COMPOSING INSIDE ELECTRONICS

Published research in the field of experimental music, 1988 – 2007

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INTRODUCTION

This document is a survey and analysis of my research and publications, submitted together with selected published works covering a twenty year period, for evaluation for the PhD by Publication in the Department of Music at the University of East Anglia.

Since the mid-1970s I have been active as a composer and performer of live electronic and computer music, as an improviser, and as an installation artist. In the mid-1980s I also began to curate concerts and festivals, write, edit and teach. Through these activities I have tried to address not only technical and aesthetic issues of relevance to my compositional work, but also the ephemeral history of experimental music, which is disappearing before our eyes (or ears).

This Critical Analysis attempts to:

- gather together the most significant examples of my written output
- explain the historical context of its creation
- re-evaluate the material in light of the current cultural situation
- draw attention to themes and concerns that recur throughout the body of my work
- discuss the impact of my research on my artistic community and on my own development as an artist

The materials submitted include:

- *Handmade Electronic Music – The Art of Hardware Hacking* Routledge, New York (2006.)
    - A book published in 2006 that represents the most coherent statement of my research to date, combining a practical guide to making musical circuits and devices with an aesthetic and technical overview of almost 100 years of performed electronic music.

- Articles and essays, from 1988 to the present, published in major magazines, journals, catalogs and on-line in the United States, Europe and South America, including:
    - Critical essays on aesthetic, technological and historical issues in experimental music and art
    - Artist's Statements discussing aspects of my own work
- Examples of my work as an editor and curator, including:
    - Nine years of *Leonardo Music Journal*, of which I am Editor-in-Chief
    - Other journals I have edited
    - Catalogs I have written or edited for exhibitions and festivals I have curated
    - CDs and CD/book hybrids I have produced
- A complete list of publications, including my recordings, as an appendix

This document follows a more-or-less linear chronology, beginning with a brief overview of my evolution as a composer; then following my activities as writer and editor in order of publication. It examines in some depth *Handmade Electronic Music*, and concludes with my contribution to the forthcoming *Cambridge Companion to Electronic Music* (Cambridge University Press, 2007)

It has been, quite frankly, difficult for me to evaluate the impact of my publications – both prose and music. As will be seen in the body of this essay, in several instances I can demonstrate that an article, composition or performance preceded subsequent treatment of similar material in print or musical form. Composition, unlike scientific research, has no accepted practice of rigorous citation, and given the specialized nature (and diverse languages) of some of the journals in which my writing has appeared, and the general dearth of serious academic treatment of Experimental Music, explicit citation of my publications has been rare (although this is not the case for my recordings). Moreover, I am of the opinion that *Zeitgeist* is often a more significant force in cultural change than overt cause and effect. I can acknowledge that I have been at the leading edge of several significant artistic and critical movements,

but am wary of casting myself as the instigator, with the exception of my recent book, *Handmade Electronic Music*, which has been widely credited as deeply influential by artists of all stripes.

In the context of a PhD by Publication my recorded music is of less relevance, except insofar as it represents the primary application of much of the technical and aesthetic research described in my Artists' Statements. As some of these recordings are referred to in these articles I have included information on my records, cassettes and CDs in the bibliography. Most of the audio files, along with scans of the cover art and liner notes, can be found on my web site: www.nicolascollins.com/records.htm

SUMMARY OF CRITICAL ANALYSIS

Music has long been touted as the most abstract of art forms, but my experience has been that it is deeply physical, rooted in a world of bodies, instruments and architecture. Like every other human product, music is a collaboration between available materials and instigating concepts. This cultural matrix of aesthetic intent, social dynamics, and material determination has been the focus of my work as a musician and, later, as a writer, curator, and editor. Recurrent concerns in this work include:

- the acoustics of architecture and instruments
- the "scores" implicit in electronic circuitry
- the dynamics of social and musical interaction in ensembles
- the interaction between audience and artwork

MUSICAL BACKGROUND

As a teenage musician I was undistinguished at best, but the Pop music of the late 1960s drew me to electronic sound. In 1971, having reached the limits of what I could accomplish with a flute and a fuzzbox, I bought a used Tandberg reel-to-reel tape recorder. It contained a hidden, undocumented switch that, when thrown, induced delicious, semi-controllable, swoops of feedback. What strikes me as significant, in retrospect, is that this switch transformed a *recording* device into a *performance* instrument: the buttons and knobs that would normally initiate and adjust the direct transfer of acoustic sound to tape became the interface for manipulating electronic sounds.

I was smitten by the siren call of electronic music, but was unable to afford any of the instruments available at the time: synthesizers – Moogs or Arps or Buchlas – were the playthings of pop stars and universities. Integrated Circuits on the other hand -- the guts of those costly machines – were getting cheaper in inverse proportion to their sophistication. These chips contained 90% of a functional circuit designed by someone who really knew what he (almost all the engineers at that time were male) was doing; the remaining 10% could be filled in by someone clueless, like myself. In 1972 I bought a chip designed for (the then novel) Touch Tone Telephone and built my first circuit, an oscillator. The last few months of high school were spent in my bedroom with the warped Tandberg and this oscillator, making electronic music.

My instruments were crude but eminently playable. Yet I played for an audience of none in my parent's apartment, while the Pop music I knew and loved was filling concert halls and clubs. I wanted to take electronic music out of the bedroom but I didn't know where to start.

In my first week of college at Wesleyan University I met Alvin Lucier: a composer who didn't own a piano, didn't write for conventional instruments (much less play one), and yet had an active career as a "composer/performer". A work like *Vespers* (1969), in which blindfolded players use hand-held, click-

emitting sonar devices to navigate through the performance space, bore no obvious resemblance to any existing form of music, yet somehow embodied the essential characteristics of live performance, such as ensemble interaction and acoustical sensitivity; it reconceived the musical score as task to be solved and, despite Lucier's aversion to the term, depended heavily on what could only be termed "improvisation". For me this latter trait was the final piece of the puzzle: the link between the "high art" of the European classical tradition (in which even a maverick like Lucier was deeply rooted) and all those other musical genres in which I felt more comfortable, such as Pop, Blues and Jazz. I posited that the breakthrough character of a piece like *Vespers* was inextricably bound to the abandonment of traditional instruments, with all their "cultural baggage" (to disinter a cliché of the time,) and the embrace of new electronic instruments.

Inspired by Lucier's example, I discarded all the instruments and many of the musical preconceptions I had brought with me to college and began developing new electronic "instruments" of my own, suitable for live performance. Some, were simply adaptations or re-configurations of familiar devices, such as a speaker and microphone set up to feed back. In *Pea Soup* (1974-76), for example, a self-stabilizing network of phase shifters nudges the pitch of audio feedback to a different resonant frequency every time feedback starts to build, replacing the familiar shriek with unstable patterns of hollow tones -- a site-specific raga reflecting the acoustical personality of the room.[1] These architectural melodies can be influenced by moving in the space, making other sounds, or even letting in a draft of cold air – all of which are options within the score. *Pea Soup* combined the affordable electronics with which I was familiar, the architectural acoustics brought to my attention by Lucier, and a classic minimalist task-oriented score. Through this work and other feedback pieces I learned that new instruments and sound materials often suggest new musical forms – the architecture determines the tuning and scale, for example -- at the same time that they rule out conventional ones. (see "All This And Brains Too", below).

I also continued to build my own circuits – aided by workshops with circuit-savvy composers David Behrman and David Tudor, and encouraged by peers such as Ron Kuivila and Paul DeMarinis. I possessed neither the instinct nor the intellectual tools for a proper study of electrical engineering; instead I picked up knowledge piecemeal, by building circuits I found in magazines or was given by colleagues, substituting components, and making note of which variations were interesting and which exploded.

My instruments – both adapted and built from scratch -- shared a few defining characteristics. They could all be played: their sounds could be articulated continuously in "real time" (I didn't have to record them and edit on tape in order to achieve my musical goals.) At the same time, they were difficult to control precisely – the sounds the audience heard were more the byproduct of the performer getting to know an instrument, rather than articulating a predefined result. Finally, the instruments' behavior often reflected site-specific factors such as the acoustics of a room (the pitches and tempo of *Pea Soup*, for example), or essential properties or limitations of the technology, such as the "ensemble circuits" I built that were inspired by the co-ordination scores of Christian Wolff.[i] These instruments lent themselves best to musical strategies that favored some degree of improvisation, and laid the groundwork of my early computer music. Just as acoustics determined the pitch world of my feedback pieces, the digital chips I used in my sound circuits suggested applying binary logic to the performer interface as well.[ii]

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[i] These instruments only made sound when played by more than one musician: the four players in *ANDS* (1978) played small keyboards that only registered players' actions if more than one player touched the same key at the same time; as a result, the piece unfolded in ways that sometimes were as surprising for the players as for the audience.

