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The Secret Love between Interactivity and Improvisation, or—Missing in Interaction: A Prehistory of Computer Interactivity

In order to understand computer-based art as a form of cultural production, we must consider the discourses that mediate our encounters with computers, including those that condition our cultural understanding of “interactivity” and its dark-star counterpart, “improvisation.” In the contemporary arts since 1950, issues concerning the nature and practice of improvisation repeatedly emerge, but terms such as “happening,” “action,” and “intuition” often mask the presence of improvisation in traditional media such as dance, theater and music. The need to exnominate improvisation here is due largely to the problematic status of improvisation, not only in the high-culture, pan-European art practice that most theorists and researchers assume as a primary cultural and historical background for art production, but in everyday constructions of morality and integrity that are active in many Western social spheres.

Nonetheless, the notion of improvisation as embodying a potentially transgressive spontaneity has persisted. A diverse array of artists working in the art worlds of the 1950s, 60s and 70s, such as Adrian Piper and Yoko Ono in performance art; Judson Church dance improvisation pioneers Steve Paxton and Deborah Hay; the Art Ensemble of Chicago and the Sun Ra Arkestra in music; and Robert Wilson, Judith Malina, Julian Beck, Augusto Boal, and Viola Spolin in theater, were working across a broad array of media, explicitly incorporating improvisation (and drawing heavily upon so-called jazz) in order to illuminate for viewers new ways of being and acting in the world.

Feminist artists of the 1960s and 70s, such as Carolee Schneemann, explored improvisation as a means of unmasking and overthrowing the patriarchal organization of the art world. Early video artists, such as Nam June Paik, Gary Hill, Steina and Woody Vasulka, Ed Tannenbaum and Bill Viola all had strong relationships to experimental music, adopting designs from analog synthesizer technology to make video improvisation instruments. The installation form, adopted by many of these emerging media artists, also became in effect a primary articulation of viewer improvisation.

If one wishes to understand the contemporary exnomination of improvisation in interactive media, theorizing John Cage’s opposition to improvisation can be quite illuminating. Certainly one of the most influential figures in post-war cultural production, Cage and his associates’ objections to improvisation can be traced to two factors, one philosophical, the other practical.

The *practical* fact is that African-American music, notably bebop, with its obvious roots in the same notions of spontaneity and uniqueness that formed part of early indeterminacy, was by the 1950s becoming widely recognized as a form or art. As such, it was a powerful, if greatly undercapitalized competitor for the mantle of high art music that Cage and his associates were seeking to gain for themselves. Luckily, the power of whiteness was readily available to ward off such competition. Cage's unbidden denunciations of jazz, spanning a thirty-year period, are as shrill as those of Theodor Adorno, and have the same basis in cultural competition.

The philosophical objection is more subtle. After three hundred years of the very real silence of violence and terror, rather than a freely chosen conceptual silence of four minutes or so, one can well imagine the newly freed African-American slaves developing a music in which each person is encouraged to speak, without conflict between individual expression and collective consciousness. In contrast to this notion of improvisation as a human birthright, a simple response to conditions, an embodied practice central to existence and being in the world, Cage's Puritanist descriptions of improvisation contrasted the image of a heroic, mystically ego-driven Romantic improvisor, imprisoned by his own will, with the detached, disengaged, purely ego-transcending artist who simply lets sounds be themselves. The notion of the ego-driven mystic who is unable to describe his or her own creative process is a staple of conventional cultural wisdom about jazz, and canonical composers of contemporary music, such as Luciano Berio and Pierre Boulez, have often deployed this trope in describing improvisation.

A second strike arose when musicians began to connect notions of freedom with improvisation. Improvisation can be seen as exemplifying new (and quite often utopian) models of social, economic and political relations. In his recent book, "The Culture of Spontaneity," (1998), historian Daniel Belgrad argues that embedded in 1950s notions of improvisation were challenges to corporatized orderings of the world through the introduction of entirely unanticipated, seemingly chaotic events and stimuli. Similarly, post-bebop improvisors, coming out of the legacy of slavery, connected freedom with discipline and struggle.

However, this was by no means a universal view, as the relationship between improvisation and freedom has often been framed in terms of European classical music's traditional composer-to-performer hierarchy. On this view, as one writer put it, "improvisation is the free zone in music, where anything is permitted and considered acceptable. You are responsible only to yourself and to the dictates of your taste." This solipsistic, community-denying isolationism actually deploys the same ego-driven Romantic ideal as improvisation's detractors. Based upon the view of jazz as dangerous freedom from restraint, this view similarly discourages critical engagement and study, insisting that the main preparation for improvisation consists in "freeing ourselves from negative attitudes."

