Reflections on Spent Time

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From the circumstances it would appear that this is supposed to be a valedictory speech, and I think it probably is. About two or three years ago, after spending nearly forty years doing little but computer music, I found myself doing none, and came to the realization that as a senior I had probably changed my major. At any rate, I had reached a point where I felt that I had finished one thing and started another. The plain truth is that I just wanted to do something new and different, something for which I needed new skills and computer music no longer filled that bill. Gary Scavone's invitation to me to give this keynote came about because of a New York Times (8/03/08) article last August that itself was a result of some liner notes I had written for a CD of instrumental music I issued in 2007 (*Etudes and Parodies,* Bridge Records CD 9222) in which I described a backwards journey of a sort. In it I said, "At an age when most young composers are learning … the difference between *sul pont* and *sul tasto*, I was … learning … to scale the output of a two-pole feedback filter in Fortran IV, … and when I looked up I was no longer a young composer." I went on to say that now I'm at an age where I once more can get into the movies cheaply and I find myself in the shoes of a young composer, learning the intricacies of preparing an orchestra score and similar things I would have learned forty years earlier had I not turned down that particular avenue. The Times writer, Dan Wakin said my liner notes read like a manifesto, which was not my intention. But, who can resist a feature article in the Arts and Leisure section of the Sunday N.Y. Times, so I agreed to submit to an interview. In my conversations with Wakin I confessed that I wasn't a big fan of "electronic" music and took some trouble to explain that the beauty of the computer was that it could rise above any particular genre. This got elided in the published interview and I caught quite a bit of flak in the blogosphere where the general response to the article was interesting. My favorite was something like "Next time I make an aesthetic decision, remind me to hold a press conference". Other reactions were a little subtler. Typical was, 'well, I do both instrumental and electronic music, it's no big deal and I don't see what the fuss is about". Well, we each have our own way of working and in my case I find that I am not good at multitasking. It's in my nature to take control and (metaphorically) design the cars I drive, which led me to write Cmix, RT, and a few other software tools that I used heavily for many years. This added a lot of time to the compositional process. But the fact remains that for about 40 years I spent ninety percent of my composing energy working with computers, produced a large body of work, of which I'm proud, and then well into my 60's found myself leaving this exciting arena for other pastures. So I suppose this is a valedictory speech. This is the twenty-third ICMC I've attended and I'm ostensibly here to say goodbye and offer some wisdom. I can't help feeling a small pang over all the time I spent developing extensive skills I may no longer use but I console myself with the realization that I put it all to good use, and that a newer generation has a whole new toolkit that I would have to learn were I

to stay current. I won't say that I'll never do any more computer music, although it seems unlikely. (One of my friends quipped that if I did return I might get another featured Times article).

It's interesting to note that exactly twenty years ago I gave the keynote at the ICMC in Ohio State, where I rigged up an interactive piece that reshaped my speech into music using Roger Dannenberg's MIDI ToolKit, an IVL Pitchrider and a Yamaha TX816 I said that if the audience wasn't interested in what I was saying, they could listen instead to the music of what I'm saying. At this point I forgot what I said (knowing Roger I'm sure that CMT is still available, but I can't find the text of my talk). All I remember is that we had some problems with the Yamaha. It certainly wasn't a valedictory speech and it probably wasn't very interesting and consisted of future-gazing about unlimited possibilities for music thanks to new technologies. But that was another day.

What I would like to talk about today, however, are my perspectives on the developments in digital technology over this forty year span, not from a "gee-whiz isn't it great what we can do now that we couldn't do then" point of view but rather from a perspective positioned on a table of musical concerns. Music of course changes at a much slower rate than technology but it has always responded to it in interesting ways. I want to look at things from this perspective and attempt to evaluate the ways in which I, as a composer, was motivated to invent the music I did. It's very important to me that the music comes first and that it overshadows its machinery. I've never been comfortable with glib demonstrations of the power of a new technology, particularly the kind in which the exhibitor runs through the equivalent of a few arpeggios. If we're going to take new technology seriously it's always worth remembering Bach's response to the development of tempered tuning. So, my talk will be partly autobiographical and I'll try to use music as a reflection of perspective. A lot of this will be personal and anecdotal. I probably have no profound and deep wisdom to offer and all I can tell you is how things appeared to me and what I tried to do.

