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A Personal Reminiscence on the Roots of Computer Network Music

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A Personal Reminiscence on the Roots of Computer Network Music

SCOT GRESHAM-LANCASTER

ABSTRACT

This historical reminiscence details the evolution of a type of electronic music called "computer network music." Early computer network music had a heterogeneous quality, with independent composers forming a collective; over time, it has transitioned into the more autonomous form of university-centered "laptop orchestra." This transition points to a fundamental shift in the cultural contexts in which this artistic practice was and is embedded: The early work derived from the post-hippie, neo-punk anarchism of cooperatives whose members dreamed that machines would enable a kind of utopia. The latter is a direct outgrowth of the potential inherent in what networks actually are and of a sense of social cohesion based on uniformity and standardization. The discovery that this style of computer music-making can be effectively used as a curricular tool has also deeply affected the evolution and approaches of many in the field.

TECHNO UTOPIA

> Over the past few years, a strong reaction against the sterile world of laptop sound and video has inspired a new interest in analog processes, or "hands dirty" art in the words of practitioner John Richards. With this renewed analog interest comes a fresh exploration of the pioneers of the electronic arts during the pre-digital era of the 1960s and 1970s. Artists and inventors such as Nam June Paik, Steina & Woody Vasulka, Don Buchla, Serge Tcherepnin, Dan Sandin and David Tudor all constructed their own unique instruments long before similar tools became commercially available or freely downloadable—often through a long, rigorous process of self-education in electronics [1].

This article is a personal reminiscence in response to the *LMJ* call for submissions on "music and sound art directly addressing history and memory." The quote from Greg Smith above is relevant for me because it outlines many of the fundamental figures in my own life experience as a composer and performer in the nascent field of "computer network music." I would add the impact of Sonic Arts Union and the ONCE festival in Ann Arbor in the late 1960s, which necessarily includes the contributions of Gordon Mumma, Alvin Lucier, Robert Ashley, David Behrman and, of course, David Tudor.

When I browse the ubiquitous music applications (iTunes, Spotify, etc.) that are tagging audio files and examine the choices for "electronic music," I am mystified. The history that I have experienced over the last four decades is not represented at all. Cage, Xenakis, Stockhausen, etc., and their fundamental electronic music contributions are nowhere to be found. "Electronic Music"—in the various forms offered by the pull-down menus of these apps—refers to a form of dance music from the late 1990s on and bears little resemblance to the "electronic music" that has been such an important part of my own musical life. For this reason, I was drawn to *LMJ*'s call for papers reflecting on "the ways in which history is recorded, forgotten and rewritten; and personal and collective memory." It seemed particularly appropriate to begin my article with the quote from Greg Smith above—a quote I discovered buried as a reference to a reference to a now-vanished online journal, *Vague Terrain*. At this time, it seems important to put forward my recollection of the transitions and evolution of electronic music from a perspective of 40 years of practice and performance.

In the second half of the 1960s, a sea change swept across Western culture—a post-"Camelot" idealism that yearned for a utopia that was being assassinated away. Buckminster Fuller was an inspiration for many at the time, with statements such as, "You never change things by fighting the existing reality. To change something, build a new model that makes the existing model obsolete" [2].

Recorded music had only really been distributed on a mass scale for 20 years before this time, and the ease with which each of the new music types could be disseminated was in a constant state of flux. The distribution of amplifiers and electric guitars, and the ubiquity of portable radios and tape players, changed the concept of music as an experience. Music that came primarily from loudspeakers was just beginning to flip the cultural reality.

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Fig. 1. The Trips Festival, 1965. 3 nights of concerts in the Longshoremen's Hall in San Francisco: <www.archive.org/details/KEN_KESEY_AND_HIS_MERRY_BAND_OF_PRAKNKSTERS_LOOK_FOR_A_COOL-PLACE_Tape-1OF2> (© Ken Kesey)