The quest for a truly pure spontaneity, unmediated by history or memory, has indelibly marked contemporary art's encounter with improvisation. The presumed failure of this quest leads to strike three. The late, influential sociologist Pierre Bourdieu, in his "Outline of a Theory of Practice," advances the thesis that improvisation draws from a totalizing habitus that forecloses the possibility of "unpredictable novelty." As it happens—and I do believe that the connection here is obvious and far from circumstantial—this notion is fully consistent with 1950s-era conventional wisdom in pan-European classical music. For instance, the important German composer Karlheinz Stockhausen rejected the idea that his notion of "intuitive music," such as "Aus den sieben Tagen," might be regarded as a pseudonym for improvisation. For Stockhausen, "One always connects improvisations with the presentation of underlying schemata, formulae, and stylistic elements," elements that he was seeking to expunge from his work.

The development of a notion of "experimental" and "American" that excludes the so-called bebop and free jazz movements, perhaps the most influential American experimentalist musics of the latter part of the 20th century, can be partly accounted for in terms of the general absence, in criticism on American musical experimentalism, of discourses on issues of race and ethnicity. This denial did not allow theorists to explore the possibility that the widely asserted dialectic between "composed" and "improvised" ways of producing musical texts might serve to obscure a more fundamental, historically asserted competition for cultural capital between the two most influential musical cultures of the 20th Century, the trans-European and trans-African. In later years, this aspect of denial in new music's intellectual environment tended to separate it from both post-1960s jazz and from other contemporary work in visual art, literature, and dance.

By now, new media discourses developed over the past 15–20 years have had enough time to eschew following a similar path—but in many cases, this has not occurred. In the foreword to his "Wireless Imagination," theorist and media artist Douglas Kahn's anxiously repeated totalizing Eurohistories of sound—and of radio art in particular—may well have prompted Latino artists Coco Fusco and Guillermo Gomez-Pena to create their own alternative histories of the practices and cultural sources of thinking about sound (*Radio Rethink: Art, Sound and Transmission* Edited by: Daina Augaitis and Dan Lander). In this and other cases we find the art worlds of new media tending to mirror those of traditional media in their appeals to whiteness. As with traditional cultural histories, new media prehistories often reference classical Greece and Rome above all in advancing the claims of the field to cultural and intellectual legitimacy. At the same time, following time-tested instantiations of whiteness, prevailing discourses in the field tend to avoid issues of race and class in downplaying the cultural embeddedness of the computer programs that undergird the practices.

Moreover, interactive multimedia and hypertext discourses often run the risk of expressing history and memory in terms of data structures designed in terms of information storage and retrieval. While one certainly does not wish to pursue transgression for its own sake, it is nonetheless worth considering whether narratives, such as this one by Erik Davis, risk becoming complicit in discourses of dominance rather than challenging them.

Imagine your local shopping center. Park the car, slip in through the whooshing automatic doors, and start exploring the place, picturing the stores and escalators and displays of goodies as clearly and distinctly as possible. Then imagine that this structure you've carved out of mindstuff is actually a database. Stick a mental Post-it note on the most striking objects you pass, associating each thing—a purple pair of Nikes, a popcorn maker, a Tickle-Me Elmo doll—with some bit of pertinent minutia. Perhaps you organize your data by venue: business contacts at Brooks Brothers, mental snapshots of your travels in the multiethnic food court, lovers' birthdays and phone numbers in Victoria's Secret. But in any case, you should inscribe this virtual mall in your imagination so vividly that you can move through it as surely as you pad around your own home. And by mentally "clicking" on each storefront and commodity, you can also recover the information you stored there.

(Erik Davis, "Cyberspace: The Virtual Craft"—excerpts from "Techgnosis")
<<http://www.techgnosis.com/techgnosis/tgcyber.html>>

Like the situation in contemporary music, narratives surrounding computer-based cultural production, including interactivity, virtual reality and new media, consistently describe processes and practices that strongly resemble improvisation—yet the word "improvisation" itself rarely appears. While many texts wax poetic about the possibilities of networked interactivity and/or hypertext, few such texts have much to say about why interactors/improvisors choose one mode or path over any other. Again, for Erik Davis, the Web is a rich field of associations, but the choices made by interactors are all too quickly passed over as the products of "imagination" and "intuition":

The closest that today's online spelunkers come to these endless associational flights of recall is surfing the World Wide Web...The icons and hyperlinks of the Web thus simulate the associational habits of memory, habits that lend the imagination its *intuitive* capacity for leaps and analogies.