Let me flash back now to the fall of 1966 when I entered the graduate program at Princeton. These were very heady times in the musical world (pun intended). The paroxysms of postwar music had come to a boil and the world was full of institutions staking claims to hegemonic superiority, with Princeton perhaps leading the pack in America. Stravinsky had become a card-carrying 12-tone composer and my first week at Princeton coincided with a visit by him for the premiere of his *Requiem Canticles* at McCarter Theater. The work was commissioned by Stanley Seeger, a Princeton alumnus, in memory of his mother. We all felt a kind of glee and sense of superiority: the future was ours and the rest of the world would come to its senses eventually and jump aboard. Even Aaron Copland was writing 12-tone music. (A well-known performer of new music was reportedly raising his children listening to nothing but 12-tone music.) It is hard to exaggerate the influence and brilliance of Milton Babbitt at that point. He was just 50, had hit his stride, and gave wonderful seminars on the theoretical and mathematical aspects of the 12-tone system, and was writing scintillating pieces.

Required reading was Nelson Goodman, Rudolf Carnap, Quine and others. The famous *Princeton Seminars in Advanced Musical Studies* had taken place in 1959 and 1960 (that led to the Musical Quarterly issue and book appropriately entitled, *Problems of Modern Music)*, and *Perspectives of New Music* had just been launched in 1964 at Princeton University Press, supported by Paul Fromm. Issue number 1 contained a landmark article by Babbitt, entitled "Twelve-tone Rhythmic Structure and the Electronic Medium". The article basically describes a way of organizing rhythm that is parallel to the 12-tone system's way of organizing pitch, and is really only possible to do accurately on a machine. The opening paragraph of this article beautifully captures both the spirit of the times as well Babbitt's brilliance at articulating it.

> "To proceed from an assertion of what music has been to an assertion of what music, therefore, must be, is to commit a familiar fallacy; to proceed from an assertion of the properties of the electronic medium to an assertion of what music produced by this medium therefore must be, is not only to commit the same fallacy (and thus do fallacies make strange bedfellows), but to misconstrue that compositional revolution of which the electronic medium has been the enabling instrument. For this revolution has effected, summarily and almost completely, a transfer of the limits of musical composition from the limits of the non-electronic medium and the human performer, not to the limits of this most extensive and flexible of media but to those more restrictive, more intricate, far less well understood limits; the perceptual and conceptual capacities of the human auditor." (Perspectives of New Music, 1/1, p.49.)

(In characteristic Babbitt style, this paragraph consists of only two sentences.) Babbitt's point was simple and elegant, our ability to hear and perceive complex structures is not necessarily correlated with our ability to perform them, and the electronic medium is a vehicle to explore this dichotomy. He had a very persuasive set of demonstration tapes created on the RCA synthesizer that he brought into seminar to prove this. Little did I realize it at the time but in a few years this dialectic would be would be one of the first that would break for me as I came to question these concepts of complexity and the relevance of the modes of perception he was concerned with. It is not my intention, however, to demean or belittle the spirit of these times and its avatars. These were exciting days. We felt that we were on the forefront of a real revolution. Perhaps I'm just remembering the excitement of being twenty-two and coming into a new high-powered environment, but as I look back I'm certain that something unusual was going on. Princeton was a 'happening' place. We had a series of British visitors, Harrison Birtwistle, Bernard Rands, Jonathan Harvey and others who came to Princeton to feel the flame. (Jonathan was one of the first people to create a convincing computer piece with the clunky machinery I'll shortly describe. I was impressed.) In retrospect I think that whatever one's feelings are about post-war serialism, the results of this moment are still

felt today in a variety of ways, principally in our willingness to accept the idea that music reserves the right to challenge the boundaries of our appreciation, and perception.

The RCA synthesizer had recently become the centerpiece of the Columbia-Princeton Electronic Music Center, founded in 1959 through a grant from the Rockefeller Foundation, and when the decision was made to house it on 125th street at Columbia rather than at Princeton, this set off a chain of consequential events, principally that Princeton composers eager to work with electronic music turned to the computer. They had, in fact, little choice.