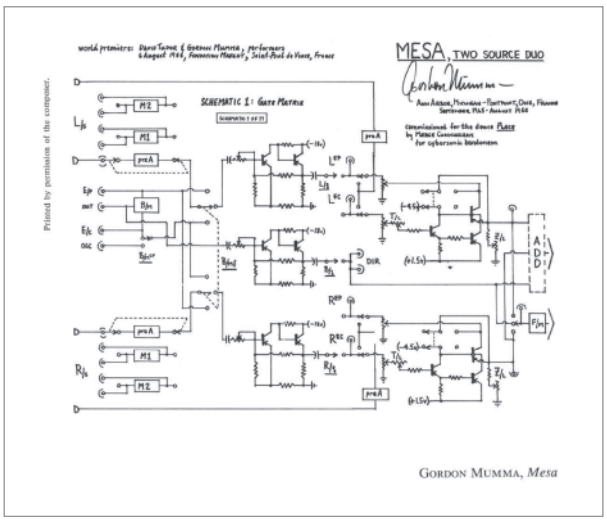

Fig. 2. "Cybersonic circuit/score MESA": <https://youtu.be/ulLt7_WB50s>. (© Gordon Mumma, from *Notations* by John Cage pub. by Something Else Press)

Early true multimedia performance events grew out of the Cage/Kaprow events referred to as "happenings." On the West Coast, their manifestations were the LSD-infused "Acid Tests" and similar events (Fig. 1). Ken Kesey said that "the acid test was a test where there were no specific goals. It was continuing to discover what was out there if you continued to move away from the norm" [3]. The cultural upheaval of that time was augmented by the electronic technology that was changing the way music was experienced [4].

Most importantly, the DIY nature of electronics had really taken hold. My own early education experiences led me to build a Theremin in 1967 from a circuit I purchased via my monthly subscription to *Popular Electronics*. This hand-constructed electronic reshaping of music creation techniques was demonstrated in 1970 by David Tudor, David Behrman, Pauline Oliveros and Gordon Mumma, among many others, when the Pepsi Corporation commissioned a group of artists, musicians and engineers to create a pavilion that would house a truly avant-garde work of contemporary art at the International Expo '70 in Osaka, Japan [5].

The circuit was becoming a new type of score. The roots of the development of the concepts that led to the first electronic music synthesizers are grounded in this spirit of adventure. Emerging types of synesthetic performance were being fostered by artists' desire to extend their resources to include a new type of music expression: the analog synthesizer. Figure 2 shows such a circuit that Gordon Mumma developed in 1966. By the mid-1970s, an artistic culture had grown around this idea of electronics as a type of score.

The self-modifying analog synthesizer patch emboldened composers and sound designers to think in terms of the emergent behavior of the circuit, as that of some sort of utopian Golem. The sounds being emitted by these machines were more wrangled than played—this was a new era of discovery that pushed the boundaries of timbre and formal structure. Serge Tcherepnin's People's Synthesizer Project was a fascinating early set of works that evolved into a set of analog synthesis modules that are still in use today as Euro-Rack modules [6]. By working with inspired individuals, many of us got our initial exposure to these new concepts of music creation by building this first generation of Serge Tcherepnin's "People's Synthesizer" (later Serge Modular Music Systems) nearly from scratch. I built one for the electronic music studio at Virginia Commonwealth University in Richmond, Virginia; Warren Burt did the same for the Center for Music Experiment at the University of California at San Diego, while studying with Ken Gaburo; etc.

RICH GOLD: THE MUSE OF UBIQUITOUS INTERCONNECTED MUSIC-MAKING

Rich Gold is a pivotal point of reference here. The search for the story that the new technology of the late 1970s was telling unfolded from the procedural style of the post-Cagean in both composition and performance. The circuit was the score in much of this work, but what story was being told? At his core, Gold was a writer, a storyteller—and he wrapped these early experiments in abstract narrative. In *The Plenitude* [7], his wry humor and wit are clear. In Fig. 3, Gold correctly depicts himself as one of the progenitors and early composer-performers of computer network music.

The "second genius" referred to in Fig. 3 is Jim Horton (the "first genius" being Serge Tcherepnin). Gold had been