[ii] *Little Spiders* (1981), an early work for a multi-player computer instrument, is the closest composition to *ANDS* that is available on record. It was released on Nicolas Collins and Ron Kuivila, *Going Out With Slow Smoke*, New York: Lovely Music. LP. 1982.

Near the end of the 1970s the first affordable microcomputers came onto the market. Cajoled by the visionary Bay-area artist Jim Horton, a handful of electronic musicians, including myself, invested in the Kim-1 – a single, A4-sized circuit board with a calculator-style keypad and a display glued on top. Programming this thing in machine language, and storing the program as fax-like tones on a finicky cassette tape recorder, was an arduous, counterintuitive, headache-inducing process, but coding offered one great advantage over building circuits: it was easier to correct a mistake by re-programming than by re-soldering.

Moreover, even computers as crude as the Kim-1 had memory and could execute sequential logical operations. These features enabled the creation of instruments that could make ad hoc decisions based on past incidents, a feature of particular interest to those drawn to the quixotic unpredictability of live performance. Rather than just give more control to the composer, computers extended the interactive and improvisational possibilities of electronics. In my work (as well as that of my experimental colleagues) the computer began to embody elements of the *score* and the *player* in addition to those of the *instrument*. In the 1980s Apple, Commodore, Atari and others introduced machines whose increasing sophistication and expanding software base gradually reduced the angst-factor of programming, leading inexorably to the extraordinarily flexible and powerful machines and languages available today. Homemade circuits by and large faded into anachronism for most musicians, but I continued to solder as well as to program. What computers offered in the way of burn-prevention and "intelligence", they lacked in tactility: the tiny keypad of the Kim (and even its later replacement by a full-size ASCII keyboard and mouse) could not provide the degree of touch and control afforded by even so crude a device as a potentiometer or photocell.

In the years since I have continued to produce what I think of as "electronic music", even as the term itself became increasingly unfastened from either experimental avant-garde thinking about musical structure, or from the gritty notion of home-built circuitry. The cost of the synthesizer plummeted, its

versatility grew, and by the early 1980s it had become ubiquitous in Pop music. By the mid-1990s computers had become as commonplace in music recording and production as they were in the office. As electronic instruments matured in an expanding marketplace, the idiosyncrasies and embedded scores of the homemade circuits and artist software gave way to more flexible, more widely applicable, more generally useful devices. By the time I finished writing *Handmade Electronic Music* in 2005 electronic sound had become more than just commonplace – it was conventional, as natural to a Techno producer whose musical roots lay in Kraftwerk as to me, an ex-student of the eminently un-danceable Alvin Lucier. Today one chooses to use electronic sound not to proclaim one's musical ideology, but simply because one likes it.

For many years my research in circuit design, computer programming and aesthetics found outlet only through my compositions, sound installations and instruments for improvisation. My primary publications took the form of interviews, most of which focused on my own music, and the publication of the odd score (see Bibliography, below). Meanwhile, I couldn't help but observe that the increasing flexibility and availability of electronic instruments shifted attention away from the ways in which an instrument – or an array of electronic devices – can structure musical thinking. This realization, combined with a nagging sense that awareness and understanding of a critical period of musical thought was being lost, prompted me to begin writing about music in the late 1980s.

SURVEY OF PUBLISHED RESEARCH

"Imaginary Landscape – Electronics in Live Performance, 1939 and 1989" (1988)[2]

Lecture delivered at the Audio Arts Symposium, Linz, 1988, on the recent history of live electronic music. The central concerns of the paper originated in a festival I produced for The Kitchen in New York in 1988, which is documented in a CD on Nonesuch Records.[3] The paper is excerpted in the notes in the CD booklet.

In 1988 The Kitchen in New York City invited me to curate a festival of live electronic music. In the course of organizing it I became increasingly aware of the graying of "Electronic Music" and electronic musicians, and strove to balance the presence of established practitioners such as David Tudor and Maryanne Amacher with younger artists such as Mark Trayle and Gordon Monahan, and also to create a bridge to improvisation-tinged electronic work such as that of Shelley Hirsch and Voice Crack. Philip Glass underwrote the recording and editing of these concerts, from which I produced a CD for Nonesuch Records that provides an overview of the state of live electronic music at the end of the 1980s.

In the aftermath of the festival I gave thought to how live electronic music had evolved from the moment John Cage put the first DJ on stage in *Imaginary Landscape No. 1* in 1939, through the glorious 1970s, to the hoary state I found it in when I went to program for The Kitchen. I articulated three issues I saw as being central to what I described as "the rise and fall of Electronic Music":

> First, the "difficulties" and long-term implications of certain ideas of Cage's, like those first presented in *Imaginary Landscape*; second, the "bell curve" of the development of musical electronic technology; and third, the trajectory of the prevailing musical aesthetic of the 60's and 70's.

I suggested that the impact of Cage on composers of the 1960s was not so much one of showing specific new paths, but rather an extreme, though often temporary, disruption of a composer's ingrained assumptions: many of the

major figures of the post-Cagean music dabbled in electronics and experimental methodology (such as phase music, process music, task-oriented prose scores, etc.) for a while, but then returned to more conventional instrumentation and styles – Philip Glass, Steve Reich, and Robert Ashley are mentioned, among others. Another factor in the contemporary condition of electronic music was the fact that in the course of the 1980s electronic sound had become disassociated from any "avant-garde" aesthetic as the plummeting technological price-point brought synthesizers into the hands of the average Pop musician. I alluded to (without naming it as such) the shift in the prevailing art aesthetic from Modernist to Post-Modernist -- with its attendant shift of attention from process to subject matter -- as having an eviscerating effect on certain musical styles, and enumerate the other forms of art practice that seemed to be attracting practitioners (and audience) who might earlier have pursued Electronic Music. I ended on a note of optimism, however, describing four artists (Gordon Monahan, Alvin Lucier, Christian Marclay and myself) who produce works I deemed representative of the "current, 'post-post-Cagean' music, which balances systems and subject, reveals variations on the implications of both, acknowledges New Music's traditions, and shows something new".

The year after the Audio Arts Symposium I delivered the paper again at Het Apollohuis in Eindhoven (NL), but it has yet to appear in print. Nonetheless, it established the groundwork for much of my subsequent research, which developed along three distinct paths:

- Critical writing on general theoretical and technical issues, with references to the work of other artists, as well as (where appropriate) that of myself
- "Artist's Statements" -- analysis of my own work as a composer, improviser, installation artist and instrument designer
- Editorial and curatorial work, in which I gather a number of other artists and writers to address a common theme or rubric

Moreover, my reflections on the state of Electronic Music near the end of the 1980s, and my selection of four forward-looking artists, proved quite prescient

of the cultural transition that culminated in the rise of Ambient, Techno, Laptronica and other electronic Pop music in the course of the 1990s.

"Alvin Lucier's *I am sitting in a room*" (1990)[4]
Liner notes for the CD of "I am sitting in a room" (Lovely Records, 1990).

In 1990 I was asked to write the liner notes for the CD release of a newly recorded version of Alvin Lucier's *I am sitting in a room* (1969), a landmark composition, and one that exerted a profound influence on me as a young composer. When I looked back on the work, almost 20 years after I first heard it, I was struck by how much I had missed when I was 18. Whether because of a zeitgeist emphasis on process and physics, or because of my own youthful naïveté, I had overlooked the poetics of the piece in favor of its phenomenological splendor. In this essay, while acknowledging the mechanics of the work, I emphasize its romanticism: the transformation of a speech "impediment" (Lucier suffers from a serious stammer, clearly audible in the recording) into a "facilitator", the very engine of the work, its rhythmic essence; as well as the quasi-*Heimat* notion of "home" that lies at the core of the work, and the evocative transfer of the private space of Lucier's home into the public arena of the concert hall (or the house of the stranger who buys the CD).[iii]

Writing this essay was critical to my realization that even contemporary music becomes historical, and that even a few years' distance can cast a work in a new light. It is easy to see that a major benefit (or at least an obvious attribute) of a traditional score is that it conveys a composition with sufficient ambiguity to allow some range of interpretation, and that these interpretations might change with fashion over time (consider the undulating hemlines of Early Music

[iii] In my recent essay for the *Cambridge Companion to Electronic Music* ("Live Electronic Music", see below) I expanded this transference into the realm of portraiture: "like a 17th Century Dutch portrait of a contented citizen surrounded by his prized possessions, [the composition] brings into public space an acoustic picture not merely of a different room, but of man in his private world".