This was the context in which I enrolled in a graduate seminar in computer synthesis taught by a young genius named Godfrey Winham. All that we had at Princeton to staff our branch office of the Columbia-Princeton Center were two Ampex tape machines and a pair of Buchla 100 series synthesizers, thanks to the generosity of Max Mathews and Vladimir Ussachevsky, respectively. The Buchlas, however, were not consonant with Babbitt's vision of the precision of the electronic medium. Though I may be misinformed, it seemed at the time that all one could do with these new Buchla boxes was patch voltage-control generators together to get dizzying electronic swirls. As far as I remember it would have been hard to synthesize the set of the Schoenberg 4th quartet in quarter notes, the anthem of Babbitt's 12-tone seminar. Of course Mort Subotnick proved a year later that the Buchla was capable of making exciting music, and Wendy Carlos, in 1968, on Moog hardware, showed that music with traditional syntax, if not a breeze, was at least possible. Princeton had recently upgraded to an IBM 7094 computer, which everyone was free to use, and Max Mathews had given us a digital-to-analog convertor, which unfortunately was no longer functional by the time I arrived. Godfrey's seminar was exciting. Charles Dodge came down from Columbia for it and we had an varied assortment of characters there, including one who was interested in exploring the aesthetics of car crashes. Since the convertors were no longer working we had to drive to Bell Labs to convert our tapes, again thanks to the hospitality of Max Matthews. (Those who have driven on 2-lane roads through central New Jersey will realize that this was not a relaxing trip. As a junior member of the club it was often my job to take people's digital tapes to Bell Labs for conversion, and eight or nine 800BPI digital tapes was an armful.) We were using an assembler macro language called BEFAP to run a version of Music 4B that Max had helped us install. Tuck Howe, as an undergraduate, had done some of the heavy lifting to get this all going. I was very excited by the possibilities. Now I could really explore Babbitt's vision. After a few months of fumbling I began to work on a piece that used combinatorial tetrachords (4 note chords with no major 3rds that can thus combine with transpositions of themselves to form aggregates – combinatoriality was at the heart of the new revolution.) I then designed a system of formants tuned in major thirds so that there would be a functional relation between the particular transposition of a tetrachord and its timbre. I also had some sort of rhythmic scheme going but I forget the details. I would play my efforts for Milton, with whom I was studying at the time, and with his excellent ears he would pick apart pitches and issues in the upper registers, though I could never get him to risk broader criticisms. I worked on this for over a year until one day while listening to it I forced myself to admit that it just sounded terrible,

and tossed it. While this was a daunting move for a twenty-three year old would-be composer it was also very liberating. My tread felt much lighter all of a sudden. (I would love to be able to play this for you but I scoured my closet and think it's long gone – trust me, it was ugly.) But I kept hope alive by listening to J.K. Randall's *Lyric Variations* for violin and computer, written for Paul Zukofsky, which I still consider one of the best early pieces of computer music, and was also made shlepping tapes to Bell Labs. Here is an effective moment when the violin re-enters after a computer passage of about five minutes.

Example 1

http://paullansky.org/icmc/randall-lyricvar.mp3

This piece seemed to me to epitomize what was newly possible and had a kind of seriousness and tone that was inspiring. The second five minutes of the piece took nine hours to compute on the IBM 7094, and that was at a sampling rate of 20k (and, it was not a batch-processing machine). (It's interesting to note that Jim Randall has just turned 80 and is obsessed with creating pieces with Sibelius notation software and a MIDI synthesizer. I refer you to his CDs on **Open Space**.)

It is worth noting at this point that the scene I am describing is somewhat different than what was going on elsewhere at the time. We were not engaged in spectral explorations, as they were at Stanford, for example, much to their credit and eventual profit, or in algorithmic composition as at the University of Illinois. In fact, one of Milton Babbitt's well-known aphorisms was "No sound grows old faster than a new sound." Nor were we trying to break cultural or avant-garde boundaries. We were really interest in the domain described by Babbitt's vision. And the computer seemed then to be the ideal tool for this effort.