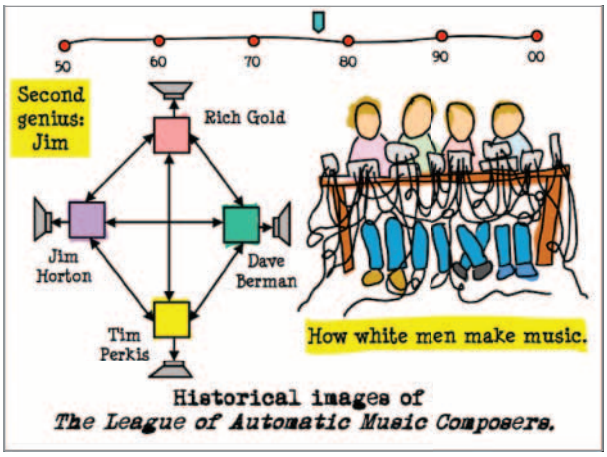

Fig. 3. Illustration from Rich Gold's book *The Plenitude*, page 28. (© Rich Gold)

tasked by Tcherepnin to create the graphic user interface for the People's Synthesizer that Tcherepnin had designed while at the early Cal Arts Institute (at its first location in Pasadena before it moved to its current location in Valencia, California). The irony of this image is most interesting in a genre-breaking context and as the background for what has become "computer network music." Jim Horton was another iconoclast about whom some readers may wish to learn more. Horton's biographical notes about this period of electronic and early microcomputer music may be of particular interest [8].

TECHNOLOGICAL IMPROVISATION

> The scene at Mills seemed worlds away from the electronic music studios I had been exposed to. They still had the public access studio going at that time, and they let me try out the electronic equipment myself and showed me how things worked. David (Behrman) was rehearsing with Rich Gold, John Bischoff, and Jim Horton, who were using tiny computers called KIMs. They were not exactly my image of what computers were like—a board about the size of a sheet of paper with a tiny keypad and a few chips.
>
> —GEORGE LEWIS regarding ~1978 [9]

George Lewis's influence is also iconic. His work from the early 1980s used a very early version of the Atari ST personal computer running the Forth operating system for the algorithmic *Voyager* software instrument that listened to and reacted to live improvisers. Lewis's work is an example of the "emerging behavior" expectation of the early period of this entire genre [10].

In the above quote, Lewis is referring to the loose and constantly changing cooperative of the League of Automatic Music Composers—a radically new synthesis of rock and/or jazz "band" with a "rich blend of communal ideologies, radical culture, technical innovation, intellectual ferment, and a hands-on attitude that has been a hallmark of California life since the pioneer days" [11].

During this same period, a broader collective of composer-performers was cultivating a new approach to music-making based on these ideas. Chris Brown's compilation of work from this ragged time of music-making, for the Museu d'Art Contemporani de Barcelona, appeared as part of the museum's Ràdio Web series *Interruptions* (in Episode 2, "Once Upon a Time in California. Brown recalls of the period "during the late 1970s and 1980s in Silicon Valley":

> It was a freewheeling time for start-ups run out of garages by a bunch of do-it-yourself geeks and venture capitalists. . . . A gaggle of music experimenters were dreaming of a future where technology might enable new kinds of musical freedom—freedom from orchestras and scores, freedom from scales and temperament, freedom from the academy, freedom from the music business, and, most of all, freedom for noise. Free improvisation was the lingua franca where jazz musicians, junk percussionists, instrument inventors, and computer hackers could come together to play [12].

Mills College was not the only source of this new extension of electronic music practice. John Chowning at the Stanford Computer Music Research Center in the 1970s, with Andrew Moore, Marc Le Brun and many others, were creating FM synthesis and digital reverb. By the 1980s at Wesleyan College in Connecticut, the influence of both David Tudor and Alvin Lucier manifested in the related work of both Nicolas Collins and Ron Kuivila. Their work reflects an evolution beyond the analog synthesizer as the primary sound source, while on the west coast Paul DeMarinis, before them, refined the idea of circuit bending as an augmentation of the raw circuit as a score. Circuit bending is the creative, chance-based customization of the circuits within electronic devices, electronic toys and other devices. Serge Tcherepnin told me his first forays into musical electronics in the 1960s were his own experiments in "hacking" small transistor radios.

As an example, Nic Collins states, "With my first microcomputer I experimented with processing feedback by modulating filters at very fast rates, producing rich sidebands and unstable shearing textures ('Second State,' 1981)" [13].

By 1986 there was a community of like-minded performers putting on a series of concerts entitled "The Network Muse." (The flyer for the series is shown in Fig. 4.) The title of the four-night festival of new music belies the subconscious desire of all involved for this new way of using computers networked together for music-making to be the "muse" for a new alchemy of sound.

