CHAPTER 4

FROM NETWORK BANDS TO UBIQUITOUS COMPUTING

Rich Gold and the Social Aesthetics of Interactivity

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Since its inception in the early 1970s, the loosely constituted field of interactive computer music has drawn on artificial intelligence (AI), cybernetics, and socio-musical networks of free improvisation in creating models of social aesthetics that include machines as central actors. Interactions with these systems in musical performance produce a kind of virtual sociality that both draws from and challenges traditional notions of human interactivity and sociality. Efforts to imbue interactive systems with values such as relative autonomy, integral subjectivity, and computer individualism, and with musical uniqueness rather than repeatability, were accompanied by an upsurge of bricolage and homegrown elements that were seen as manifesting resistance to institutional hegemonies. Musical computers were designed to stake out territory, assert both identities and positions, assess and respond to conditions, and maintain relativities of distance—all elements of improvisation, in and out of music.

Among a number of interactive artist-theorists, Simon Penny (2016, 402) has been particularly perceptive in observing that the advent of real-time computational technologies has led to art "objects"—artifacts that "possess behavior, 'make decisions' and 'take actions' based on changes in its context in real time." According to Penny, "This development has led to categorically new kinds of cultural practices" (401), for which aesthetic theory has been lacking. Today, according to Penny, these kinds of systems include such "new media" forms as "online interactive worlds, augmented and mixed reality work, locative media and fully physically embodied interactive installation and performance—in single and multiple participant, discrete and distributed modalities" (401).

Recent new media histories (see Chandler and Neumark 2005; Salter 2010) have implicitly challenged the field's conventional wisdom that traces the origins of interactive computer-based art making to the mid-1980s. Around the time that the first voltage-controlled synthesizers were being invented by Donald Buchla and Robert Moog, the young composer Joel Chadabe (1997, 286) was putting together hybrid analog-digital constructions that generated music autonomously by means of pseudo-random processes. By 1977, Chadabe had created one of the earliest computer systems for live musical performance. The heart of Chadabe's CEMS system was a Digital Equipment Corporation PDP-11 "minicomputer," which was able to both input and transform analog data and control analog hardware. Frequently found in academic music departments, minicomputers were relatively portable in that, unlike the mainframe systems of the period, they could be loaded into a van or truck and transported to concert sites.

Chadabe (1997, 291) characterized his devices as the first fruits of a practice of "interactive composition" in which the instruments "made musical decisions, or at least seemed to make musical decisions, as they produced sound and as they responded to a performer. These instruments were interactive in the sense that performer and instrument were mutually influential. The performer was influenced by the music produced by the instrument, and the instrument was influenced by the performer's controls." Roughly coterminous with Chadabe's work, a number of young composers began making interactive computer music using the new eight-bit microcomputers, systems far more portable and less expensive than Chadabe's. Much of the most influential work took place in the San Francisco Bay Area, a center for experimental music since the 1950s. Their music and ideas were developed in itinerant settings among independent researchers, designers, and artists in public performance spaces such as the Blind Lemon in Berkeley and, most crucially, the Center for Contemporary Music at Mills College, which became an important gathering place for new ideas and practices around the emerging interactive directions.

The college already possessed a strong reputation for supporting cutting-edge music. In the 1930s, the Mills Concert Hall featured performances of works by Béla Bartók, Henry Cowell, Igor Stravinsky, and Anton Webern, as well as the American premiere of Alban Berg's *Lyric Suite*. Around the time that Darius Milhaud began his long tenure at Mills in 1940, John Cage was teaching music (in the Department of Dance). Harry Partch lived at Mills for two years, between 1951 and 1953, and among the composers who taught at Mills over the years were Luciano Berio, Lou Harrison, Pauline Oliveros, Morton Subotnick, Iannis Xenakis, Anthony Braxton, Gordon Mumma, David Rosenboom, Frederic Rzewski, Larry Polansky, Maryanne Amacher, Alvin Curran, and Roscoe Mitchell. Former Mills students represent a great diversity of musical directions; among those whose work intersected with experimental music were Subotnick, Maggi Payne, Laetitia Sonami, Paul DeMarinis, Charles Amirkhanian, Leland Smith, Richard Felciano, Miya Masaoka, Steve Reich, Dana Reason, and Frankie Mann.[1]

In 1966, the San Francisco Tape Center, founded in 1961 by Subotnick and Ramon Sender, received a Rockefeller Foundation grant that supported its eventual move to Mills, where in due course it became the Center for Contemporary Music (CCM), with Oliveros as its first director.[2] In 1969, Robert Ashley became a co-director of the CCM, and in 1978, his fellow Sonic Arts Union founder, David Behrman, joined him.