"authenticity" of the last few decades). Recordings and unconventional scores throw up a smokescreen of sorts: the apparent permanence of tape or vinyl, or the cultural specificity of non-standard scores, seems to stamp a work indelibly with its date of production. But *I am sitting in a room* had become at least a little Post-Modern by the end of the 1980s; in hindsight the composition owes as much a debt to the lonely Pop sentimentality of Brian Wilson's "In My Room" (1963) as it does to Cage-inspired avant-gardism.

"Low Brass: The Evolution of Trombone-Propelled Electronics" (1991)[5]
"Low Brass" describes in detail several electronic and electro-acoustic instruments of my design, and their influence on composition.

Many artists conduct research of some sort in the pursuit of their art, and in the field of electronic and computer music research into circuit designs, software tools, and new instruments can have significance beyond an individual musical work. Over the years I've published a number of essays on these subjects, starting with this piece, which was solicited by Larry Polansky for the premiere issue of *Leonardo Music Journal* in 1990[iv].

The essay begins with a confession of my fundamental musical quandary: "In the backwash of the Cagean edict that 'any sound can be a music sound', I find that I have no great instinct for originating sounds of my own, and much prefer recycling existing ones." Although today digital samplers and signal processors are easily and inexpensively available (in hardware and software form), this was not the case in the 1980s. The article goes on to describe a few of the instruments I designed and built for the purpose of "shifting the location of meaning in sounds back and forth between pure acoustical presence and messy cultural significance, from the tiny fragments that constitute sonority to the interconnections that belie phrase, form, structure, music".

[iv] A journal of which I became Editor-in-Chief seven years later – see below.

I discuss three specific instruments: "backwards electric guitars", a sampling system for my composition *Devil's Music*, and "trombone-propelled electronics". The backwards guitars (1981 on) are electric guitars with additional coils mounted over the strings, so that sounds can be played *into* the strings, forcing them to resonate at sympathetic frequencies, thereby transforming the guitar into a resonant filter bank that can be played by fretting with more or less normal left-hand guitar technique, retuning the strings, adding distortion, etc. For *Devil's Music* (1985) I configured a network of three inexpensive Electro Harmonix samplers, modified with the addition of a "stuttering circuit" to allow automatic "re-rhythmitizing" of samples recorded live off radio, then layered; this system allowed the performer to "DJ" with live radio broadcasts.[v] Trombone-propelled electronics (1986 on) is a system for live sampling and digital signal processing built around a highly modified digital reverb, controlled from the slide of a trombone (the slide is coupled to one-half of a mouse, and holds a keypad whose buttons could be pressed to map the slide to various parameters of the sound processing software), and playing back through a speaker mounted on the mouthpiece such that the *electronic* sound could be further processed *acoustically* by movement of the slide (changing the resonant frequency of the air column), use of a mute, aiming of the instrument, etc.

I describe the technology in some detail and the process through which it developed. I go on to discuss several of the pieces of music created with each instrument, with an emphasis on the musical entwining of found and modified technology with found and modified sound material.

This essay presents an overview of the interaction of my aesthetic instincts, my technical research and my musical output during the 1980s. These premises and methods still remain central to my work, much of which is still

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[v] *Devil's Music* was revived and reworked in software in 2002; for a detailed description of the legacy of this work please refer to "Remixing the Remix – or How to Be in the Right Place at the Wrong Time -- Twice", submitted with support materials and described below.

characterized by recycling and processing of found sound material. Several of my recent hardware and software instruments grew out of the research described in this essay: my latest variation on the backwards guitar -- a lap-steel built from carpenter's levels -- was used in my 2002 composition, *Mortal Coil*;[6] while *Devil's Music* was revived in a software version in 2002 (see below); and I am currently playing (and continuing to develop new software for) the third version of my trombone-propelled electronics.

American composer George Lewis once described me as "the first musician to take a computer onto a bar stage".[7] Throughout the 1980s I was developing new musical strategies and technologies that were demonstrated internationally in venues ranging from CBGBs to the Concertgebouw. More sophisticated music software was being written at CNMAT and CCRMA in California, and more elegant instruments were being built at IRCAM in Paris, but my work turned out to be prescient of (and to some extent a direct influence on) several subsequent musical developments of some significance. I have never been in the habit of seizing cutting edge technology to develop tools for extant musical models, but rather I tend to wait until specific technology reaches a certain level of practical accessibility, and then develop tools for nascent aesthetic paradigms, often of my own invention.

In the early 1990s British artist Scanner (Robin Rimbaud) achieved notoriety for music built around sampled cell phone conversations – the use of radio as a sound source goes back to John Cage and others, of course, but the musical appropriation of private but transmitted conversations was an innovation that could be traced directly to *Devil's Music*. Live sampling, an oddity when I started doing it at the start of the 1980s, became rather more commonplace by the middle of the next decade – the Dutch music foundation STEIM (see "Ubiquitous Electronics" below) based their "LiSa" live sampling software on many of the techniques I had developed for *Devil's Music* and my trombone-propelled electronics.[8] "Alternate Music Controllers" were a significant area of musical research in the 1990s, with STEIM (under my directorship for several years) at the forefront; the field found formal expression in the annual NIME

(New Interfaces for Musical Expression) conferences, which began in 2001, and the 2006 conference included a paper on a trombone-controller very similar to mine, developed by British composer Neal Farwell after seeing mine in action at a concert in Norwich in 2003.[9] Electromagnetically resonated strings have become a subject of several on-line news groups for experimental instruments, and my work with backwards guitars is frequently cited.

"Ubiquitous Electronics – Technology and Live Performance, 1966 – 1996" (1996)[10]

A paper first presented at the Institut für Neue Musik und Muzikerziehung in Darmstadt, Germany, in 1996 and subsequently published in *Leonardo Music Journal 8* in 1998. It incorporates much of the content of "Exploded View – The Musical Instrument a Twilight", an earlier paper I presented at the "Hyperkult" symposium at University of Lüneburg, Germany, in 1993.[11] Both articles address aspects of live performance after the advent of recording and modern digital music technology.

The thinking embodied in this paper was prompted by my immersion in the technological and artistic environment of one of Europe's most important foundations for music research. In 1992 I relocated to Amsterdam to take up the position of Visiting Artistic Director of STEIM (Stichting voor Elektro Instrumentale Muziek – Studio for Electro Instrumental Music), a public foundation for music technology research and production.[12] STEIM's focus at the time was on developing artist-initiated alternative electronic performance instruments, and designing software and hardware tools to suit the needs of artists who came to do residencies.[vi] I oversaw research and development,

[vi] Two principle products at the time were the "Sensor Lab", a compact computer for translating information from switches and other sensors into MIDI data, and the "Lick Machine", software that allowed the user to trigger and manipulate pre-recorded sequencer data via MIDI software commands. Typical projects of the time included Laetitia Sonami's "Lady's Glove" VR-derived controller for her computer music system, and Jon Rose's "Space Violin", which translated hair pressure and bow position into MIDI data.

supervised the artist-in-residence program, and organized performances and other public events designed to showcase work produced at STEIM and by kindred spirits visiting Amsterdam.

After four years experience developing the trombone-based alternate controller described above, and after working closely with the 50 or so artists who visited STEIM each year to design new instruments and present musical work, I couldn't help but notice that, following the introduction of synthesizers in the 1960s and the subsequent proliferation of MIDI in the 1980s, the pre-electronic paradigm of the musical instrument had gone through a major transformation. Invited by the University of Lüneburg to present a lecture at the "Hyperkult" symposium in the summer of 1993, I began work on a paper that eventually was published in several languages under the title, "Exploded View – the Musical Instrument at Twilight."