My first encounter with digital synthesis thus had the effect of beating my head against a brick wall. It was unsatisfying from every point of view. I decided to retreat to more traditional domains, which also proved frustrating and difficult. A forty-five minute string quartet got me pats on the back, but I knew it wasn't very good. I then got involved in collaboration with my former teacher George Perle (who recently passed away at the age of 93) on what was to become his system of "12-tone tonality". This occupied me from 1969 until 1973, and I wrote a number of instrumental pieces using it, only one of which survives, entitled *Modal Fantasy,* for solo piano. In 1973 after the arrival of our own D-A convertors and Barry Vercoe's Music 360 language, written to run on our new multi-million dollar, gold-plated, IBM 360/91 (with a whole megabyte of memory!) I decided to give the computer another whirl and again dived into pitch-manipulation creating an 18-minute piece based on a 3-dimensional pitch-class array using the methods Perle and I had devised. The array was formed by a 0258 tetrachord and its inversion, in other words the 'Tristan Chord" and the 'dominant 7^{th}'. This was also partly inspired by Ben Boretz' massive dissertation *MetaVariations* which was thundering around the halls of Princeton and had an extended section on the syntax of *Tristan*. With typical juvenile hubris I called it my piece *mild und leise.* Here is the first minute:

Example 2

http://paullansky.org/icmc/mild_und_leise.segment.mp3

Now I really felt as if I had accomplished something. It took a year to complete and I sweated bullets over every note. It won an ISCM recording competition in 1975 and was issued on a Columbia/Odyssey LP (*Electronic Music Winners,* Columbia/Odyssey, Y34149). Twenty five years later Jonny Greenwood, of Radiohead would come across it in a used record store and the four chord sequence that ends the passage you just heard would make its way into their song *Idioteque* on their 2000 Album *Kid A*. As a result it has unfortunately become my most famous piece. (Until I corrected it, the Wikipedia entry for *mild und leise,* only referred to my piece rather than to one of the most famous arias in the history of opera.)

One of the first things I noticed about this experience was not so much the joy of having a loyal and faithful performer in the computer, but rather that it improved my musical social life as I was able to play excerpts from the work in progress for friends, students and colleagues. I no longer had to wait for a concert and the composer's dreaded 'perp-walk' as people dive for the exits to avoid having to say something to you. While I was proud and pleased with the piece I did notice two things that I eventually came to consider problems. First the timbral space was too limited. I was using frequency modulation, as it had just been developed at Stanford, (John Chowning's famous AES article had just been published, **Journal of the Audio Engineering Society** 21(7): 526-34) and a special arbitrary frequency response filter-design program written by Ken Steiglitz. I found the world behind the loudspeakers to be increasingly artificial and confined. Second, I noticed that there was decay in the listening experience. What seemed lively and exciting on first hearing became less so on repeated listenings. This, of course, is an endemic problem with tape music and recording in general, and was not accounted for in Babbitt's vision. (Although I did notice that recordings of live music decayed a lot more slowly than electronic music. Was there something about the music that was responsible for this?)

And there were a whole bunch of compositional issues. Far from reinforcing Babbitt's conception my frustrations seemed to contradict it. I became disillusioned with an approach to composition, furthermore, where one constructed the theoretical basis for a piece before composing it. Second, the world encapsulated by the loudspeakers began to feel 2-dimensional. Years later I would come to feel that there are two basic ways to look at the role of loudspeakers: as instruments themselves or as windows into a virtual space. This piece was lively in neither domain. I also felt that there was a problem in my approach in that it placed a much larger premium on pitch than on timbre. What was coming out had lots of sophistication in terms of harmony and counterpoint but the timbral landscape seemed like a placeholder. I began to wonder if, in fact, 'the search for new sounds' wasn't such a bad idea after all. This led to my first piece using Linear Predictive Coding, *Artifice,* in 1976. I had enjoyed Charles Dodge's *Speech Songs* and decided to give it a whirl. Godfrey Winham and Ken Steiglitz had been experimenting with it and had written Fortran subroutines to do the math.

Example 3

http://paullansky.org/icmc/artifice.segment.mp3

The piece attacked both of the issues I felt were problems in *mild und leise.* First it was highly motivic rather than being based on a precompositional scheme, and it was all about an exploration of vocal timbre. I think that ultimately it fails because both domains are too limited and it dwells too heavily on extensive manipulations of a small amount of data. But, for me it was a game changing experience.