While the Bay Area has continued to produce what, at this writing, amounts to nearly two generations of innovative computer music artists, this chapter focuses on the early flowering of the scene, as represented by the work of the League of Automatic Music Composers and the artists and institutions surrounding it. The earliest version of the League was formed by a group of Mills graduates and graduate student composers, including John Bischoff, Jim Horton, and Rich Gold, and remained active until 1983 (Chadabe 1997, 296). Other active members of the League included Donald Day, Tim Perkis, and Behrman, who became a key early adopter of the KIM-1, which he used along with his own "homemade" electronics to produce one of the first released recordings of interactive computer music, *On the Other Ocean* (Bischoff 1991).[3]

After presenting a sense of the developing social aesthetics of that scene—in particular, its connection with practices of improvisation—I pursue the evidence for my contention that the work of Rich Gold (1950–2003), a cofounder of the League of Automatic Music Composers, bridges the historical lacuna separating practices of interactivity in computer music of the early 1970s from the development of interactive multimedia in the 1980s. Gold's later work in the corporate sector and at the Xerox Palo Alto Research Center (PARC) was influential on new models of gaming and, in particular, the early development of ubiquitous computing, a technology that framed relations among people and interactive systems as microcosms of the social. Both system design and real-time interactions with the results were marked by a utopian politics of interactivity, with an emphasis on establishing non-hierarchical, collaborative, and conversational social spaces that were nonetheless indeterminate at the level of structure—aspects of a social aesthetics of free improvisation that dates from the mid-1960s. Through Gold, these technologies continue to exhibit the genetic imprint of the social aesthetics of early Bay Area interactive music practices.

"Let the Network Play"

This early period produced a number of "interactive" or "computer-driven" works and practices, representing a great diversity of approaches to the question of what interactivity (then usually called "interaction") was and how it affected viewers, listeners, and audiences. In many cases, works were designed precisely to stimulate this kind of reflection, to explore communication not only between people and machines, but also between people and other people. The ideals of this creative community also reflected emerging debates and social changes in U.S. society, with particular emphasis on emergent musical phenomena; itinerant rather than institutional activity; social, conversational, convivial, and communitarian ethics; and collective, networked, democratic work, expressed in terms of a lack of hierarchy between human and non-human roles, as well as between humans and other humans.

Chris Salter (2010, 206) recounts the reminiscences of Joel Ryan and David Behrman, who saw the Mills scene as "driven by an anti-authoritarian attitude combined with an experimental atmosphere of tinkering and aesthetic curiosity." Indeed, the developing social aesthetics of this scene embraced bricolage and autodidacticism, reflected in preferences (born of economic necessity, to be sure) for portable, inexpensive, homegrown, and personal systems rather than general-purpose devices, and for an artist-programmer model of techno-musical development rather than institutional separation of roles.

At many public events, artists from around the community would present electronic circuits and software of their own design to audiences and other composers (Chandler and Neumark 2005, 378). In this way, the new technology was also widely viewed as providing possibilities for itinerant social formations that could challenge institutional authority and power. As League members Gold, Horton, and Bischoff (1978, 28) declared, "The advent of not-very-expensive micro-systems can help free the computer musician from the pressure to conform to the mores of highly-structured business and academic institutions."

Salter (2010, 206) identifies the Bay Area scene around Mills College as "the first known use of cheap, portable computing technology for real-time musical performance." League members, among a number of other Bay Area artists, adopted as their computing platform the MOS Technology KIM-1, one of the first single-board microcomputers. The KIM (an acronym for "Keyboard Input Module"), which could be had via mail order for as little as $250, sported an eight-bit microprocessor running at 1 megahertz, an interface and timer chip, an operating system stored in read-only memory (ROM), a hexadecimal LED readout, and anywhere from 1,000 to 4,000 bytes of random-access memory (RAM).

John Bischoff called the League of Automatic Music Composers "the world's first computer network band."[4] From the start, as Bischoff and his colleagues declared, they intended to create computer music that valorized sociality and performativity, concepts that they mapped onto the signifier of the "band":

> Music over the milleniums [*sic*], traditionally, has involved more than one person, either in its composition, in its production or both. In fact, it seems to be one of the most social of the artforms. While there has been individually produced music as well, computer music, until very recently, because of its nature, could only be individual, solitary music. However, with the introduction of microprocessors at a reasonable cost, composers can now own their own computers, and, operating free from major institutions, true computer bands are possible. While such bands can take many forms, network music seems best suited and the most contemporary. (Bischoff et al. 1978, 24–25)

This model of performance presented a new model of liveness that included computers as part of the matrix while affirming the central place of the human: "To bring into play the full bandwidth of communication there seems to be no substitute, for mammals at least, than [*sic*] the playing of music live" (28).