> In the summer of 1986 we decided to produce a mini-festival at "The Lab," which ran a space at 1805 Divisadero St. [San Francisco, California] in an old converted church building, devoted to Automatic Music Bands. This was a collection of composers working with computers who were collaborating in duos and trios, connecting their computers in various ways in networks to share sound, control data, or both. We called the festival "THE NETWORK MUSE—Automatic Music Band Festival" [14].

NICOLAS COLLINS CREATES THE HUB

Collins heard about "The Network Muse" festival and offered the opportunity for the participants to perform together in New York the following year. It was from this context that an ongoing collective called "The HUB" was consolidated. This collective—which included myself—was an expansion of the duo of Tim Perkis and John Bischoff that constituted the initial "HUB." A year later in 1987 we performed at two venues connected by 300-baud modems, the Clocktower and Experimental Intermedia in New York, at a concert that was noted in the *Village Voice* by composer and then–music critic Kyle Gann in the article "Musica Telephonica" [15]. It was Nicolas Collins (now retiring as LMJ Editor-in-Chief) who organized this set of concerts. The opportunity to perform together in New York consolidated the loose collective of interested composer-performers from the San Francisco Bay Area into the HUB ensemble. Nicolas Collins is the Brian Epstein of the HUB.

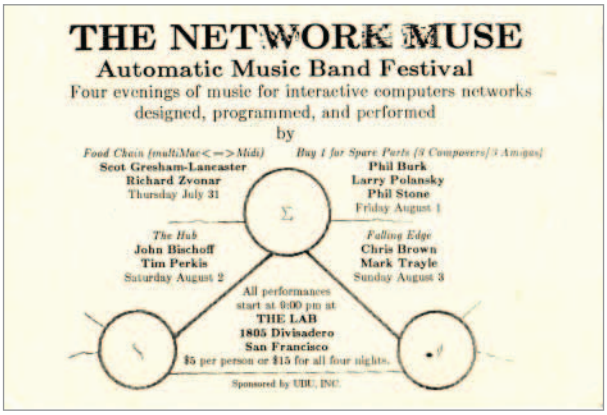

Fig. 4. Flyer for "The Network Muse" festival, 1986. (© Tim Perkis)

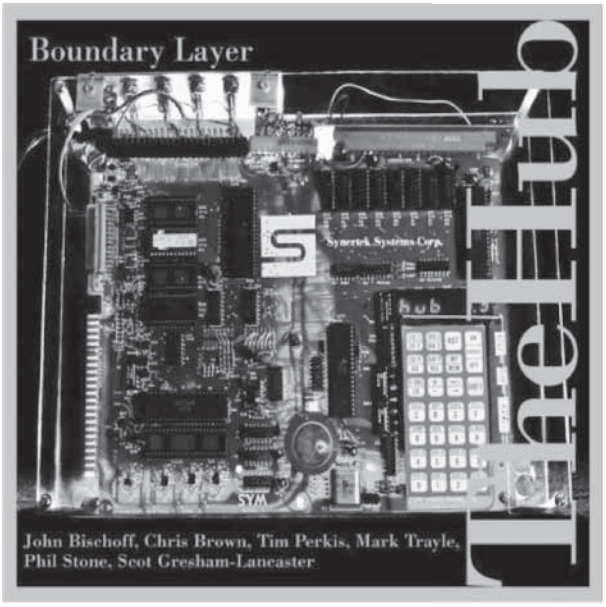

Fig. 5. Cover for *The HUB: Boundary Layer* (3-CD retrospective) (Tzadik TZ 8050-3, 2008) (© Tzadik)

Since this initial set of concerts in New York, the "band" or composer-performer collective the HUB has had a fairly consistent run, performing nearly every year for the last 30 years (with a five-year break from 1997–2002). The group produced three CDs, culminating in *The HUB: Boundary Layer (3-CD retrospective)* (Tzadik TZ 8050-3) (Fig. 5), which includes 30 pages of liner notes. The HUB remains active, continuously pushing the boundaries of a new form of music-making that has come to be referred to as "computer network music." The members of the HUB (shown in Figs 6 and 7) are (in alphabetical, nonhierarchical order) John Bischoff, Chris Brown, Scot Gresham-Lancaster, Tim Perkis, Mark Trayle and Phil Stone. For purposes of this reminiscence, rather than focusing on the HUB's many pieces and performances, I point out below some singular aspects of the configuration of this group that bear attention, particularly when considering the laptop orchestra phenomenon that is so often linked with the

Fig. 6. The HUB in Berlin, 2005 (from left to right: Scot Gresham-Lancaster, Chris Brown, Phil Stone, Mark Trayle, Tim Perkis and John Bischoff). (© Jens Brand)

development of this form of music-making ensemble. The members of the HUB itself are often rightfully characterized as the "grandfathers" of this genre of live coding and laptop orchestras.