LPC seemed like such a good idea at the time. Despite its obvious shortcomings it was exciting to imagine being free of the binding of pitch, rhythm and timbre. So, in 1978 I decided to give it another try with my *Six Fantasies on a Poem by Thomas Campion.* What is interesting here is that my motivation for doing the piece had very little to do with the lure of the machine, although it was certainly the capabilities of the computer and LPC in particular that enabled me to think in these terms. It all began, rather, with a seminar at Princeton on poetry and music led by the poet Lawrence Wieder. He introduced us to the Campion poem, *Rose cheekt Lawra,* as, per Campion's stated intention, an effort to create qualitative verse in English as in Latin, where stress is created by vowels rather than consonants.

Rose-cheekt Lawra, come,
Sing thou smoothly with thy beawties
Silent musick, either other
Sweetely gracing.

Lovely formes do flowe
From concent devinely framed;
Heav'n is musick, and thy beawties
Birth is heavenly.

These dull notes we sing
Discords neede for helps to grace them;
Only beawty purely loving
Knowes no discord;

But still mooves delight,
Like cleare springs renu'd by flowing,
Ever perfect, ever in them-
selves eternall

Observations in the Art of English Poesie, 1602

It struck me right away that to sing this poem would most likely flatten out its roll around the vowel box and that what I was really interested in was exploring the spoken text. LPC seemed to provide an ideal way of finding its inner music by orchestrating a spoken rendition of the poem. The poem, what's more, talks about implicit music and this was a nice conceit as well. Here are two settings of the opening quatrain from movements 1 and 4:

Example 4

http://paullansky.org/icmc/campion-fan1.mp3

Example 5

http://paullansky.org/icmc/campion-fan4.mp3

What I thought then, and still think now, is that part of the success of the piece lies in the way that it rises above the illusion of machine magic and manages to use the computer to make a larger point about the intricacies of human speech. This piece also opened my eyes to the real genius of the computer: its generalized ability to implement mathematics in software. It dawned on me at that moment that there was no music-making wizard lurking behind a curtain, everything resided in software and know-how. Tweaking LPC was a laborious task, and most of it was done by hand. My object was simply to make it as realistic as possible, while taking advantage of the freedom from the binding of tempo, timbre and pitch. (It's with more than a little peevishness that I take in the current uses of Auto-Tune, which I'm told uses LPC, via Cher or Lil Wayne. They seem to revel in just the faults of LPC that I tried so hard to avoid. I also notice the crummy nature of cell-phone transmissions, some of which apparently use LPC.) I developed a reputation for being good at LPC but in fact all I was doing is orchestrating around its weaknesses. One doesn't generally score music on an oboe that was written for a harpsichord, for example. Another interesting insight gleaned in the first ten or so years of the piece's life came from people's response when I told them that the piece was made at a 14k sampling rate. They consistently said something like, "that's surprising, it sounds so good". It was as if there was an explicit connection between audio and musical quality. (On the other hand I can never understand how people could listen to those old scratchy mono 78's.) Finally, it quickly dawned on me that this was specifically not related to Babbitt's vision. It was not so much opposite as it was orthogonally related – it was just different. Rather than using super-human machine capabilities I was interested in teasing out those qualities in my wife Hannah Mackay's voice that made her reading particularly sensitive, and human. The metaphor that I came up with at that point and used for many years was that the computer now seemed to me to be more like a microscope than a synthesizer. And, an idea that threads through almost all my work from this moment on seems to be the creation of a virtual space within the loudspeakers; a concern that my sounds create the illusion of having a physical source, one that involves motion and energy. This is where I think I draw a difference with Musique concrete and a lot of terrific work that people have done involving spectral manipulation. I want to create the illusion that someone is back there banging, blowing, or beating something recognizable.

Despite my earlier promise I'd like now to spend a few moments reflecting on the struggles we had to get anything done in the years prior to the arrival of the NeXT machine. This is not so much meant to demonstrate how great things are now but rather to draw a picture of our relations with the computer during those years. In 1978 the ICMC was just a few years old and personal computers hadn't even been imagined. Nobody dreamed of ever interacting with a machine in real time and most who were interested had to struggle to even get access to a computer. I gave a lot of talks and demos in those days and it didn't feel good. I was from a wealthy institution and had lots of access and freedom. Jealousy was the most frequent subtext I sensed behind admiration. It was a paradoxical situation. I was trying to create interesting music but all most could hear was the fact that it was made on a computer, and a big and expensive one at that. Moreover, until the early 1990's I would estimate, a significant part of ICMC talk consisted of bragging. "We've got a VAX", wow. I remember photos of people proudly standing by their newly acquired hardware: "We've got over 600 megabytes of disc storage." And, those here under forty probably don't remember the agony of getting a D-A convertor to work. One of the longest nights of my life was spent with an engineer and an oscilloscope hooked to a D-A circuit board, timing things and trying to see how many PDP11 *mov* instructions I could squeeze into a single sample period. It was not long after that that I read Tracy Kidder's book, *The Soul of a New Machine,* and my heart went out to the engineer who vanished leaving only a note saying that he had gone to where he would contemplate no length of time shorter than a season. I won't even go into the deflationary cost of disk storage except to remember that we spent about $30,000 in 1986 for a pair of Fujitsu Eagles totaling about 700 megabytes of storage (and requiring air conditioning). (We're now at about 10 cents a gigabyte. You do the math.)