(Erik Davis, "Cyberspace: The Virtual Craft"—excerpts from "Techgnosis")
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Similarly,

The networks that have come to dominate so many technological, scientific, and cultural discourses and practices—communication webs, cognitive neural nets, interlinked computers, parallel processors, complex institutional frameworks, transnational circuits of production and trade—are not linear vectors or stable

expressions of control. They are complex weavings, criss-crossed webworks, complex fabrics of unpredictable and semi-autonomous threads. The network is a *matrix*, a womb, the mother-matter that spawns us all.

Erik Davis, <<http://www.techgnosis.com/techgnosis/tgspirit.html>>

If, following Pierre Levy, the networks are now exploding into cyborgian matrices that exhibit “collective intelligence,” it has nonetheless become clear that theorizing the network alone is not really enough now. We must theorize the process and experience of navigation as well, and in doing so, I want to consider how the production of knowledge in improvisation and interactivity arises through responses to conditions that include real-time analysis, generation, manipulation and transformation of meaning, all of which are themselves mediated through the body, temporality, space, memory, intention, materials and diverse methodologies and knowledges. Critical ethnographies of the kind now being developed, such as work by N. Katherine Hayles (see among others “The Condition of Virtuality” in Lunenfeld, *The Digital Dialectic*, p. 88.), will play a leading role in addressing these issues, in part because the theorization of the role, function and processes of the interactuator are so poorly developed that new stories are needed now. Once trenchant examples start to outline a field of commonalities, along with the inevitable dislocations, the interpretation of those stories can follow. Theoretically and critically oriented artists’ descriptions, such as in the writings of media artist Antoinette LaFarge, are very important in this regard.

In interactivity discourses, the most common route to theorizing the experience of the interactuator runs through the worlds of theatrical and dance improvisation. Brenda Laurel’s early account of “mediated improvisation” at Carnegie-Mellon (*Computers as Theater*, 1993, p. 189–192) constitutes a particularly influential example, but with the advent of MOOs and MUDs, the relation to theatre strategies becomes even more prominent.

*[including the work of Sherry Turkle, as well as the related work of Adriene Jenik on “Desktop Theater” (“Keyboard Catharsis and the Masking of Roundheads” *Drama Review* 45,3, Fall 2001)]*

Laurel’s conception of drama was drawn from a notion of Aristotelian organicism (*Computers as Theatre*, p. 49), in which already-canonicalized classical Greek and Shakespearean forms, from a period spanning 3rd Century BC through the 16th Century AD, are linked in a seamless history. These conceptions of drama assume a well-formed environment in which roles are clearly delineated and causality is transparent. Other theatrical forms—Noh, Wayang, the Sundanata Epic—never appear as potential models, although white artists of the late 20th Century who drew upon these forms, such as Cage, Wilson, Brook, Beck and Malina, receive a small mention.

In Laurel’s model for improvisation, drawn from the Italian commedia dell’arte, we have the widely expressed notion that in order for improvisation

to be “satisfying,” constraints must be imposed. (Laurel 99, 106, 189–92) This view is shared by prominent and arguably highly successful video game designers such as Eric Zimmermann. Similarly, for theorist Florian Brody, rigorous pre-planning is required to ensure a “sophisticated” experience.

In a computer program that has any hope of working reliably, the necessity for rigor would seem to go without saying. But Brody is not discussing the structure of code, but a model for constraining interaction, drawn from traditional media—in this case, Sergei Eisenstein’s precompositional diagram for the film “Alexander Nevsky”—an utterly linear plan, despite its embedded montage. The diagram reminds Brody of a well-formed score made in a multi-media authoring program such as Macromedia Director. Brody complains that, despite all the rigor, hypertext technologies that permit “structured access” and allow readers to define their own paths, end up enmeshing interactors in “a maze of mirrors.” (Brody, *The Medium is the Memory*, p. 140–141, in Lunenfeld) Here, one is struck by how the professed need for constraints serves a larger need to commodify the experience, the interface, the software, the user, or all four at once.