My central thesis was that electronic innovation since the 1960s had "exploded" the musical instrument. Acoustic instruments depend on a linear chain of physical stages: buzzing lips excite the resonant frequency of a column of air whose length is changed with valves and is radiated through a bell; or a pick sets a string in motion, stray overtones dampen out quickly leaving a strong fundamental determined by the length between the fret and the bridge, which is in turn anchored to a soundboard that amplifies and radiates the sound. MIDI on the other hand interconnects sound production modules, mimicking the traditional acoustic models but without being dependent upon them: a piano-style keyboard can trigger brass samples as easily as it can a piano sound. Moreover, the "chain of command" can be broken: by inserting a computer between the keyboard and the sound module one can redirect the player's gestures, so that (in the case of STEIM's Lick Machine, for example) each finger can triggers a full melodic statement, rather than a single note. This model of the "exploded" musical instrument allows for control to be shifted with equanimity throughout the sound production chain, allowing the composer to re-assert control *after* the player's actions, or add a virtual duo partner to a solo instrument, or control a single sound module from a committee of players, etc.

In the paper I drew parallels between this modular hierarchy and the post-recording model of music, by highlighting the influential roles of new power brokers such as producers, engineers, A&R men and Disk Jockeys. I ended the essay with some suggestions as to how this modularity could be exploited to create not just new instruments, but also radically new musical structures and modes of music consumption, at a time the majority of MIDI application still followed the "press a key and make a sound" model of conventional acoustic instruments.

In 1996 I was updating "Exploded View" with the intent of presenting it in lecture form at the Instituts für Neue Musik und Muzikerziehung in Darmstadt, Germany, while at the same time reading a collection of essays by Glenn Gould edited by Tim Page. Gould's 1966 essay for *High Fidelity Magazine*, "The Prospects of Recording", addressed several of the same issues I had taken such pride in raising.[13] His focus was on the "death of the concert" and the contemporary styles of music most suited to the recording medium, and Gould, like me, devoted considerable space to the influence of the studio and the music industry. In my reworked essay, "Ubiquitous Electronics – Technology and Live Performance, 1966 – 1996", I acknowledged and summarize Gould's precedent, evaluated the accuracy of his various predictions, and drew attention to what I saw as the flaw in his argument for the end of live music: his admission that recorded music lacked "acoustic splendor".

Gould's evocative term was a catalyst for me. After four years at STEIM (following two decades of involvement in electronic music) I was tiring of electronic sound, and had begun to work more extensively with acoustic ensembles. Sound coming out of a loudspeaker now seemed flat when I contrasted it with the vivid three-dimensional acoustic presence of an orchestra, a chamber ensemble or even a solo instrument. Friend and fellow composer Peter Cusack quietly suggested that, as a recent father, I simply hadn't been getting out to any good clubs, but whatever the reason, I seized on "acoustic splendor" as the ingredient missing in so much electronic music. In

"Ubiquitous Electronics" I contrast speaker-based, un-splendid recorded music with the vivid "acoustic holography" of Alvin Lucier's *Vespers*, and then return to several predictions on the future of performed electronic music that I had originally presented in "Exploded View".

This essay shadows changes in my compositional thinking during the 1990s: after two decades of immersion in electronic sound I was returning to the acoustic essence that lies behind all music, even that which emerges from speakers. When I moved to Berlin in 1996, as a guest of the DAAD, I worked primarily with chamber ensembles on compositions combining conventional instruments and electronics.[14] My quandary was indicative of widespread musical concerns that emerged in the course of the 1990s: aspects of physicality in post-digital music became reference points in the development of musical styles during that decade, with cool, studio-produced computer music (both Pop and non-Pop) facing off against slapdash Circuit Benders and grunge bands.

Creating Music: New Instrument Design (1997)[15] and **"My First Sony"** (2003)[16]
Creating New Music is a 30,000-word report on music technology, emphasizing its potential applications in interactive exhibitions for the general public, prepared for Sony Europe in 1996-1997. "My First Sony" is a retrospective critique of the Sony project written for *Positionen* magazine in 2003.

Creating New Music was commissioned by Sony as groundwork for its "Music Box" venture in the then under-construction European corporate headquarters in Berlin. The final building plan included an odd-shaped unused space that Sony decided to dedicate to "The Music Box", a "location-based music entertainment center" (i.e., a music-oriented theme park). Learning of my musical background and my work at STEIM, Sony's Project Manager, Andrew Woodmansey, invited me to prepare a report on options for "hands on" musical instrument exhibits, educational displays, interactive installations and a possible role for artists in residence. The resulting 30,000-word report surveys

the history and future of music technology, research institutions and museums in the U.S. and Europe, and the principle innovators in the field of experimental music and multi-media, with emphasis on applications for interactive public exhibitions. One of the proposals put forward in the report was a co-operation between ZKM (a media research foundation in Karlsruhe, Germany -- see http://www.zkm.de) and Sony, which led to a set of artist-designed installations included in the complex.

Coming hard on the heels of "Exploded View" and "Ubiquitous Electronics", *Creating New Music* stands as a thorough overview of the state of alternative musical instrument design at the end of the millennium, and it translates some of the more abstract and theoretical proposals of my earlier papers into concrete suggestions for the marketplace of a musical Disneyland. Its availability as a document was limited by its status as proprietary report commissioned by a corporation, but in 2003 the Berlin-based music journal *Positionen* asked Woodmansey and me to reflect on the project, and I contributed "My First Sony". Whereas advances of the intervening seven years had rendered some of the technology I had discussed obsolete (or at least quaint), several of my proposals, while still untested, struck me as still appropriate for exposing a general public to basic aspects of musical interactivity. These proposals – including visitor-built instruments, video-based image-to-sound translators, and voice-controlled sound pieces – are included in the *Positionen* article, along with a summary of my design goals for a hands-on musical instrument exhibition.

"The Fly in the Ointment: Proto-Web Music by the Hub" (1997)[17]
"Of Mice And Men" (2002)[18]
An article written in 1997 for the German journal *Positionen* describing the first documented performance of modem-linked music, and a subsequent essay updating the topic written for the on-line journal of the American Music Center.

One of the most dramatically unsung of the many unsung visionary groups of early computer music was the League of Automatic Music Composers, whose members interconnected their individual computers to create music with programs that shared data across a local network – a radical idea in 1978, long before the advent of the World Wide Web. In the early 1980s the League expanded from a trio to a sextet and re-named itself The Hub. In 1987, while curator of concerts and audio installations for PS1 and The Clocktower in New York City, I invited the Hub to present what I believe was the first concert of modem-linked music. Inspired by the economic necessity of splitting six airfares between two budgets, the concert took place simultaneously in two performance spaces, the Experimental Intermedia Foundation and the Clocktower, with the performers connected by modems. The Hub wrote new software to link their computers remotely, and the audience was free to wander the ten blocks separating the two venues.

Ten years later, as the Internet was emerging as an exciting new resource for computer music, the Berlin-based music journal *Positionen* asked me to contribute an essay on the Hub project for an issue devoted to the Web and networked music. In "The Fly in the Ointment: Proto-Web Music by the Hub" (published in German as "Zwischen 'data' und 'date': Erfahrungen mit Proto-Web Musik von The Hub") I gave a brief history of the Hub, surveyed the state of networked music at the time of the concert, and described the concerts themselves. Like many early experiments with emerging technology, the musical content of those evenings was overshadowed on occasion by the machinery itself. Whether working properly or breaking down, the computers and their networks were the focus of attention, and yet the concert had unexpectedly beautiful moments.

Today, twenty years after the event, I see this concert as a radical event that presaged peer-to-peer file exchange and other cultural uses of the Web (even though the Web's promise as a performance arena has yet to be fulfilled). It would be silly to credit the Hub – much less my production of the event – with precipitating Napster, but in hindsight it is clear that we were working hard at adapting pre-Internet computer networks for musical use.[vii]

In 2002 I returned to the question of the musical application of the Web in a brief comment I wrote for *NewMusicBox*, the on-line journal of the American Music Center, and specifically addressed this divergence between the uses of the Web anticipated in its early days, versus its actual musical (and economic) significance in the new millennium.