A solid distinction here is that the HUB has always been a cooperative of independent composer-performers. Often, the design of pieces is formed around the current composing and performing practices of the group. Currently two of us use Pure Data, two use SuperCollider, one uses Max and one uses his own command line C++ synthesis language. We use Open Sound Control (OSC) as our common communication and transport layer for performing. Our individual instruments and playback setups are constantly evolving, influenced greatly by developments in our independent instrument creation, as part of our individual solo practices.

We all often adjust code parameters during performance. This sort of "live coding" was a hallmark of our playing style before the term "live coding" came into common parlance. The software and hardware configuration of each player was completely independent of the others'.

Points of Presence (1997) was a well-funded attempt to take the HUB back to its roots. In this piece, the performers are in separate performance locations: John Bischoff and Phil Stone at Mills College in Oakland, California; Mark Trayle and Scot Gresham-Lancaster at Cal Arts Institute in Valencia, California; and Chris Brown and Tim Perkis playing at Arizona State University in Tempe (as illustrated in the postcard in Fig. 8). The performance ended in failure because of our naiveté regarding the early versions of firewalls and because this was before we had the skills to send Open Sound Control (OSC) messages via Network Address Translation (NAT) techniques. We were trying this literally on the alpha (version 0.0.1) compile of OSC that Matt Wright had graciously provided for us. By 1997, the core aesthetic of our work had moved much closer to what is now practiced in the context of "live coding." The specification for *Points of Presence* did not require any live code, but rather required a uniformity of code that was unfamiliar to most of us, and difficulties tunneling the nascent OSC messages through the increasingly rigorous security of the three campuses where we were playing made a recipe for disaster. The group took a five-year break after the 1997 *Points of Presence* debacle [16].

By the time performance opportunities arose for us again in 2002 at the Dutch Electronic Arts Festival (DEAF) in Rotterdam in the Netherlands, our collective experience had helped us to overcome these problems. Technology had evolved, allowing our performance practice to return to the more heterogeneous style of our earlier work. To this day, we are using the brilliantly conceived OSCgroups code developed by Ross Bencina that we first used at DEAF in 2002 [17]. This has allowed us to move forward with independent software designs for each player that still meet the specifications of a given HUB piece and allow us to sync tightly with the integrated messages needed for the specifications of each new piece.

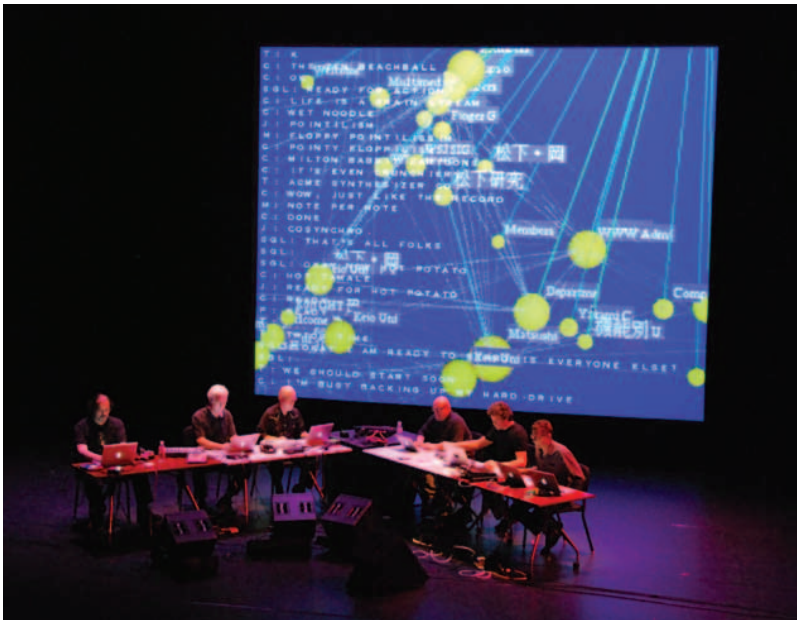

Fig. 7. The HUB in performance at REDCAT, Los Angeles, 2013 (from left to right: Scot Gresham-Lancaster, Chris Brown, John Bischoff, Tim Perkis, Phil Stone and Mark Trayle). The large screen shows a chat dialog between the players that we use to coordinate changes from one piece to another. (© Phil Althouse)