To gain a broader perspective, perhaps we need to pursue what Erkki Huhtamo calls “an archaeology of interactivity (“From Cybernation to Interaction: A Contribution to an Archaeology of interactivity, in Lunenfeld.) Spanning a historical period that encompasses the early cybernetics talk of the 1950s, all the way to the 1990s, Huhtamo notes that in the ideal case, a real-time relationship between the human and the machine is desired—or even, quoting an MIT Media Lab denizen, “simultaneous activity on the part of both participants, usually working toward some goal” (Huhtamo 106) and recognizing what Ted Nelson in 1977 called the “impatient user, slam bang, sloppy, unwilling to wait for detailed instructions.” (Huhtamo 107).

Huhtamo sees this real-time concept as having come to fruition only in the late 1980s, notably with Jeffrey Shaw’s well-known virtual reality piece, “The Legible City.” However, this account seems to simply leap over what happened in the area of interactive music-making between 1977 and 1990. This historical black hole in the history of computer interactivity in the arts is common in new media discourses, and is the subject of the rest of my paper. To explore this forgotten history, we will have to go on an archaeological dig in places like Albany, New York, Urbana, Illinois, and East Oakland, California, to explore the notions and practices that arose in the computer music communities beginning in the early 1970s, well before the current notion of interactivity was born.

In 1972, composer Salvatore Martirano, working at the University of Illinois, built a massive contraption called the Sal-Mar Construction out of digital logic circuits. A few years earlier, Martirano, Gordon Mumma and others had been performing large-scale, multi-channel electronic tape music pieces in soccer

stadiums in Europe and Asia, but this new performance was something different. The 7-foot tall, metal “Construction” featured nearly 300 touch switches that were used by the performer—usually Martirano himself—to shape the sonic output of the logic circuits, and to distribute the sound among a group of 28 loudspeakers placed throughout the performance space—all in real time performance. These first “interactive composing” instruments, according to composer Joel Chadabe, “made musical decisions as they responded to a performer, introducing the concept of shared symbiotic control of a musical process.” (291) Thus, a Sal-Mar performer was not so much in control of the device as a partner with it. As its creator observed, “Control was an illusion. But I was in the loop. I enabled paths. Or better, I steered. It was like driving a bus.” (Chadabe, *Electric Sound*, 291)

This immediacy distinguished the new work from the bulk of computer music pieces of the period, whose performances simply consisted of playing a tape of the already composed piece, usually with the lights off. This early period produced a number of such “interactive” or “computer-driven” works, representing a great diversity of approaches to the question of what interaction was, and how it affected viewers, listeners, and audiences. Part of the intellectual excitement of interactive computer music was in the discovery that artists, listeners, and viewers all had different ideas about how they interacted with their environment. In many cases, works were designed precisely to stimulate this kind of reflection, to explore communication not only between people and machines, but between people and other people.

For these composers, biological metaphors such as ‘behavior’ and ‘organism’, were frequently employed to highlight the difference between the new interactive pieces and the idea of a traditional music composition. Among others, the composers Mumma and Behrman, utilizing complex synthesizer patches, or employing electronic circuitry of their own design (“homemade” electronics), made pieces in the early 1970s that exhibited a kind of “behavior”, as distinct from so-called “live” synthesizer pieces of the period that basically were ‘performed’, running through sequences of pre-composed events in essentially traditional fashion. The composer Alvin Curran aptly referred to his own early pieces of this kind (made with Serge Modular synthesizer systems) as ‘organisms’.

Mumma had constructed pieces as far back as 1967 in which an *analog* (not digital) computer interacted with the improvised sounds of Mumma’s French horn. Behrman’s “Runthrough,” created that same year, featured performers who used flashlights to stimulate photocells that were in turn linked to analog synthesizers. These pieces, like the Sal-Mar, exhibited quasi-independent behavior, rather than being totally controlled by performers as instruments. You played *with* the systems, not *on* them.

This live electronic music concept of a “hardware composition”, or a piece whose “score” is a circuit diagram, migrated to the digital domain with the

advent of relatively inexpensive microprocessors and the first widely available single-board computer systems. By 1977, Behrman was making “software compositions” that integrated multiple human instrumentalists with a responsive computer system that was making choices based upon the playing of the musicians.

