technology. She can create and embody her sound and

visual world, control tools rather than having them dominate her, and, be downright noisy—an example of “female commodity fetishism.” There’s the thrill of being *out of control*, and of being *in control*—both perceived in the past as dangerous spaces for women. Mary Russo proposes, “Making a spectacle out of oneself seem(s to be) a specifically feminine danger” and the “carnival and the carnivalesque suggest a redeployment or counter-production of culture, knowledge, and pleasure” (Russo, 1986: 213-218). Gamman and Marshment, in *The Female Gaze*, offer that, “Popular culture is a site of struggle, where (sic) meanings are determined and debated...It can also be seen as a site where meanings are contested and where dominant ideologies can be disturbed.” (Gamman and Marshment, 1989: 1) So, our challenge has been to create a “pop” figure drawn from a female gaze, a strong female character who is not situated within a male dominated narrative, who appears alone, and simply showcases her pleasures empowered with technological dexterity.

Heralded by Haraway, a number of feminists point out technology’s liberating affects. (Becker, 2000) Haraway proposes that:

Cyborg imagery can suggest a way out of the maze of dualisms in which we have explained our bodies and our tools to ourselves...It means both building and destroying machines, identities, categories, relationships, space stories. Though both are bound in the spiral dance, I would rather be a cyborg than a goddess. (Haraway, 1991: 181)

In performance, theory fuses with practice through embodied acts, collapsing established dualities of composer/performer, musician/dancer, researcher/participant. Pikapika breaks down numerous other dualities: self/other, male/female, machine/body, culture/nature and Hahn’s own East/West biracial identity. Pikapika, in transgressing these dichotomies, constructs her own sense of self, yet simultaneously embodies one of Hahn’s own inner selves.

Pikapika can be loud. We hear music when she moves, a sonic mask broadcasting Pikapika’s character. Sound is gendered because *her* body enacts and manipulates it. Pikapika’s body is at once a site and sight of situated meanings and complexities. As a wired Asian American, biracial woman Hahn can enact resistance to passivity through sound intensity, and wrap the audience in Pikapika’s noisy articulations. Pikapika appropriates space with her rambunctious noise and shakes up the room visually, viscerally, and sonically. Pikapika poses a crossfire of gender questions, Kristeva-style: “by calling attention at all times to whatever remains unsatisfied, repressed, new, eccentric, incomprehensible, disturbing to the *status quo*.” (Kristeva, 1977: 37) Technology, Pikapika knows, is her vehicle for existence, pleasure, and the posing of somatic (cyber-) potentials (Casado and Cano, 2000). Hahn finds there is pleasure in this enactment, the immersion in sonoric

virtual space, the mapping of her body, *as* Pikapika, *as* sound.

7 Conclusions

Exploring the social traditions of music and dance reveals rich interactions beyond those commonly examined in the discourse of “interactive computer music performance.” The common trend towards larger-then-life presentation in electro-acoustic music, perhaps a desire to replace the sensuous involvement and physicality of musical performance, often subverts these social contexts of music making.

A prioritization on music as “activity” in both instrument design and sonic display can address this phenomenon. We have found that by creating rich sensory performance environments and discovering their feedback “resonances”—between body and technology—we in turn discover music that is simultaneously familiar (being “of the body” and performed in socially familiar situations) yet radically new. Physicality, feedback, and gesture—the reintegration of the body in electronic music—are all key to maintaining and extending musical/social traditions within a technological context.

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