LAPTOP ORCHESTRAS AND NETWORK PEDAGOGY

The cultural milieu the HUB arose from was deeply heterogeneous and was driven by our independent work as composer-performers. This is in stark contrast with the homogeneity of the "laptop orchestra" ensembles that have often credited the "League" and the HUB as their progenitors. Dan Trueman's article on this topic goes into some depth on the issues leading to this aspect of the evolution of computer network music.

> I think we will never discover what is ultimately possible with computational-based performance if we don't see challenge and difficulty as instrumental virtues. I believe we can have it both ways. We have already created pieces for PLOrk [Princeton Laptop Orchestra] that can be taught, learned and performed in an afternoon, and there is no reason not to continue doing so [18].

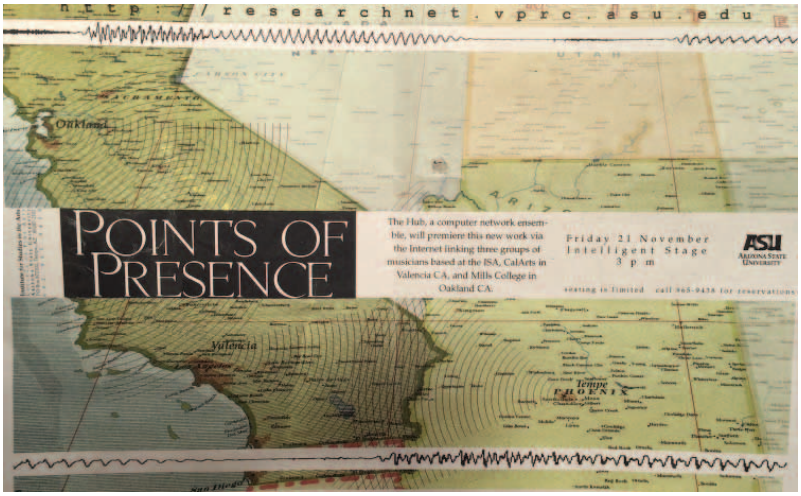

Fig. 8. Postcard illustrating *Points of Presence*, Institute for Studies in the Arts, Arizona State University, 1997.

This represents a fundamental change in a strategy that arises from a different motivation and cultural context for these new computer network music realizations. As I have outlined above, the initial work in this field arose from a nascent hacker culture and a vague dream of an untapped "network muse" arising from the circuit/score. This context and motivation have now given way to the vision of an orchestral realization of live computer music that belongs more to the cultural context and promise of virtuosity that is so deeply a part of orchestral music. The pursuit of this vision is particularly evident in the struggling music/media art departments tasked with keeping the standard traditional art and music curriculum relevant—even as the very core of what art and music is in our society has been revolutionized by the innovations of that now-mature hacker culture.

My own HUB piece/specification "Stuck Note" (1995) has been cited as the "best known" of our works. The simplicity and homogeneity of this piece may explain why it has been a choice for many of these new institutionally supported laptop orchestras.

> "Stuck Note" was designed to be easy to implement for everyone, and became a favorite of the late Hub repertoire. Every player can only play one "note," meaning one continuous sound, at a time. There are only two allowable con-

> trols for changing that sound as it plays: a volume control, and an "x-factor," which is a controller that in some way changes the timbral character or continuity of the instrument. Every player's two controls are always available to be played remotely by any other player in the group. Each player cannot control their own volume or "x-factor" [19].