Another thing the younger generation won't remember is the extent to which we were still living in an analog world. My *Campion Fantasies,* done at a 14k sampling rate, were captured on a Scully tape machine that added a noticeable hiss. Then when it was issued on an LP my beloved, noisy 5th movement sounded like garbage. My father, who was a recording engineer, told me that I was getting "inner diameter distortion" as the angle of the stylus to the grooves grew closer to the perpendicular. It was a landmark moment for me when I first saw someone play a CD on a Mac laptop. The convergence of audio and computing had finally arrived. This changed everything.

The point of this digression is to draw a picture of the relations we all had to musical computing prior to the advent of the NeXT machine in 1989, and in retrospect the extent to which NeXT changed the game. It was a daunting task to get access to the machines, let alone make them go beep. But we felt that we were part of a revolution and that it was all worth it. On the other hand the distractions were so numerous, both from the perspective of power and access, as well as jealousy and resentment that I often found the music getting lost in the mix. On top of that labor costs were very high. In 1982 I spent six months writing an i/o driver for the convertors I just mentioned and we ended up using them for about a year. Nevertheless we all saw the computer as opening up new musical vistas that we hadn't imagined before, and it did.

The next significant chapter in the evolution of my relation to the machine came in 1985 when I wrote *Idle Chatter,* now using the University's IBM 3081 mainframe.

Example 7

http://paullansky.org/icmc/idlechatter-seg.mp3

I was still struggling with the classical problem of 'tape music', the fact that it's the same every time, and that the music grows less interesting with repeated listening. *Idle Chatter* uses a kind of stochastic distribution, random selection without replacement, of LPC-synthesized voice fragments in which words are edited so that they are unintelligible and the pitch contours are slightly flattened so that in the aggregate they have recognizable pitches. The first thing I noticed about it was that everyone had a different reaction to it. Some tried to parse the words, some the rhythm, some the texture. The only thing nobody had any trouble with was the harmony, which begins the piece in a pretty simple F major tonality. I had originally intended to use more complex harmonies but found the listening experience much too exhausting. This, in fact, marked the beginning of my increasing interest in tonality. What is ironic is that tonality was initially not anything more than a way to have a placeholder so that complexity could reside in other domains. It's also ironic that it was the computer that gave me the freedom to do this. Had I written a string quartet in F major in 1984 at Princeton I would have been greeted with polite stares, at best. What was noticeable, however, was that my listeners had to do some work while they listened. The combination of this and the random textures seemed to be a step in the right direction with respect to the problem of decay.

I like to think of this as the moment I hit my stride. While I continued to search for other ways to work I now had acquired a vocabulary of creative options that made dealing with the computer more of a musical than a technological experience.

Several other threads that I followed were reimaging familiar sounds, as in *Night Traffic* and *Smalltalk*, physical modeling (of which LPC is an instance), simple speech, without LPC, as in *Now and Then* and *Things She Carried,* and modeling live performance, as in *Heavy Set* and *Folk Images*. Here again paradox arises in that all these approaches are emulating and transforming sounds of the natural world. In retrospect they seem to be an attempt to humanize the music and neutralize any machine-like tendencies, or in other words, hide the computer. I also seemed to be intent on rubbing against the grain, doing things that were not indigenous to the machine. Earlier, in the 1980's I did a set of folk-song settings using LPC on a violin sample. Here is the opening of a folk-like piece I called *Pine Ridge*.