Pfeifen im Walde (1994)[19]
An encyclopedia of whistling, produced in conjunction with a festival I first organized in Berlin in 1994, and then – in greatly expanded form – in Luzern in 1997.

Pfeifen Im Walde - Ein Unvollständiges Handbuch Zur Phänomenologie Des Pfeifens ("an incomplete handbook of the phenomenology of whistling") was created to accompany the most ambitious of my curatorial projects in Europe, *Pfeifen im Walde*, a festival on the "phenomenology of whistling". Taking the 11th edition of the Encyclopedia Britannica as inspiration, the book consists of hundreds of alphabetized entries by two-dozen authors on whistling-related subjects, from

[vii] It is interesting to note that the first application software written for the first home computers by members of the Homebrew Computer Club in Palo Alto, CA in 1975 was a music program. The Hub can trace its roots back to that club -- its members and friends were pioneering musical applications of computers long before iTunes. Whereas retailing in general has become the most profitable development of the World Wide Web, its musical applications have proven the most controversial and the most threatening to the existing models for product sales and distribution, and those applications clearly have their origin in the hedonistic radicalism of California culture of the mid-1970s.

"Abpfiff" (the final whistle in a sports match) to "Zwei glorreiche Halunken" (the German title of Serge Leone's film "The Good, the Bad and the Ugly", which features Ennio Morricone's famous whistling soundtrack), as well as program notes and artists' bios. These entries ranged from the ridiculous to the academically sophisticated, covering subjects as diverse as the acoustics of birdsong, whistled languages around the world, and bosun (boatswain) whistle patterns. Whistling links a long documented musical history, from the Renaissance to the present, with a sound that seems eerily "electronic": the puff of white noise damping down to a pure sine tone. But it also has a utilitarian aspect, summoning cabs and steering border collies, and is truly an instrument of the people, second only to the human voice in its ubiquity.

The book documents the first iteration of the *Pfeifen* festival, which took place in and around the Podewil arts center in Berlin over ten days in 1994, and featured concerts of music that ranged from Baroque imitations of birdsong, through works of Messiaen, to those of Cage; a series of films with whistled soundtracks; lectures and installations; a sheepdog trial on the streets of Berlin; and an amateur whistling competition. In 1997, in collaboration with two colleagues from Berlin and Luzern I produced a larger version of *Pfeifen im Walde* as part of the *Luzern Festwochen*. (Twenty-four events featuring 190 performers from 19 countries were presented over a two-week period.) The program included the first European appearance of the Amazonian Wayana Indians; performances by indigenous musicians from Albania, the Basque Pyrenees, and central Africa; audio installations, a film series, an amateur whistling competition, and a sheep dog trial; and whistling workshops conducted by an international team of virtuosos. We also sponsored the first "International Symposium on Whistling", which garnered a number of papers that await publication in a forthcoming second volume of the "Handbuch".

Leonardo Music Journal (1998 – present)

Ghosts and Monsters -- Technology and Personality in Contemporary Music. Vol. 8 (1998)

Power and Responsibility -- Politics, Identity and Technology in Music. Vol. 9 (1999)

Southern Cones - Music Out of Africa and South America. Vol. 10 (2000)

Not Necessarily 'English Music' -- Britain's Second 'Golden Age'. Vol. 11 (2001)

Pleasure. Vol. 12 (2002)

Groove, Pit and Wave – Recording, Transmission and Music. Vol. 13 (2003)

Composers Inside Electronics – Music After David Tudor. Vol. 14 (2004)

The Word – Voice, Language and Technology. Vol. 15 (2005)

Noises Off -- Sound Beyond Music. Vol. 16 (2006)

These nine issues of the annual *Leonardo Music Journal* were produced under my editorial leadership; each includes an essay addressing the works included in the issue and articulating the subject that the issue was designed to explore.

In 1997 I accepted the position of Editor-in-Chief of *Leonardo Music Journal*. I had written an article for the first volume of the journal back in 1990 (see *Low Brass*, above) and had followed the journal's development under various editors. Through my curatorial work (such as *Pfeifen im Walde*, above) I'd become quite enamored with the way in which a rubric can be used to harness and focus the collective creativity of an artistic community. I saw the Leonardo position as an opportunity to publish a series of book/CD hybrids on subjects relevant to the state of contemporary art.

For each issue I draft and circulate a call for papers on a particular theme: pleasure in serious music, the influence of David Tudor, "sound art", etc. I choose a CD curator for each issue, who has a free hand within the rough limits of the theme. I evaluate manuscripts as they are received, send them out for peer review, make suggestions for changes, and select and sequence the best work for the issue. Finally, I write an introductory essay that discusses the

relevance of the theme to contemporary music practice, and that evaluates and places in context the papers and audio tracks included.

Some issues have had a geographic focus: *Southern Cones – Music Out of Africa and South America* (Vol. 10, 2000) addresses the role of technologies usually associated with the United States and Europe in the development of new music in the "Third World"; *Not Necessarily 'English Music' – Britain's Second 'Golden Age'* (Vol. 11, 2001) gives insiders' views of a broad spectrum British music from the 1960s to the present day. The majority of issues, however, are organized around more conceptual themes designed to encourage and accommodate contributions from a wide geographic, historic and aesthetic spectrum. My first volume, *Ghosts and Monsters – Technology and Personality in Contemporary Music* (Vol. 8, 1998), takes as its point of departure Cornelius Cardew's infamous 1972 essay on political correctness and the avant-garde, and presents numerous composers' meditations on the role of "ghosts" (the weight of history and traditions) and "monsters" (the "anti-people" character of new technology) in the art making process.[20] *Power and Responsibility – Politics, Identity and Technology in Music* (Vol. 9, 1999) picks up the political thread from the previous volume and addresses the locus of identity in new music, where composerly authority is under challenge from improvisation and open-form scores, and "extra-musical factors" – such as nationalism and sexuality – play an increasingly important role.

Vol. 12 (2002) focused on *Pleasure*, pondering its conspicuous absence in "serious" music, and posing the question, "can there be no bump and mind?" *Groove, Pit and Wave – Recording, Transmission and Music* (Vol. 13, 2003) discusses artists' use of media, both older (vinyl records, radio) and newer (CDs, the Web). *Composers Inside Electronics – Music After David Tudor* (Vol. 14, 2004) builds on the symposium "The Art of David Tudor" held at the Getty Research Institute in Los Angeles in 2001; it gathers papers on Tudor's work and influence, alongside statements by younger artists (such as Reed Ghazala) who create what can be seen as Tudor-esque work. *The Word – Voice, Language and Technology* (Vol. 15, 2005) focuses on that most ubiquitous and personal of

sound sources, the voice, and examines its role in technologically driven music. *Noises Off – Sound Beyond Music* (Vol. 16, 2006) builds on my observation, after several years of teaching in an art school, that art is getting noisier, and that the "non-musical" uses of sound – ring tones, film sound effects, audible warnings -- are becoming more intrusive in contemporary life.

2007 will see the publication of *My Favorite Things – The Joy of the Gizmo* (Vol. 17, 2007), which addresses the significance of physical objects in an age that is supposedly dominated by the "virtual" and intangible software. *Why Live? Performance in the Age of Digital Reproduction* (Vol. 18, 2008) will ask whether downloads and file exchange have rendered the concert hall obsolete or merely highlighted its social significance and sweaty substantiality.

Leonardo Music Journal is ostensibly an "academic" journal: all submissions are peer-reviewed before being accepted for publication, and the vast majority of subscribers are libraries, not individuals. Having come to the journal from a background that encompassed a wide range of musical activities from composition to improvisation to audio installation, in venues ranging from the prestigious (the Concertgebouw) to the ridiculous (CBGBs), I wanted the journal under my leadership to reflect a similar diversity of voices. Accordingly, I have actively solicited a large number of articles by previously unpublished writers. Themes such as *Pleasure* were specifically crafted to reach an author pool more self-consciously allied with Pop than with the avant-garde. I have also tried to bring in a greater number of non-English speaking authors (although lack of a translation budget has been a limiting factor). To the occasional consternation of the editorial board, my managing editor and the publisher, I have tried to broaden the guidelines for style and content, incorporating interviews, journal entries, manifestos, and even scans of notes on cocktail napkins.