Each of the League's computers was running a program created by one of its composers that was able to produce music without outside intervention—an automatic composition (or improvisation) program—as well as taking in data that could affect the behavior of its own system and outputting data that could affect the behavior of the other machines.[5] Jim Horton's description of a performance by Bischoff, Tim Perkis, and himself in 1980 encapsulates the characteristic social aesthetic behind the approach:

> The musical system can be thought of as three stations each playing its own "sub"-composition which receives and generates information relevant to the real-time improvisation. No one station has an overall score. The non-hierarchical structure of the network encourages multiplicity of viewpoints and allows separate parts in the system to function in a variety of musical modes. This means that the moment-to-moment form the music takes is the combined result of the overlapping individual activities of the parts with the coordinating influence of the data exchanged between the computers.[6] (Horton 1999)

League performances were exoskeletal; the composers were often seen programming, debugging, and even soldering as the concert proceeded. "Envision a table full of electronic circuits, little boxes, computers, all kinds of wires and so forth," Horton told an interviewer. "A typical concert would be us at this table, continually fooling around with electronics, changing parameters on the programs" (1999).

Particularly transgressive was the League's penchant for simply sitting back and listening as the computers created the music. League performances often cast the computer in the role of independent composer-performer rather than instrumentalist. In 1979, the League set up a biweekly series of concerts at the East Bay Center for the Performing Arts. As Bischoff recalled, "Every other Sunday afternoon we spent a few hours setting up our network of KIMs at the Finnish Hall in Berkeley and let the network play, with tinkering here and there, for an hour or two" (quoted in Chandler and Neumark 2005, 378). Often, the composers would leave the stage and join the audience as the computers played (380).

As Bischoff remembers, "After a while it seemed more fun to perform along with the network, so we began to sit around our large table of gear, adjusting parameters on the fly in an attempt to nudge the music this way or that" (quoted in Chandler and Neumark 2005, 380–81). However, it is important to note that when League members took hands-on improvisative roles with their machines, they did so from a collaborative rather than an instrumental standpoint, negotiating with their machines rather than fully controlling them. "Letting the network play" became a key aspect of its performance practice, and when the humans performed, they became part of the network, as well.

Several possible precursors and probable influences on the League and other artists in this scene can be identified. First, in terms of processes and materials, the work of this scene appears closely related to the open-form music of Christian Wolff, who created compositions for performing musicians in which complex structures emerged from the results of several interacting decision-making processes rather than the chance operations for which Cage was noted. Works such as "For 1, 2, or 3 People" (1964) require the musicians to perform actions according to, among other things, their perceptions of what other musicians are doing, their position in the score, and certain overarching rules. The composer provides an environment in which real-time decision making by performers, and therefore responsibility for the direction of the music, is paramount.[7] The similarity of this human-driven performance process to the processes of networked exchanges of musical data that we see in the work of the early interactive computer musicians is striking. As Bischoff and his colleagues (1978, 28) wrote, "An extension of that idea is to write 'reactive' compositions which can interact with one another as well as with their players."

Second, in the wake of works such as Cage's *Cartridge Music* (1960), work on electrically and electronically modified acoustic sound developed into a practice of "live electronic music" that differentiated itself in terms of approaches to temporality and performativity (and, in many unacknowledged cases, improvisativity) from electronic works whose primary medium of presentation was magnetic tape playback. Composers associated with Cage, such as Behrman and Gordon Mumma, invented hardware to transform human sounds and gestures musically. Mumma's series of "cybersonic" works, beginning with *Medium Size Mograph* (1963), were "hardware compositions," pieces for which the "score" would include a circuit diagram.

Mumma's *Hornpipe* (1967) for horn and electronics appears particularly prescient with respect to what was coming in live computer music:

> The acoustical feedback loop which exists between the French Horn, the resonant pipes, and the loudspeaker, is part of an electronic feedback system which employs amplitude gated frequency translation. As the performance begins the system is balanced. Sound is produced only when something in the acoustic-electronic feedback-loop system is unbalanced. The initial sounds produced by the French Hornist unbalance parts of the system, some of which rebalance themselves and unbalance other parts of the system. The performer's task is to balance and unbalance the right thing at the right time, in the proper sequence. (Mumma 1967)

The conception of performance as task in *Hornpipe* is both dialogic and exploratory. The performer treats the electronics as a quasi-independent coperformer and can glean the inner state of the electronics only by making a sound and ascertaining its effects through listening observation. The music results from three factors: the acceptance and performance of the task of restoring balance, the real-time adjustments in musical strategy by the performer, and the similarly real-time sonic behavior in response to the performer's initiatives.

Following Mikel Dufrenne (1989, 196), the electronics become a quasi-subject, an object not simply and totally constituted by a Kantian perceiving and constituting subject: "But what of a world of the aesthetic object? We may speak of this too—if the aesthetic object is a quasi-subject, that is, if it is capable of expression. In order to express, the aesthetic object must transcend itself toward a signification which is not the explicit signification attached to representations but a more fundamental signification that projects a world." The performance as whole becomes a form of real-time world making, a roughly delineated, reciprocal mediation between the exhibited behavior of human and machine actants.