In 1976, a group of musicians calling themselves “The League of Automatic Music Composers” developed interactive systems using what were then called “microcomputers” and what their mentor, David Behrman, called “homemade” electronic interfaces. In contrast to the institutional base of the Sal Mar and other computer music efforts in America and Europe, these musicians—Rich Gold (now at Xerox PARC), John Bischoff and Jim Horton, simply used their own money to buy mail-order, single-board computers for \$ 250. They taught themselves to program the computers in machine language, learned the intricacies of interfacing the machines to output chips and three-state busses, and eventually connected their computers to both human instrumentalists and other computers in a networked conception that mirrored the community they had formed as a support network for their technological interventions. This model of the “itinerant” composer who performed his or her own work stood in contrast to the “institutional” model of computer music interactivity. (Chadabe 295, <<http://crossfade.walkerart.org/brownbischoff/>>)

At the time, much was made of the view that it was interaction with human input that “humanized” the computer. This notion animated other, arguably interactive works, such as live computer music pieces incorporating so-called intelligent instruments (Chadabe, Wessel), or interactive synthetic performers (Vercoe, Puckette, Manoury) that performed pre-composed material in concert with human (or, conceivably, non-human) performers.

I contend, however, that it was the quasi-independent behavior of the computer programs, rather than the simple possibility of response to outside input, which “humanized” the machine. Indeed, much of the early 1980s work of David Rosenboom, Ron Kuivila, Laetitia Sonami, and by now many others, impresses me as being strongly animistic, centering around the construction of nonhierarchical, interactive musical environments. My own interactive computer works advocated a dynamic of negotiation, including a notion of “emotional transduction”—the idea that interaction and behavior carry complex symbolic signals. In my piece, *Voyager*, gesture is construed as an intentional act, that is, an act embodying meaning and announcing emotional and mental intention. Through gestures, then, the emotional state of the improvisor may be mirrored in the behavior of the computer partner, as independent agent, and may evoke a feeling of dialogue.

This kind of interactive work, as well as the brainwave-driven music made by David Rosenboom, Pauline Oliveros and others, used computer-articulated decisions to raise important questions about how human beings made choices

and established pathways, as well as asking what the consequences of those decisions might be for the social world of a given piece. The system's quasi-independent behavior both asserted difference and called into question notions of autonomous human identity. For Chadabe, the process brought to mind a quote from Yeats: "How can we know the dancer from the dance?"

A major question for the recuperation of this history concerns how the second coming of interactivity in the late 1980s managed to completely miss this earlier articulation of interactivity. To address this question I have developed these preliminary possibilities:

First, the early interactive composers tended to see themselves as heirs to a tradition of vanguard classical music that eschewed contact with popular culture, political concerns, and the social world generally. In part, this stance is drawn from their major influence, John Cage, whose generally poorly developed ideas in the realm of the interculture prompted him to make fairly naïve analyses of some of the major issues of his time. For example, Cage opposed "Black Power" on the ground that empowering blacks in the way that whites were empowered would "only create new whites"; Cage felt that "only a few blacks" understood this. (Jonathan D. Katz, "John Cage's Queer Silence" in Bernstein, David, *Writings through John Cage's music, poetry and Art*, University of Chicago 2001., p. 60.) Thus, the absence of a strong theoretical base, particularly in terms of race, gender and economics, left the early interactive musicians unprepared to contextualize their issues beyond the frame of pan-European composition. Moreover, the recusal from the social and cultural world, critiqued most trenchantly by musicologist Rose Subotnik, ultimately militated against engaging a wider audience in dialogue surrounding the fascinating questions being raised by the technology.

Second, an ongoing theme in computer music concerns its scientism, which the improvisor and anthropologist Georgina Born has remarked upon in her groundbreaking ethnography of the French computer music institute IRCAM. Extending the classic scientizing view articulated by French composer Pierre Boulez as Ircam's founding rationale, and following computer science, new media artworlds were able to forge an effective nexus of relations between powerful institutional forces in academia, the sciences and the corporate world, as well as the art world and corporatized popular culture, in ways that served to legitimize its art world practices in a higher and richer register than either itinerant or institutional computer music were able to reach in the 1970s and 1980s.

Third, in contrast to the situation with the early interactive musicians, the possibility of becoming an "itinerant" media artist has become greatly complicated by the technology's much greater expense. Even as the cost of itinerancy rose in the late 1980s, these artists from the itinerant era were able to maintain their extra-institutional stance to varying degrees in later years. However,

today's itinerant artists are much more dependent upon the technology industry. Artists are not going to create their own version of, say, Final Cut Pro in the way that the early interactive musicians created hardware and software.