By comparison to many more elaborate HUB pieces, "Stuck Note" requires only a rudimentary understanding of synthesis and the programming related to that synthesis for each player. It is a good introductory exercise for creating a piece of music that relies on the interaction of a network to be successful as a musical performance. It therefore has an unintended pedagogical strength that was not part of its original conception. When it was originally conceived, Mark Trayle had moved to work at the Cal Arts Institute, and so out of necessity we tasked ourselves with pieces that were easier to realize and coordinate in a couple of four-hour rehearsals. This origin reflects a much different cultural context from that of the educational exercise it has evolved into. It has changed from set of freewheeling "work arounds" to meet heterogeneous compositional "recipes" into a way of helping students understand what network connectivity actually is and to develop a sense of social cohesion based on uniformity and standardization. These are critically important concepts for current multimedia education environments, but reflect a much different aesthetic.

TIME MARCHES FORWARD

This cursory reminiscence across time relative to the specific area of computer network music is clearly just an impression, but my hope is that this may inspire a deeper understanding of the various roots and pathways that all of us working in this area have been exploring and responding to. It has been a slow evolution for us, and we look forward to working through the changes that will happen in the field over the next 20 or 30 years. The one clear conclusion we have come to regarding this very specific branch of music-making practices is that it reflects the cultural milieu more transparently than most musical practices.

The call for this volume of *LMJ* included a request for "recreations and updates of historical works, including software emulations of lost hardware"; our most recent HUB concerts offer a perfect example of such a recreation. Mark Trayle (1955–2015) was a prolific composer and performer who recently passed away way too young and is deeply missed by all of us who had the opportunity to know him as a friend and a brilliant collaborator. His piece "Simple Degradation" was chosen to be recreated for a series of memorial concerts in 2016.

> One performer generates and processes a waveform, simulating the response of a plucked string. This waveform is then broadcast on the computer network, the other performers using it for amplitude modulation (loudness variation). The rate at which the waveform is played back by the performers is determined by the performer who generated the waveform. The performers are free to choose whatever timbres and pitches they wish. The waveform may only be used for amplitude modulation. Pitch may only change after one complete cycle of the waveform [20].

This piece was first specified by Mark Trayle in 1987 as part of the HUBs very first New York gig. In 1987 our communication transport were two Synertek single board 6502 computers with 128k of ram communicating over phone lines at 300 baud.

Phil Stone's assembly language program allowed us to remotely address the waveform Mark Trayle was generating using the relatively newly minted Karplus-Strong string synthesis algorithm [21]. This is what made Trayle such a wonderful collaborator. He was writing the C code needed to make a piece like this possible in 1987. Fast forward to his memorial concert, at which time we had been using OSC for almost a decade. It was necessary to translate the intention of that original code into our current working environment. Chris Brown rose to the challenge and gave us all a stream of data that continued to diminish throughout the performance of the piece. We performed this piece at Mills College in February 2016 and at REDCAT theater in Los Angeles in December 2016 with SF Soundworks organizer and composer-performer Matt Ingalls stepping in to fill the now vacant sixth chair.

Chris Brown had created a version of the original realization in SuperCollider. We went back and forth regarding this specific realization because it differed from the original. In 1987, we could all pull data one byte at time from the time-varying "pluck" that Mark was generating and loading into the 128K buffer. In the new version, Brown had made the buffer in SuperCollider and just streamed the buffer out over OSC to us all. From each new "pluck" all six players created a slow and, yes, simple degradation of the initial blast of sound from our computers. While the entire mechanism had completely changed over the three decades, the sound of the piece, and the experience of each new "pluck" eventually diminishing to silence, was maintained. What Mark could not have anticipated was the poignancy of the piece in the context of his own memorial concert. Each new note, plucked and then diminishing to silence, never failed to leave us with a profound sense of the finite quality of all things. Not so simple this degradation in the context of remembering a dear friend and collaborator of decades.

Acknowledgments

This volume of the *Leonardo Music Journal* is the last that will be edited by Nicolas Collins. I mention this because my first article regarding the history and aesthetics of the HUB was published in the first volume for which he was the editor, in 1990. In that sense, this article has a quality of completion. This seems perfect for a volume regarding history and memory. I deeply thank Nic for all of his years of support and, dare I say, guidance in this world at the edge of sound. Additionally, I have had the good fortune of working for the last few years very closely with the executive editor of *Leonardo* and the *Leonardo Music Journal*, Roger Malina. He is a wonder for all his years of nurturing and fostering collaboration across the tricky art/science boundary. Finally, I would like to acknowledge my close friends and compatriots who have shared in the experience that we have called the HUB.

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