Third, a number of the early interactive pieces drew on open-form compositional procedures, and a number of these composer-performer-technologists directly identify Cage as a major influence in terms of pioneering "an important form of collaborative music, that is of the simultaneous playing of compositions" (Bischoff et al. 1978, 28). Thus, the composers advance an aesthetic of emergence *avant la lettre*: "Independent simultaneous activities viewed as one single activity always bring to mind the idea that groups can work wonderfully together without the anxiety of control structures that supposedly insure success" (27). What also comes to mind is a notion of productive freedom rooted in anarchy, and in that regard it comes as no surprise that for these composers, "Making music together using ideas and structures developed independently without thought of future collaboration now seems a natural musical process due, in large part, to the work of John Cage," himself an avowed anarchist (27).

At the same time, in contrast to Cage's well-known antipathy to jazz, the League's members express a social aesthetic of voice that would be familiar to any jazz musician: "At this stage in the development of the experimental tradition it is thought well to develop a personal, even idiosyncratic, approach to music. To find such an approach is not always easy" (Bischoff et al. 1978, 28). We can easily compare this to the Afrological trope of "telling your own story" (G. E. Lewis 1996, 118–19). A similar affinity with both Cageian aesthetics and the Afrological arises as the composers declare, "At each stage in the development of the network the music changed unpredictably. It became clear that it was impossible to tell beforehand where the music was going to come from (Bischoff et al. 1978, 28)." Similarly, the saxophonist Steve Lacy observed of his musical practice of improvisation, "You have all your years of preparation and all your sensibilities and your prepared means but it is a leap into the unknown" (quoted in Bailey 1992, 57).

"Listening to the combined result," wrote Bischoff and Chris Brown, a computer musician and professor at Mills College, in 2005, "one hears independent musical processes at work—each station has its distinct musical viewpoint—along with the coordination of those processes through a real-time choreography of data flow" (quoted in Chandler and Neumark 2005, 381). This aesthetic valorization of the melding of individual voice with the unforeseen undoubtedly stems from the machine-improvised nature of the networked music itself. "At times, the computers did indeed seem to have minds of their own," Horton (1999) wrote, "sounding not unlike a group of musicians playing off each other, be it free improvisation or an almost unified consciousness." Indeed, we can read Horton's recollections in terms suggested by sociologist of science Andrew Pickering (2010), as an account of post-humanist dances of human and nonhuman agency: "Sometimes when the system enters a strong interactive mode, its activities may be heard as if there is a unified mentality improvising or composing. Because the semantics of whether we can ascribe intentional acts to nonliving entities seems to be open, we can choose to consider that we have invented a (partially guided) musical artificial intelligence" (Horton 1999). With regard to this aspect of League ideals, I want to take into account Nicolas Bourriaud's (2002, 14) declaration that "the possibility of a *relational* art (an art taking as its theoretical horizon the realm of human interactions and its social context, rather than the assertion of an independent and private symbolic space), points to a radical upheaval of the aesthetic, cultural and political goals introduced by modern art." One of these upheavals has to do with Penny's (1995, 216) observation of "a novel art form in which the key aesthetic element is the 'behavior' of the work in response to the viewer." We do not need to embrace Bourriaud's urban-based origin narrative for the aesthetics of relational art to see that the League's version of interactive computer music making, following Bourriaud, is a kind of work for which quasi-independent behavior is key, where "the substrate is formed by intersubjectivity, and which takes being-together as a central theme, the 'encounter' between beholder and picture, and the collective elaboration of meaning" (Bourriaud 2002, 15).[8]

In the particular form of sociality created by the League's interactive performances, a world is constructed in which the hierarchy of agency of humans over machines is not at all axiomatic.

Bourriaud does not address technological artmaking directly, but a work of relational art, in his view, "may operate like a relational device containing a certain degree of randomness, or a machine provoking and managing individual and group encounters" (30). Relational works propose "moments of sociability" and present "objects producing sociability." Membership in the relational world is centered on this primary criterion: "Does this work permit me to enter into dialogue? Could I exist, and how, in the space it defines?" (109).