The CD for each issue is intended to stand-alone as music product, not merely to act as audio illustration for the texts. A few have been particularly successful or innovative: Guy van Belle produced an early example of a "mixed use" CD

(audio CD plus CDROM with software) for *Power and Responsibility* in 1999; David Toop assembled extraordinarily rare recordings from the 1960s and 1970s for his double CD companion to *Not Necessarily 'English Music'*; and Peter Cusack's CD for *Noises Off* provides a timely overview of the emerging field of "phonography."

I have seen that even in our digital times, people still like to hold and read books and magazines, and printed and recorded matter retain archival value. In 2007, ten years after I started with Leonardo, the idea of collaborative artists' objects still seems relevant. I have occasionally mocked *Leonardo Music Journal* as the "best-known unread journal" -- despite my efforts at market expansion it continues to have a modest circulation, primarily to libraries. But as a collection of unique writing by important but generally under-published artists it has enormous value, both to those studying experimental music and sound art, and to their practitioners. It is frequently cited in papers and books and, as I know from direct contact with students at my own school and elsewhere, it has proven an invaluable research tool for many practicing sound artists.

"At The Tone The Time Will Be..." (1999)[21]
Essay discussing my approach to structuring time in my audio installation work, first presented as a lecture for the *Berliner Gesellschaft für Neue Musik* in 1996, then revised and submitted to their *Jaarbuch* for publication in 2000.

In 1999, the *Berliner Gesellschaft für Neue Musik* invited me to give a lecture on my work as an installation artist. I focused on the structural differences between installations and concert pieces, contrasting concert music, which I observed "invariably depends on the lack of interruption for the coherent conveyance of meaning", with installations, where "a visitor is free to listen for one second or all day". Noting that "installations cannot assume the programmed time framework of concert music", I discussed the various methods of structuring time that I developed in my installations over two

decades. I concluded with a description of *Truth In Clouds,* a large-scale project I had recently premiered.

As mentioned earlier, while a Composer-in-Residence in Berlin I worked extensively with the Kammerensemble Neue Musik Berlin and Zeitkratzer ensembles, focusing on interactive works for acoustic instruments and live electronics. *Truth In Clouds* (1999) is a hybrid between a multimedia installation and performed chamber music – what I dubbed a "chamber installation". Based on the trappings of séance culture, the work recreated a 19th Century parlor in an abandoned wing of a Berlin *Schloss*, with a séance table in the center and period appropriate props (borrowed from the Deutsche Oper) distributed throughout. A hidden camera tracks the movement of an inverted wineglass under the fingers of visitors seated at the table, channels various sounds through speakers hidden in the props, and projects a narrative in "spirit writing" on the table top. A group of musicians plays a sort of experimental *Hausmusik* in a remote corner of the parlor: they perform variations on excerpts of scores from 1350 to 1850, according to instructions generated by the computer in response to the movement of the glass and sent to small displays on the music stands.

In my essay, I detail how *Truth in Clouds* addresses several of the temporal weaknesses of audio installations. The linear narrative unfolding in the writing projected on the table is essentially a ghost story, and it keeps the audience engaged, as does their growing awareness that their actions are effectively "conducting" live musicians. Shortly after writing this essay my position on the faculty of The School of the Art Institute of Chicago brought me in contact with an emerging generation of artists working with sound (see "Sound For Picture", below). Coming from a visual arts background, they did not draw on concert music conventions when conceiving the role of sound in their installation projects, videotapes or even pure audio pieces. My observations in "At The Tone…" served as a useful roadmap for developing a new pedagogy for "sound art".

Noisy.org (2000)[22]
Premiere issue of a web-magazine, for which I was guest editor.

In 2000 Roulette, a performance space in downtown New York, invited me to edit the premiere issue of their new online magazine, *Noisy.org*. Given Roulette's long involvement in improvised music, I chose the theme of "collaboration," and invited four duos to submit cross-interviews in which they discuss their collaborative methods. These duos encompassed a wide range of musical styles: New York pop darlings They Might Be Giants (John Flansburgh and John Linnell); English piano four-handers Peter Hill and Benjamin Frith; quirky Belgian computer artists Guy van Belle and Herbert Sempel; and the noisy British electronic duo Furt (Richard Barrett and Paul Obermayer.) The site featured transcriptions of the interviews, photos, audio samples, and web links from each duo, as well as my introduction and brief history of homemade electronic music in the USA. For forty years, young musicians around the world have grown up under the thrall of musical collaborators such as Lennon and McCartney, Jagger and Richards, but the mechanical details of such collaborations have been poorly documented. The cross-interviews in *Noisy.org* were a convenient forum for getting musicians from four rather different genres to discuss this most personal area of creative practice.

After several years of the print-centered strictures of *Leonardo Music Journal* I appreciated the seamless integration of text, images, sound files and url links that the web site afforded. Given the range of musical styles represented in the issue, and the wide net cast by the artists' urls, the issue had relevance to a community far larger and more diverse than even a venue as adventurous as Roulette would attract. On the other hand, in the aftermath of Roulette's decision to discontinue the project after the first issue, the site disappeared from the web. It was only through extensive research that I was able to recover a backup file from the site's programmer (transferred to CDR for inclusion in this Critical Analysis) – an indication of the archival ephemerality of web publishing, and a strong argument in favor of old-fashioned paper.

"All This And Brains Too -- Thirty Years of Howling Round" (2002)[23]
Essay on the role of feedback in my music, written for Resonance Magazine in 2002.

"All This And Brains Too" surveys the use of feedback as an audio material and structural element in my music. The essay was solicited by *Resonance*, the magazine of the London Musician's Collective, for an issue devoted to feedback. The invitation was timely: I had recently revived one of my oldest feedback pieces, *Pea Soup* (1974-76) (see Musical Background, above), replacing the no longer obtainable hardware with software to facilitate email distribution for more widespread performance. I began the essay by describing how feedback – "the Zen-like infinite amplification of silence" – acted as a solution to the Cagean quandary of being "unable to choose any one sound over another" that I raised in "Low Brass" (see above):

> Feedback conveniently mapped the acoustical characteristics of any space (its resonant frequencies, reverberation time, frequency balance) into a sonic portrait, a site-specific raga -- a fortuitous collusion between the methods of Cage and the concerns of Lucier. Turn up the volume and let physics do the rest. Feedback, moreover, revealed links between electronics and acoustics, between circuitry and instruments, between structure and sound.

I go on to detail my use of the material over a period of almost 30 years, from *Nodalings* (1973), in which table-tops and culverts are "mapped" by feedback between contact mikes or air mikes and small portable sound systems; through computer-manipulated feedback in *Second State* (1981) and *Charlotte Aux Poires* (1997); to electromagnetic feedback resonating guitar strings in *Mortal Coil* (2001). In the conclusion I observe, "the tautological elegance of feedback has a primal charm." The Resonance issue had been prompted by a marked revival of interest in feedback, and indeed response to the issue was so enthusiastic that London Musician's Collective organized *Feedback: Order From Noise*, a tour of seven British cities, featuring eight emerging and established artists, including

Alvin Lucier, Otomo Yoshihide, Sarah Washington and myself. A CD/DVD document of the tour will be released in 2007.

A Call For Silence (2003)[24]
Premiere issue of a CD/book hybrid for which I was guest editor, published by Sonic Arts Network in 2004.

In 2003 I was invited to edit the premiere issue of another startup project, this one a limited edition CD/book hybrid to be produced by Sonic Arts Network, the "UK national organization that explores the art of sound", for distribution to its members.[viii] In the wake of 9/11, I was still haunted by the hole in the Manhattan skyline where two ugly towers used to stand, and chose to organize the project not around any specific sonic subject but rather its audible absence. Starting from the old roué's quip "a drink before and a cigarette after are the three best things in life", I chose to focus on what happens in the ellipse. In response to my "A Call For Silence" I received over a hundred extraordinary submissions, which were whittled down to 33 tracks and some four-dozen texts and images. Groove grit, tape hiss and CD glitch rub shoulder with audience anticipation, count-offs, and reverb tails. The tracks are alternately heart-wrenching (Bush's speech declaring war on Iraq with all the words edited out) and zen-like (a 12-second recording of an apple falling from the tree under which Isaac Newton sat).