Example 8

http://paullansky.org/icmc/pineridge.mp3

(For this work Ken Steiglitz figured out how to shift the formants in LPC, allowing me to create a 'cello out of a violin, for example.) I was interested, almost vicariously, in the subtle things that good performers do naturally. For the violin sample I wrote a short piece for solo violin and recorded a performance of it by Cyrus Stevens. The experience taught me a lot about the violin, such as the fact that vibrato consists of a lot more than amplitude and frequency modulation, and that there is rich noise in the sound of the bow

being dragged across the string. I also learned that the pulse-like excitation function of LPC, designed to model the vocal tract, was not so great for bowed strings. It would be twenty-five years before I would work up the courage to write for string orchestra, but it was clear even then that there was an aspect to my computer work that consisted of wishful thinking.

In *Night Traffic* I created a Strauss-like harmonic landscape for the sounds of cars passing:

Example 9

http://paullansky.org/icmc/nighttraffic-seg.mp3

I learned a lot from this. First that traffic noise is inherently ugly, second that by using a romantic harmonic landscape I could create an almost operatic scenario from an unlikely source (my colleague Ken Levy called the piece *Tod und Verklärung* on wheels) – my big breakthrough on the piece came while watching *Twin Peaks,* from which I blatantly stole the opening chord sequence – and finally I learned the evils of DC bias.

And in *Smalltalk,* I raked plucked string filters over the quotidian sounds of casual conversation:

Example 10

http://paullansky.org/icmc/smalltalk-seg.mp3

(The analog domain pokes its head in here as well in the form of high frequency pixie dust coming from the Sony Walkman cassette player I used to record the source.) There is an implicit tension in these pieces between Brahms and Cage. On one hand I'm interested in the music of everyday life, while on the other, very traditional musical values form the bed on which the images lie. The machine in these cases is probably more mediator than anything else. This is not to understate its power but rather to think of it more as a puppet master than virtuoso performer.

Physical modeling, on the other hand, exercised my interest in the complexities of real instruments. In this instance, from *Still Time,* I luxuriated in the glories of superhuman flutes, thanks to Perry Cook's slide flute model.

Example 11

http://paullansky.org/icmc/stilltime-seq.mp3

But once again I spent way too much time worrying about all the things that real instruments did that I couldn't manage.

One of the most recent works I did is an interactive piece for five laptops, written for the Princeton Laptop Orkestra (PLOrk) called *A Guy Walks Into a Modal Bar.* The title refers to my port to SuperCollider of a number of Cook/Scavone STK physical models,

the modal bar ones in particular. This excerpt is from a movement called *Mbira Madness,* (The mbira model is not from STK, it's someone's clever SC3 patch, although a number of the other sounds are from STK.)

Example 12

http://paullansky.org/icmc/mbira-seg.mp3

This doesn't sound much like an Mbira of course, but this is probably due more to tuning than timbre. (If I had tried to emulate the tuning I probably would have been susceptible to a charge of cultural imperialism, which I take much more seriously than undue physical modeling.)

Finally, I have two examples of rather blatant physical wishful thinking. The first is from a piece that constructs an algorithmic model of an improvising pianist, with very big hands. This, again, is an attempt to get into the skin of human performers. It's called *Heavy Set.*

Example 13

http://paullansky.org/icmc/heavyset-seg.mp3

The piano is thanks to Kurzweil. The results would be different with different random seeds, of course, but I routinely used my family member's birthdays and couldn't break faith with that. I'm very proud of my flat-third algorithm and wish that I could write real piano music that flowed this smoothly

And last, here is a segment of an ersatz orchestra piece, called *Chords*

Example 14

http://paullansky.org/icmc/chords-seg.mp3

This was made by granulating the SGI sample library. When I wrote it I was certain that this was the closest I'd get to writing a real orchestra piece. As we speak, I'm in the process of finishing one and began it, in fact, by doing a transcription of this piece and attempting to orchestrate it, a task at which I failed, giving me a little more confidence in the efficacy of this computer piece as well as new insight into the complexities of writing orchestra music.