Cybernetics and AI discourses were important influences on this generation of computer music artists. Horton's posthumously published diaries, "Unforeseen Music: The Autobiographical Notes of Jim Horton," composed in August 1996, set out a number of elements of an emerging social aesthetics of interactivity that are not only compatible with Bourriaud's ideas but are also strongly inflected by AI and cybernetics discourses. In one diary entry, Horton explicitly cited the cyberneticist Gregory Bateson's ideas as an influence on a performance of 1980:

1. A mind is an aggregate of interacting parts or components.
2. The interaction between parts of mind is triggered by differences [*sic*, *difference*].
3. Mental processes require collateral energy.
4. In mental processes, the effects of difference are to be regarded as transforms (i.e., coded versions) of events which precede them.
5. Mental processes require [*sic*, *Mental process requires*] circular (or more complex) chains of determination.
6. The description and classification of these processes of transformation disclose a hierarchy of logical types immanent in the phenomena. (Quoted in Horton 1999)[9]

A remarkable prefiguring of the work of the Bay Area computer musicians appears in the unusual odyssey of the British psychologist and cyberneticist Gordon Pask. After conversations with Norbert Wiener, who was lecturing on cybernetics at Cambridge, the young Pask was moved to demonstrate how a machine could learn. Adapting his electronics expertise to the artistic connections he had developed in the theater, between 1953 and 1957 Pask developed the Musicolour, a unique device that used the sounds of music performance to control theatrical lighting. Signals from a microphone were passed through a set of tuned filters whose output controlled the lights in response to the pitch and beat of the music.

Andrew Pickering's (2010a, 316) account of the Musicolour makes it clear that the device operated according to the tenets of cybernetics: "In analogy to biological neurons, banks of lights would only be activated if the output from the relevant filter exceeded a certain threshold value, and these thresholds varied in time as charges built up on capacitors according to the development of the performance and the prior behavior of the machine."

In an essay about the device, Pask presented his notions of "an aesthetically potent environment":

> a. It must offer sufficient variety to provide the potentially controllable variety required by a man (however, it must not swamp him with variety—if it did, the environment would be merely unintelligible).
> b. It must contain forms that a man can learn to interpret at various levels of abstraction.
> c. It must provide cues or tacitly stated instructions to guide the learning process.
> d. It may, in addition, respond to a man, engage him in conversation and adapt its characteristics to the prevailing mode of discourse. (Pickering 2010a, 322)[10]

The relationship between subjectivity and agency was prefigured by Musicolour, which "staged the encounter of two exceedingly complex systems—the human performer and the machine—each having its own endogenous dynamics but nevertheless capable of consequential performative interaction with the other in a dance of agency" (Pickering 2010a, 319). Pickering tells us that "the cybernetic brain was not representational but *performative* . . . and its role in performance was *adaptation*" (6). Thus, again prefiguring the questioning of the human-machine distinction, Pickering writes that "a Musicolour performance undercut any familiar dualist distinction between the human and the nonhuman. The human did not control the performance, nor did the machine. . . . A Musicolour performance was thus a joint product of a human-machine assemblage" (319).

As Pickering notes, in such an assemblage considerations of power inevitably arise, and the Musicolour's ontology was remarkably similar to what we find a decade later with Mumma and Oliveros, as well as the implicit and explicit politics of performance that emerged twenty years later among Bay Area interactive computer musicians: "In contrast to the traditional impulse to dominate aesthetic media, the Musicolour machine thematized cooperation. . . . The Musicolour performer had to find out what constituted a synesthetic relation between sound and light and how to achieve it. We could speak here of a search process and the temporal emergence of desire—another Heideggerian revealing—rather than of a preconceived goal that governs a performance" (Pickering 2010a, 320).

Across the Great Divide: From Network Bands to Quotidian Computing

In this chapter I extend my interest in pursuing what the first-generation new media theorist Erkki Huhtamo, in the title of a 1999 article, called "an archaeology of interactivity."[11] Huhtamo's archaeology traces the desire for a dialogically real-time human-machine relationship across a period from the cybernetics talk of the 1950s to the then emerging new media discourse of the 1990s. 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" (1989–91).[12]

Part of the reason that early and now canonical new media histories appear to be unaware of the earlier history of interactivity discussed in this chapter may be laid at the door of the computer music community itself. As we now see from Horton's diaries, the early experimenters realized privately that their work aimed at projecting new models for the study of meaning and sociality. However, as I remarked in an earlier essay, their public transcripts evinced a certain tardiness in coming to terms with the social implications of their technologies, practices, and aesthetics:

> The field of interactive music quickly recapitulated the stance of the earlier mainframe-based work in tending to see itself as heir to a tradition of vanguard Euroclassical music that, after the explosions of 1968, had once again retreated from contact with popular culture, political concerns and the social world generally. Unprepared to contextualize their issues beyond the frame of pan-European composition, the questions they raised would be left to a later generation of interactivity artists and theorists whose work became subsumed within the field of "new media." (G. E. Lewis 2007, 109; see also Born 1995)

Well after the early network performances with Bischoff and Horton, League co-founder Rich Gold (2008, 27) said, "The Terrain Reader, in all its myriad forms, was my primary computer music work and could easily be called my only real work." The Terrain Reader, which Gold deployed frequently in League performances, composed music algorithmically by modeling a virtual landscape in software and a virtual hiker that freely traversed the terrain. The hiker's activity would be reflected in the sounds coming from the speakers.[13] As Gold whimsically put it, the program had "three notable qualities: it could produce a wide range of sounds; it could fit within my KIM-1; and it had a charming metaphor which made it fun to explain. If I were to describe the music it made today I would say it was *syntho-bebop*, a form approximately fifteen years too early" (27).