From the abundance of submissions, it seemed clear that the rubric was timely. Subsequently there has been significant growth in music and sound art addressing similar issues to those featured in this project, such as the audible residue of sound removal software, recordings of very quiet environments, the use of background noise of recordings (LP ticks and pops, tape hiss) as primary sound material; and artists are still wrestling with the classic Cagean conundrum of whether there is such a thing as silence. Earlier this year, *A Call*

[viii] see www.sonicartsnetwork.org

For Silence was the centerpiece of an exhibition on the subject of silence in audio art at Gigantic ArtSpace in New York.[25]

"Remixing the Remix – or How to Be in the Right Place at the Wrong Time -- Twice" (2003)[26]
A paper on the evolution of my composition *Devil's Music*, presented at the MaerzMusik festival in Berlin in 2003, then published in their proceedings in 2004.

The theme of the 2003 MaerzMusik festival symposium was "remix and copyright," and it constituted a conspicuously appropriate forum for a presentation and discussion of my composition *Devil's Music* (see "Low Brass", above): not only was the 1985 version of the piece based entirely on copyright-infringing live sampling and remixing of radio broadcasts, but the technology needed to perform the piece had recently been reworked as software for wide-scale, non-copy-protected distribution.

In 2002, shortly after adapting *Pea Soup* into software (see "All This And Brains Too", above), I revived my 1985 composition, *Devil's Music*, whose original circuits lay rusting in a New England attic. In "Remixing the Remix" I describe the original circuit-based solo and the process of reconstructing it in software 17 years later, for web-based distribution and group performance -- initially for a Chicago concert, then several concerts in Europe, culminating in an all-night event at *MaerzMusik*. In doing so I describe technical aspects and aesthetic implications of the piece in its various incarnations, and discuss the shift in public attitude toward the piece over almost 20 years.

In 1985 *Devil's Music* had been a pretty radical piece: DJ-ing the airwaves by live sampling of radio, with a stuttering rhythm reminiscent of the nascent Hip Hop movement of the time. It was, in the words of critic Philip Sherburne, "an early template for techno".[27] But, as I discovered when I tried to get the LP into the bins of local dance record stores, *Devil's Music* was *too* early: seven years

later used copies were changing hands for considerable money at DJ swap meets, and emerging British sound artist Scanner was making innovative electronic Pop music by sampling cell phone transmissions with a scanning radio; but in 1985 the vinyl was too weird for clubs, and radio roulette evoked Cage more than Pop. By 2002, on the other hand, the broad genre of "Electronica" could comfortably absorb *Devil's Music*, and the performances I heard at the hand of DJs in Chicago, Glasgow, Palermo and Berlin displayed a beautiful balance of the rhythmic essence of the original piece, and the individual musicians' choices of sound material and timing. As I said in a recent interview, *Devil's Music*, with its surprising adaptability and timelessness, might be the closest thing to a "standard" that I've ever written.[28]

"Sound For Picture: Teaching Music in Art School" (2003)[29]
Keynote address at the Leeds Music Technology Education Conference in 2003.

"Sound For Picture: Teaching Music in Art School" addresses the idiosyncrasies of teaching sound in an art school, contrasted with teaching similar material in music departments. At the time of this conference I had been teaching in the Department of Sound at The School of the Art Institute of Chicago for four years, and in this paper I examine the lack of traditional musical background and skills in typical art students, which is offset by fewer (non-Pop) musical preconceptions and a greater enthusiasm for experimentation. The artist's typical love of physicality and making "things" is complemented by digital fluency in a number of media (video and sound editing, graphic design, etc.). All my students share an enthusiasm for DJ culture and a love of obsolete audio gear, while they nonetheless found large mixers and patchbays daunting. Perhaps most significantly, they seem to have a keener understanding for the interaction of art and audience than the average composer of the same age. I close by offering advice that I think might have relevance "beyond the walls of art school": encouraging a physical approach to working with sound, bringing in lots of visiting artists, maintaining "obsolete" technology, and asking

introductory students to work in pairs – these are suggestions that are applicable in any educational program.

Four years later, my paper still holds up, and forms the underpinning of my teaching methodology both in art school, and in my workshops and residences at music schools and liberal arts colleges as well. Many of the observations I cited in this lecture were later incorporated into *Handmade Electronic Music* (see below), as I designed a new music curriculum around the limitations and expectations of non-musicians and non-engineers.

Handmade Electronic Music – The Art of Hardware Hacking (2006)[30]
A book combining a practical guide to making electronic musical instruments with an historical overview and aesthetic analysis of significant contributors to the field.

Assuming no technical background whatsoever, *Handmade Electronic Music* carries the reader through a series of sound-producing electronic construction projects, from making simple contact microphones, to transforming cheap electronic toys into playable instruments, to designing circuits from scratch. Along the way the technologies are put into historical and aesthetic context through a dozen essays about artists who have used similar devices to make significant musical breakthroughs, and through an audio CD containing examples of their music.

When I began teaching hands-on electronics to my students at SAIC, I discovered that they, like so many young visual artists and musicians, had adopted the computer as an almost universal tool: they were adept at using their laptops to edit a video, compose a dance track, retouch a photo, layout a poster, write a term paper, and design a website. But what the computer offered in the way of power and universality was obtained at the expense of *touch* (see "Sound For Picture", above). They were artists, after all, and even the filmmakers and web designers had started out scribbling on paper. Many of

them complained about the lack of immediacy and tactility in digital media, and I designed the course to show my students some tactile electronic alternatives to the computer – ways to bridge the gap between the sound world of a generation raised in an electronic culture and the gestural tradition of the hand.

At the same time, with each circuit diagram I tried to elucidate its historical and aesthetic context – in every design I saw a network of connections stretching back through my entire personal history in electronic music, linking all the papers I've listed in this Critical Analysis. This network was foremost in my mind when Routledge asked me to prepare a book. In it I set out to regain the radical rethink of *Vespers*: to disassociate music and sound from the limited types of objects sold in music stores, and through this disassociation to prompt new musical discoveries; and at the same time to explore how this drama of interaction between object and idea has played out in experimental music of the past 50 years. An appendix includes an extensive list of books, periodicals and websites devoted to experimental music and technology of the past half-century, and the audio CD provides twenty tracks of music by artists discussed in the body of the text.

Writing the book was not simply a matter of adapting the designs of my youth to today's broader aesthetic climate – the technology itself has changed as well. Thanks to the recent introduction of rubber paint ("Plasti-Dip"), a basic 1970s-era contact mike (a piezo disk wired to a guitar plug) can be waterproofed for use as a hydrophone. Even the simplest of electronic toys today is a sample-playback computer, whose clock speed can be adjusted by adding a potentiometer or photocell, allowing the most inane of barnyard sounds to be slowed down into a spookier, more musically interesting range. Out of cheap handheld computer games come LCD screens that can be transformed into crude video projectors. And the pressure to increase battery life in cell phones and other portable devices has made low power components so ubiquitous that all our experiments can be done with batteries – cheaper, quieter and much safer than the power supplies needed 30 years ago. Some of these changes are

merely practical; others imbue an instrument with a character distinctly different from its 1970s ancestor.

The book begins with *listening*: making contact mikes and piezo drivers, experimenting with coils and tape heads, and using headphones and speakers as microphones. Readers are instructed to lick their fingers and lay them gently on a radio circuit board: small currents flowing through their skin will create feedback paths that tip the circuit into oscillation and transform the radio into a touch-sensitive synthesizer; alongside this project is a discussion of the infamous STEIM "Cracklebox" from the early 1970s, which used this same idea of skin resistance to create an inexpensive electronic instrument whose expressiveness distinguished it from the keyboard synthesizers of the time.

In other projects, toys are opened and re-wired, and another sidebar essay describes the work of "Circuit Benders" who favor this approach to building new instruments with unpredictable musical results. In later chapters digital logic chips are misused to build simple oscillators, distortion circuits, gates and panners, such as those used by the "Composers Inside Electronics" who gathered around David Tudor in the 1970s. As the sophistication of the projects grows, I discuss some of the "silicon luthiers", such as Bob Bielecki, who designed one-of-a-kind instruments for Laurie Anderson and others. As the reader learns to listen to the video signals from cameras and video games, and to hack LCD-based toys to create miniature pixel animations, attention is drawn to "visual hackers" from Nam June Paik to Billy Roisz. Game controllers are adapted for interfacing various circuits to computers in order to build alternative digital instruments. The book wraps up with "glue" circuits: simple mixers, amplifiers and power supplies that can be used to pull everything else together. By the last page the reader will have acquired not only a wide range of electronic skills, but an appreciation of experimental method in both the technical and aesthetic realms as well.