So, what originally began for me in 1966 as an attempt to bypass the frailties of human performance and traditional instruments ended up as a way to glorify just these things. At the end of the day, moreover, I think it is the computer that created my intense interest in the qualities of everyday, unmediated sounds. Thus when I found myself writing music that didn't involve electricity it didn't so much seem to be abandoning the realms of physical modeling and machine performance as much as it felt as if I had my hands on those things that I was grasping for in my computer work. The challenges are of course entirely different. Now instead of worrying about distortion in the high register I worry about page turns. Instead of worrying about debugging software I worry about rehearsal schedules. But a lot feels familiar. I wrote a percussion quartet for Sō Percussion. When

they asked me to do it I objected, saying that I had never written for percussion before and worried that I'd be alone on the island with only a loincloth. They objected, citing *Table's Clear* as a terrific percussion piece. What surprised and pleased me, however, was how familiar writing for human percussionists felt. I had to pay attention to spectral envelopes, registral transients and balances, masking and interference, spatial distribution and so on. The basic difference was that rather than trying to create an impression of physical activity I found myself actually choreographing it. And, now that I'm doing what I swore I would never do, write orchestral music, things feel familiar in the same way.

I view my work as a constant attempt to 'get it right', as most of us do, to find and express the implicit music within me rather than within an instrument or machine. In almost all the pieces I've done I have the feeling of *almost* getting it right, but not quite. And the process over the years has been akin to getting better at almost getting it right. I found at the end of my time working with computer music that this process had ceased in a sense. I was good enough at it to get what I wanted and while I wouldn't claim that my later pieces were any better than my earlier ones I did feel that just the sense of getting better at something was gone, and 'getting it right' was no longer the main issue. Now, however, I find myself clinging by my fingernails to the bottom of a very steep cliff. It's frustrating to begin a climb with the realization that I don't have the seemingly unlimited years ahead of me that I did when I was 35, but nevertheless the process of climbing the wall is exhilarating.

If I do have any valedictory wisdom it's this: the real genius of the computer lies in its ability to intervene and operate on many different levels and in many different ways. I think that one of the problems with conferences like this is that there is an implicit pressure to demonstrate technological muscle. I'd run out of fingers and toes many times over were I able to recall all the conversations I've heard in these and similar halls that faulted an otherwise lovely piece for its simple-minded use of technology. While it is true that the function of these conferences is to exhibit advances in technology, music sometimes suffers in the process. I guess my advice then is in the form of a recommendation to feel free to use whatever computing resources seem musically appropriate, from the complex to the simple, and even, as in my case, to choose not to use them at all.

Surprisingly, time spent on gaming consoles takes up only 0.94 hours of the day for these countries. Mobile devices accounted for more than half the time we spent online in 2020, but most internet users still use a combination of mobiles and computers to access the internet and this accounts for nearly half of all screen time. People reported visual symptoms during office work, specifically computer use.Â Check that there are no distracting reflections on the screen from a window. Adjust the font size on your screen so it's easy to read. Use document holders for reading or reference materials. We can say that time well spent is the time that goes toward creating those happy states in life. By Ian Scott â€“ Own work, CC. Does an individual perhaps experience cognitive dissonance between the desire to stop and wonder, and Western societyâ€™s motto of â€œtime is moneyâ€? This question touches on the central notion of time. There are different points to keep in mind. There is subjective or existential time (the time we experience). For example, if you and I go to the cinema, and you hate the movie, time will seem to slow down for you. Whereas if I like the film, time to me will seem to fly by. There is public time, which is common and shared. For instance, Iâ€™ll talk to you at 10 am tomorrow morning. What about objective time? Winter Vacation Self-Reflection Exercise 2017 1. Time Management. This year I feel that managing time has been one of the harder aspects of the course for...Â This year I feel that managing time has been one of the harder aspects of the course for me. Having to balance self-priorities with assignments takes time to get used to, although I believe that with time the two will assimilate and will become easier to manage as the assignments become more frequent.Â With year-round school teachers will have to spend less time reviewing and more time teaching lessons required by the government. Teachers need to follow guides and requirements for the classes they teach. or spending time with family members. According to a recent report, about one out of every two employees either. engages in work-related activities or reï¬,ects about work during their off time (American Psychological Association, 2013). Given the high prevalence of work reï¬,ection during leisure time, it is important to understand how work-. related thoughts affect employee well-being. Cumulative evidence indicates that lack of psychological detachment.Â reï¬,ection during leisure time with well-being at bedtime and the next morning. To model change in the outcome. (i.e., well-being) and to rule out that the effect of positive work reï¬,ection can be explained by the affective tone.