In distinction to his Bay Area artist colleagues, and at variance with earlier League critiques of "highly-structured business and academic institutions," Gold joined the corporate world, working for much of the 1980s as director of the Sound and Music Department of the U.S. division of Sega USA, which was still well known for its home gaming devices and for the strong presence of its machines in coin-operated arcades ("In Memory" 2003, 253). By that time, Gold had replaced "syntho-bebop" with a new term, "Algorithmic Symbolism" (AS), which he usually described as a "field"—one for which he was the inventor.

Gold presented various explanations of the intent and subject of the field. In one formulation, published in 2008, algorithmic symbolism became "a form of art where the underlying procedures of generation contain meaning that interplays with the surface meaning. The algorithms matter and need to be presented as part of the art" (Gold 2008, 30). This formulation describes the Terrain Reader rather well and forms the basis for his self-distributed Party Planner program, which was featured in a *Scientific American* article published in 1987. In Bourriaud's terms, the Party Planner is a relational artwork that combined sophisticated programming with humor and whimsy as it sought to advise users as to the best way to foster congenial sociality through counsels on social space (Dewdney 1987, 112–15).

Gold's 1993 description of AS encapsulates a post–Party Planner ideal: "Algorithmic Symbolism uses various computer programs that seem to have a lifelike quality—a charm and humanness—in their ability to make things happen that can only occur in the anti-natural world. That pool ball going uphill, for example, shows a lot of determination on the pool ball's part. These programs would include chaos, fractals, cellular automata, and neural nets" (Gold 1993a, 10). Taking a position at Activision, a competing firm, Gold, with a collaborator, David Crane, produced a highly successful commercial example of this latter version of AS: Little Computer People (LCP), described in one article as "the first fully autonomous, computerized AI game" ("In Memory" 2003, 253). The game, which was released in 1985, ran on new, sixteen-bit microprocessor computing platforms, such as the Atari ST and the Amiga. These machines adopted the now universal WIMP-style (windows, icons, menus, pointer) graphical user interface, which had been popularized earlier in the decade in Apple's Lisa and Macintosh computers, and was itself an outgrowth of a system invented by Alan Kay and his associates at PARC in the early 1970s (see Broneck 2002, 207–9).

The activities of the LCP demonstrated the extent to which algorithmic symbolism was an outgrowth of the social aesthetics of Bay Area microcomputer experimentalism. The screen presented a two-dimensional representation of a house, with dining room, living room, recreation area, kitchen, and other areas visible. The virtual person played the piano, exercised, watched television, and performed other quotidian tasks while completely ignoring the so-called user, who was often relegated to the status of voyeur—hence, the characterization "autonomous."[14]

The user manual strongly encouraged anthropomorphization and subjectivization of the LCP, informing new purchasers of the protocols needed to encourage him to move into his new home:

> The first time you visit your LCP, his house will be empty when it appears on the screen. This is because most LCPs are quite shy and will not readily rush into a new situation. In fact, it may take several minutes before yours actually musters the courage to step inside the new home you're providing for him. On the other hand, LCPs are also quite loyal. Once he's moved in, you can expect him to be home on subsequent occasions.
>
> When an LCP enters a house for the first time, he will usually inspect the new home for anywhere from 5 to 10 minutes. Then he'll leave to retrieve his belongings. Yours will probably return shortly with his suitcase. Most LCPs also bring their dog. (Polley and Nelson 1986, 3)

There were channels for communication with the little man on the hard drive, however, via a set of keyboard commands. Like the Tamagotchi digital pet of the late 1990s, LCPs required care and feeding, including food and water for both the LCP and his dog.[15] In anticipation of emotional computing and the humanoid robots created by Cynthia Breazeal and other researchers at the Massachusetts Institute of Technology,[16] users were also required to monitor and tend to the LCP's "emotional needs" via "mood boosters." To get the user's attention, the LCP would "knock on the glass of your TV or monitor" (Polley and Nelson 1986, 7). Mood boosters included "phone calls" ("unless they are constantly interrupted to the point of irritation"), petting ("he must be sitting in his easy chair in the living room"), playing card games (including Blackjack and Five Card Draw), and leaving a new LP record at the front door for the LCP's listening pleasure (6). The LCPs were fine amateur pianists and were often seen reading the newspaper in front of the fireplace or playing with their computers.

Users could communicate with the LCP via text, including making requests and suggestions and asking questions. "LCPs are especially responsive to good manners," the manual said, "so remember to incorporate words like 'please' and 'thank you' into your requests" (Polley and Nelson 1986, 7). In the end, however, users became aware that "LCPs are basically quite independent" (4), thus bringing into the picture a mode of machine agency that framed the LCP not only as an object invested with agency conceived along Latourian lines but also as a quasi-subject (see Latour 2005).