In selecting topics and projects for inclusion in the book, I reached back to my earliest days in electronic music.[ix] I tried to remember what it was like to be completely incompetent, and – with the benefit of hindsight – what kind of advice and information would have helped me out of my jams. I selected designs that were easy to understand and build, impossible to blow up, and could be mixed and matched to create complex networks from simple building blocks (like Lego). Performability is stressed throughout: the projects make extensive use of photoresistors (inexpensive devices that change resistance with light), direct skin contact with the circuit board, pressure pads, and other intuitive, gestural interfaces. The projects set out to expose readers to types of manipulations and experiences that are fundamentally different from digital simulations, and thereby inspire a different relationship to both sound, and to the material world of electronics. Having once opened up the sealed Pandora's box of a hand-held game, people are, I find, oddly empowered: they realize the contingency of things that had seemed fixed or beyond their control or intervention.

Watching people learn these skills, I find there's always this beautiful moment (usually around the time of discovering the ticklish spot that causes the radio to swoop and warble) where euphoric self-confidence sets in. They leave happy, fearless, and an obvious threat to the electronic possessions of roommates, lovers and children. The book was designed to be a roadmap to this euphoria, and to suggest that euphoria can have a higher calling: it can be used to make music and art. It has happened in classes and workshops around the world: a happy Techno producer starts off merely wanting to add something new to his or her sound pallet, only to finish up making "sound art" and tracking down obscure recording by artists mentioned in the book. One of my first students in Chicago hacked a "video paintbox" toy; his new instrument produced a rich

[ix] "Searching for the Perfect Beep" is an essay I wrote in 2005 on the evolution of the project from my earliest days learning circuitry to the finished book. It was published, in slightly different versions, in 2006 in Germany (*Sonambiente Berlin – Klang Kunst*. Berlin: Kehrer Verlag. 2006) and Belgium (*.X-MED-A. – Experimental Media Arts*. Brussels: X-Med-A, 2006, pp. 22-24).

array of digital video images, as well as droning and undulating electronic sounds, and he went on to build a career as a one-of-a-kind club "VJ" using this device.

The book acknowledges the proliferation of electronic sound today, and I've tried to make it useful to the electric guitarist, VJ, location sound recordist, and card-burning experimentalist alike. At the same time I cannot deny that the book carries an avant-garde bias. Most of the projects were adapted from the work of musical colleagues, not Intel Application Notes, and I make the point that their tools are best understood in the context of the music they made with them. Moreover, I am keenly aware of the ephemeral nature of the field of live electronic music – usually un-scored, frequently un-recorded, and in general poorly documented. In my book I hope not only to perpetuate the craft of handmade electronic instruments, but also build up the documentary record of significant music made with them.

Despite the awareness within musicology of the profound effects of instrument design on the development of musical forms and composition, *Handmade Electronic Music* is the first book to have linked the making of musical circuitry with critical listening to extant electronic music, or to the history of the field. Critical response has praised the book's mix of historical content and contemporary application, emphasizing its broad historical and aesthetic contents, and the fact that it prepares the reader to continue inventing new circuits, rather than merely to replicate those included in the text.[31]

Reviewers and readers alike have commented that the lightness of prose style eases the novice into the previously inconceivable act of soldering -- more than one reader has used the term "empowering" to describe the experience of working through the book. Within a year of publication the book has entered its third printing. It is being used as a text in courses in numerous schools in the USA and UK (including San Francisco Art Institute, California Institute of the Arts, Dartmouth College, Carnegie Mellon University, Columbia University

and Anglia Ruskin University) – and in several cases institutions have designed entirely new subject classes around the book.

Musical objects may seem anachronistic in our digital age, but as I discovered from the overwhelming number of submissions we received at *Leonardo Music Journal* in a response to our call for papers on the subject of "my favorite things – the joy of the gizmo" (see above section on LMJ), we are in the midst of a major resurgence of interest in what I call "post-digital physicality". My book can be seen as a bellwether or catalyst – take your pick.

"Live Electronic Music" (2006)[32]
Essay on live electronic performance written for *Cambridge Companion to Electronic Music*.

This essay, for the *Cambridge Companion to Electronic Music,* draws on research done for *Handmade Electronic Music*, and returns to the same general turf as my first piece of serious critical writing, "Imaginary Landscape – Electronics in Live Performance, 1939 and 1989," (see above). But the intervening 18 years had seen the arrival of new works that both broadened the genre of what could be considered "Electronic Music" and deepened my insight into it. In this essay, the history of the genre gets pushed back to the Telharmonium of 1897 and brought forward to incorporate "Circuit Bending", Web-based performance and the rise of the DJ.

Given my essay's role within a broad overview of the larger field of "Electronic Music", I emphasize the essential trait of "live-ness", beginning with the early distinction between the use of electronic recording technology for recording and its adaptation for use on stage; continuing through the 1970s notion of not merely incorporating technology for its sonic characteristics, but embedding aspects of the score or a virtual performer in the circuitry (typified in Tudor's notion of the "composer inside electronics"); and ending with the rise of

Turntablism as an antidote to the absence of physicality in much "Laptronica" and other digital music in Pop and non-Pop genres alike.

CONCLUSION

I made my first boops and beeps over 35 years ago. Sixteen years passed before I felt comfortable writing critically about my chosen field. I didn't publish my first book until 2006. I've always thought of myself as an artist first – a composer, improviser, installation artist – and a writer only secondarily. My research and writing have been done in response to my appreciation of the collective knowledge of my artistic community, and of the importance of documenting, critiquing and disseminating that knowledge.

This Critical Analysis has attempted to gather together the most significant examples of my written output and to draw attention to whatever overarching shape and direction they might possess. As I have said, it is difficult for me to determine whether my research had a causal effect on subsequent musical events, or merely reflected the leading edge of a nascent cultural shift.

In reviewing the texts I frequently was left with the impression that I have been refining a handful of ideas, over and over, for decades, with incremental enlightenment occasionally freshening the treatment. If the latter is true, then my writing can be seen as shadowing my music, which likewise sometimes strikes me as a helix revolving around a few core concepts. I can only hope that process has yielded some insight into the music of our time.

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Imaginary Landscapes, New York: Nonesuch Records, 1990
Producer
Produced CD from material recorded at a two-week festival I curated at The Kitchen (NYC) bringing together three generations of electronic music, from David Tudor to Laetitia Sonami.

De Zoetgevooisde Bliksem. Amsterdam: Stichting STEIM, 1993
Editor
Editor and principle author for festival catalogue and survey of 25 years of live electronic music.

Oren van Rumori. Radio documentary, NCRV Radio, The Netherlands, 1994
Co-producer of a series of radio documentaries on new music.

Collins, Nicolas, Volker Straebel, Matthias Osterwold, Valerian Maly and Elke Moltrecht, eds. *Pfeifen Im Walde - Ein Unvollständiges Handbuch Zur Phänomenologie Des Pfeifens*. Berlin and Cologne: Podewil/Editions Maly, 1994.
Conceived and co-edited "an incomplete handbook on the phenomenology of whistling" as accompaniment to a whistling festival produced initially in Berlin and later in Luzern .

Stroomgeest. Amsterdam: Stichting STEIM, 1996
Curator/editor
Designed a catalog in the form of a collection of historic letters for a ten-artist exhibition of site-specific installations I curated in a semi-derelict country house, based on theme of ghosts, séances and spiritualism.

Leonardo Music Journal
As Editor in Chief since 1997 I have designed the calls, solicited papers, appointed CD curators, performed editorial oversight, supervised peer review, sequenced the articles, and wrote introductions for the following issues:
**Ghosts and Monsters -- Technology and Personality in Contemporary Music*. Vol. 8 (1998).
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Guest Editor
Curated the premiere issue of CD/book hybrid, featuring 35 artists contributing recordings, texts and images on the theme of silence and absence.

**Noisy.org*, Roulette Intermedia, Web publication, Vol. 1, 2000
Guest Editor
Directed premiere issue of on-line music magazine, featuring cross-interviews between four pairs of collaborating artists; wrote introduction and "Chip Chop Shop", an essay on history of home-made circuitry in American music.

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