Fourth, the pieces of the early computer musicians were often performed by skilled performers and improvisors, preserving what theorist Jacques Attali called the mode of "Representation." In contrast, new media installations regularly foreshortened or eliminated the distance between artist, audience and work, articulating a public outreach for interactivity that opened out to new communities. A richer and more public engagement with improvisation in digital media often became subsumed within a notion of interactivity that constructs the viewer/participant as a performer. Interactive works by Toni Dove, Ed Osborn, and many others promoted notions of audience conversation with a quasi-subject positionality, articulated by a responsive computer program. This form of dialogic art making holds out the promise of Attali's notion of "Composition," which actually describes a form of improvisation which, for Attali, locates its origins in the highly transgressive and culturally dissonant African-American music known as free jazz.

The nature of the challenge to viewers posed by the "transforming mirror" of computer interaction, where an unscripted conversation could become the model for a broad series of artistic endeavors, has been effectively theorized by Canadian installation artist David Rokeby. Various flavors of chat spaces, such as MUDs (multi-user domains) and MOOs (object-oriented MUDs) facilitate interaction between total strangers across long distances; these environments functioned essentially as public improvisative spaces, as UCSD Professor Adriene Jenik realized in promulgating "desktop theater," improvised interventions in chat spaces. Breaking down barriers between fiction, history and critical engagement, these "live" new media performances explore the possibilities (and limitations) of public enactment, participation, and pedagogy within cyberspace.

Fifth, and perhaps most damaging, the early interactive computer musicians failed to theorize their own practices of improvisation. One composer's observation that Behrman's work "was electronic, but it had the feeling of improvised music" (Chadabe 297) stood in sharp contrast and direct challenge to pan-European contemporary music's widespread disavowal of improvisation. For the most part, however, no theoretical apparatus emerged from the community to counteract the massive investment in the disapprobation of improvisation.

I'll conclude with a brief story. Quite a few years ago I had a conversation about music with one of the founders of the field of Artificial Intelligence, out there at MIT. This guy was very fond of music, and at a certain point we started to discuss his great love, which is keyboard improvisation. In fact, he maintained very strongly that he was not a composer, but an improvisor. He always had a lot of keyboards at his house, and we listened to some of his latest

improvisations, which sounded a bit like Charles Ives. I noted, based on the reading I had done in the field as it existed then, that AI researchers working on music seemed to spend most of their time studying European composition, i.e., how Bach worked, or hoping to reproduce the work of the great European masters by computer.

That seemed a bit odd to me; after all, the point of AI as I saw it was to get a computer to operate in the real world. The original notion of the Turing test, as I understood it, was that to convince you that the computer was really intelligent, it had to respond to unexpected questions, to which prefab, worked-over answers were presumably impossible. So I ventured the suggestion that the study of improvisation, or what he was doing everyday, might be more germane to the field as a whole. Since my friend was an improvisor, I figured, he might be able to bring the tools of his discipline to bear to find out more about himself.

I must admit that I was very surprised by his very quick, curt reply: “You can’t study that.” That conversation was actually very encouraging, because in thinking about it over the years, I have come to identify a variety of issues that make the study of improvisation difficult. Part of the problem is that, to paraphrase the cultural theorist George Lipsitz, improvisation is everywhere, but it is very hard to see. Humans have not only the capacity, but more importantly, the need for improvisation; our daily lives depend upon it to generate, perceive and interact with the complex structures of everyday life. In the arts, improvisation itself has long served as a site for the articulation of interdisciplinary exploration, the exchanges of personal and cultural narratives, and the blurring of boundaries between art forms, providing models for new forms of social mobilization that foreground agency, history, memory, identity, personality, embodiment, cultural difference and self-determination. Challenging totalizing narratives that seek to reify notions of the role of creative expression in society, improvisation is well positioned to bring what theorist Ajay Heble calls “dissonance” to emerging postcolonial forms of aesthetics and cultural production.

Improvisation must be open—that is, open to inputs, open to contingency—a real-time, real-world mode of production. Thus, my conclusion here is that the direct study of improvisation is vital to the production of new ways of using information technology—not only in the arts, but across the board. The point here is that “our” identity as humans, particularly in negotiation with new technologies, are continually conditioned and reinscribed through processes of interactivity. If we allow interactivity and improvisation to finally consummate their relationship through an interdisciplinary study of how meaning is exchanged in real-time interaction, combining the insights of artists, cultural theorists and technologists, we could witness the development of far more powerful new user interfaces, engaging new forms of art, and more sophisticated interactive computer applications.