In the terms suggested by Penny, we can theorize the LCP as an artwork exhibiting behavior. Moreover, following Bourriaud, we can conceive of the LCP as a relational work that proposes and produces dialogue and sociability. Finally, as with the League's computer network performances, we can theorize the LCP's quasi-independent behavior as an improvisative form of machine-human sociality, a social improvisation that constructs a world that challenges the hierarchy of humans over machines.

The interaction becomes improvisation when a third term of freedom enters the picture: when the LCP's analysis of the situation mirrors that of its "user," who is no longer a user of software in the traditional sense. Both the human and the LCP are responding to conditions and actions that cannot be wholly foreseen by either, which obliges a recognition by the human that in the world of the game, both parties to the improvisation become free agents with respect to the position of the other.

Finally, it is important to recognize that this kind of relational artwork pursues an improvisation that could potentially take place over very long time spans—days, weeks, months—thereby undercutting the notion of improvisation as an ephemeral practice bound to the moment. Another way to put it is that the improvisation between the human and the LCP expands the notion of the moment itself, as well as positing a notion of shared temporality along the lines suggested by both the sociological phenomenology of Alfred Schutz and the music-informed Christian theology of Jeremy Begbie (2000, 207; see also Schutz 1964), who maintains, "When I, the improviser, come to terms with and engage with another improviser, I come to terms with the other's temporality." Thus, what is being proposed in this analysis of LCP is not a metaphysics of machine consciousness but a phenomenology of freedom as dialogic interaction.

In 1991, Gold took a position at Xerox PARC and became an integral part of the development of "ubiquitous computing," or ubi-comp, working with a team that included Marc Weiser, a computer scientist who was then chief technologist at PARC and had headed PARC's Computer Science Laboratory. According to an article written by Weiser, Gold, and John Seely Brown (1999), the concept of ubiquitous computing dates back to the founding of the ubi-comp program at the Computer Science Laboratory in 1988.

In Weiser's words (1993, 76), "The idea of ubiquitous computing first arose from contemplating the place of today's computer in actual activities of everyday life." In the article "This Is Not a Pipe," Gold complements Weiser's view by troping the surrealist painter René Magritte's famous painting to present a vision of the computational remediation of everyday objects such as toys, and indeed, a pipe:

> Ubiquitous computing is a new metaphor in which computers are spread invisibly throughout the environment, embedded and hiding as it were, within the objects of our everyday life. Each of these computers can talk with any of the other computers much like chattering animals in a living jungle, sometimes exchanging detailed information, sometimes just noting who's around. The everyday objects themselves become a kind of ruse: a baby doll (or toy block) might look like a familiar remnant of childhood, but It is really only one of a thousand distributed nodes which control the functioning of the whole house. Likewise, the baby doll itself activates its own mechanisms, behaviors, and charms based partly on the comings and goings of its adopted (organic) family, and partly on digital discussions with other objects in the house. (Gold 1993b, 72)

Gold ends the article by invoking a vision of the independent decision making of embedded systems: "This new augmented reality is perhaps a little like the enchanted village in which common objects have magically acquired new abilities, a village where toy blocks really do sing and dance when I turn out the lights" (Gold 1993b, 72).

By the fall of 1993, Gold had distilled this vision into a set of five fundamental characteristics of ubi-comp objects, using as examples computational analogues to lunchboxes and pipes:

UBI-OBJECTS ARE SENSUOUS AND REACTIVE. They feel, see, hear, and touch the environment and then respond to it in various ways.

UBI-OBJECTS ARE COMMUNICATIVE. They talk a lot among themselves, between themselves and other ubi-objects, and between themselves and us.

UBI-OBJECTS ARE TACITLY AND INVISIBLY EMBEDDED INTO DAILY SOCIAL LIFE.

UBI-OBJECTS ARE ANTI-NATURAL. When an object says "hi" in the morning, it is hard not to say "hi" back.

UBI-OBJECTS ARE EVERYWHERE. (Gold 1993a, 4–6)

Gold concluded that through computational remediation, everyday objects would become "deeply enspirited" (Gold 1993a, 3), an invocation of what I have elsewhere called "technology-mediated animism" (G. E. Lewis 2000, 37).

As Jane McGonigal (2006, 8) notes, "Although Gold never uses the term 'performance' to describe the phenomenon of ubiquitous computing . . . [his] vision for ubiquitous computing is fundamentally a vision of distributed networks of play and performance." Again, we can trace these networks back to the social aesthetics of Bay Area interactive computer music improvisations. As the human-computer interaction theorist Paul Dourish (2004) notes, Weiser cites the anthropologist of technology Lucy Suchman's notion of "situated actions" as a source for the ubiquitous computing idea. Dourish quotes Gregory Abowd's view that "Situated action emphasizes the improvisational aspects of human behavior and deemphasizes a priori plans that the person simply executes. . . . Ubicomp's efforts informed by a situation action also emphasize improvisational behavior and would not require, or anticipate, the user to follow a predefined script" (quoted in Dourish 2004, 20).[17]

The ubi-comp team produced a number of patents for devices that included early versions of palmtop and notepad computers. However, for the most part, these devices were less compelling than Weiser, Gold, and Brown's (1999, 694) prescient conceptual realization that "ubi-comp created a new field of computer science, one that speculated on a physical world richly and invisibly interwoven with sensors, actuators, displays, and computational elements, embedded seamlessly in the everyday objects of our lives and connected through a continuous network." Arguably, both Gold's early work with the League and the creation of LCP presaged this conception of quotidian, deeply embedded human-computer interaction. The presence of computers in everyday life in the West has become, as Tolmie notes, "unremarkable" (quoted in Dourish 2004, 29).[18] In this sense, the advent of ubicomp objects has also transformed human experience and potential.

Epilogue

As with ubiquitous computing itself, the social aesthetics of the early interactive computer musicians have now become unremarkably embedded in the fabric of our everyday encounters with computing devices. As a final example, consider the famous world-building game *The Sims*, whose author, Will Wright, was queried about his experience with LCP:

> MAX STEELE: Will, did you ever play "Little Computer People Research Project" from Activision, and did it influence you at all?
>
> WILL WRIGHT: Yes, a long time ago. I've since gotten to know several people who were involved with that project, and many of them gave valuable feedback on *The Sims*, especially Rich Gold.[19]

Gold's posthumously published *The Plenitude* (2007) lays out a complex and contradictory vision of the connection among computing, commerce, interactivity, and everyday life, informed by his leading role in Xerox PARC's ubiquitous computing area and, later, its artist-in-residence program, whose vision pursued strong connections between artists and scientists. When Gold joined PARC, as the interactivity theorist and designer Anne Balsamo remembers, the center's director and chief scientist, John Seely Brown, encouraged him to "become a corporate provocateur, cultural mediator, and institutional visionary, and to act as a catalyst for creative thinking and practice" (Balsamo 2011, 57). From this point, Gold's work developed into a vector of transmission linking the cybernetics orientation and social aesthetics of the early interactive computer musicians with a later vision of interactivity that may one day embrace an understanding of improvisation as a fundamental aspect of the human condition.

Notes

1. See "A Brief History of the Music Department," http://www.mills.edu/academics/undergraduate/mus/history.php (accessed July 3, 2016). See also "Music at Mills: An Illustrious Musical History," http://musicnow.mills.edu/music_at_mills_history.php (accessed July 3, 2016).

2. For the definitive history of the San Francisco Tape Center, see D. W. Bernstein 2008.

3. The Behrman work is recorded on David Behrman, *On the Other Ocean*, Lovely Music CD 1041, 1976.

4. See the introduction by Bischoff in Horton 1999.

5. For a first-person account of a rehearsal of the League by a nonparticipant, see Roads 1985.

6. According to Bischoff, Horton (1944–98) began working with musical microcomputers as early as 1976 and was "the first composer to postulate the idea of using computer networks to make music," as well as creating the first network music performance with Gold in 1977.

7. Christian Wolff, "For 1, 2, or 3 People," music score, C. F. Peters, New York, 1964.

8. For a discussion and critique of Bourriaud's ideas, see Georgina Born's chapter, "After Relational Aesthetics: Improvised Music, the Social, and (Re)Theorizing the Aesthetic," in this volume.

9. For the original, see Bateson 1979, 92.

10. As we can see, the trope of conversation was central not only to the famous Turing Test, but also to other forays into human-machine relations in AI and the arts.

11. See Huhtamo 1999. For my earlier article on this topic, see G. E. Lewis 2003.

12. See http://www.jeffrey-shaw.net/html_main/show_work.php?record_id=83.

13. For a technical explanation of the program, see Bischoff et al. 1978, 26–27.

14. I remember running into Rich, I think in San Francisco. He told me that he was working on "a little man that lives on your hard drive." "What's he going to do there?" I asked. "Whatever he wants," came the reply.

15. For a personal account of life with a Tamagotchi, see Turkle 2012, 30–34.

16. For a critique of the project of humanoid robotics, see Suchman 2007.

17. Originally in Abowd et al. 2002.

18. Originally in Tolmie et al. 2002.

19. "Will Wright: A Chat about 'The Sims' and 'SimCity,'" CNN.com, January 20, 2000, http://www.cnn.com/chat/transcripts/2000/1/wright/index.html (accessed July 3, 2016). The iPhone application Pocket Guy is also based on LCP.