Interview by Shun-ichi Shiba 1997 published in ICC Journal (Japanese translation only)

1 (artistic career)

First we want to ask about your career. Could you give us your brief career

as an artist (and musician)?

I grew up an artist in a science family. My father was a scientist and we learned the basics in the course of daily life, doing chemical experiments in the kitchen, reassembling the bones of a chicken after dinner as an anatomy lesson and so forth. I began playing with batteries and wires at the age of 4, and with the piano soon after. I didn't understand the difference between science and art and so connected the wires of the piano together with my other wires. I had a short-wave radio and would often stay up late at night listening to the electronic noises it made. I thought they were the music and language of some faraway lands. About age 14 I became intensely interested in the arts, and music in particular. My studies in science did not stop - the educational system was replete with math and science in the wake of sputnik - but my fantasies, my interests drew away from science. I was fortunate to study piano with an amazing teacher, Hazel Hart, then in her eighties. She was very conservative musically, but taught me to trust my own artistic intuition. At university I studied music, film and philosophy. Film with filmmaker Paul Sharits, who was a very wild guy and a Fluxus artist. In music I began to make experiments assembling sounds on tape and had the good luck, starting in 1968, to be allowed to use the facilities of the Center for Contemporary Music at Mills College during off-hours. A few years later I attended CCM a graduate student, still undecided whether to pursue a visual art or music career.

In my second year I began to build electronic circuits. Integrated circuit op-amps were just becoming available on the surplus market, and there were a variety of cookbooks loosely circulating that allowed anyone with some basic concept of electricity to build their own analog synthesizers. I made a few synthesizers myself culminating in "The Bitter Melon Synthesizer" - a collection of oscillators, filters, noise sources, and mixers that was built into a wooden box scavenged from a Chinatown vegetable market. I wanted to emphasize the everyday nature of integrated circuits. I had a realization though, that made me disinterested in the synthesizer, in the very idea of the "general purpose tool" or designing instruments. I began to create electronic circuits which were, in themselves, compositions or works of art. The very first was "The Pygmy Gamelan" of 1973, a small circuit which responded to the electrical fluctuations in its neighborhood by improvising 5 note music. I started doing installations of 6 to 12 of these circuits, just letting them respond to whatever happened. In 1976 I bought my first computer, the Kim-1, a 6502 processor running at 1Mhz with 1K of RAM, and began programming in machine language to control my analog synthesizers at first, and then to make sounds itself. Within a few years the Apple II had appeared and I used one to create "The Music Room" at the Exploratorium, an interactive musical environment in which 5 people could jam on 5 electric-guitar-like controllers to make some very enjoyable music together. In the mid-80's I worked a lot with DSP on specialized processors from Texas Instruments and created realtime processing software for many of my pieces that use speech as the point of departure. Throughout I have continued to work both in performance and installation - oftentimes ideas that come from one part of my work feed into the other in interesting ways.

2 (Robert Ashley)

In your early days, you worked with Robert Ashley. Could you give some

about his influence on you? (You seem to have some parallel with him such

as speech melodies...) Please tell us if there is any other person who made

big influence on you.

At CCM I began study with Ashley, who was coming from a very different place than I had experienced up to that time. I was freshly arrived from the midwest, and in many ways very naive. Ashley's seminars were a real awakening for me. He taught us not only about making pieces, but about surviving as artists. His work at that time was moving away from the very innovative ensemble performance ideas of the Once Group and toward pieces conceived for video. He was also working with his voice in a new way, and his thinking had a very profound influence on me at that time with regard to speech melody.

In 1974 Ashley asked me to work with him on a piece - "In Sara, Mencken, Christ and Beethoven There Were Men and Women", based on a poem by John Barton Wolgamot. The poem has 127 stanzas, each consisting almost entirely of proper names of artists and writers held together with a sort of grammatical cantus firmus. Ashley had recorded each stanza in one breath and spliced them all together to create a single vocal line that went on without pause for 45 minutes. In approaching the problem of how to make an accompaniment for this, we decided to use acoustic features of the voice itself to generate the accompaniment. I used a large bank of tunable high-Q filters to detect certain pronounced resonances in Ashley's voice, the idea being that these would necessarily delineate certain vowel harmonies the poet had created. Using what now seem the primitive means of analog synthesizers( envelope followers, triggers, sequencers and oscillators), I devised the 7 tracks of musical accompaniment to Ashley's voice in that piece (Cramps CRSCD 103 )

About this same time I met visual artist Jim Pomeroy, who had just finished the graduate program in art at UC Berkeley - we had totally different backgrounds but shared an interest in technology and discovered that we were converging on many of the same areas of interest - performance, electronics, interactive installation. We started to collaborate on various events in underground venues which have since been transformed into legitimate "alternative spaces". In 1976 we created our first performance with a computer-based interactive environment , "A Byte at the Opera". We used my Kim-1 computer to control various devices that evolved a "lunar landscape" by extraterrestrial means, and tectonically from within. Pomeroy was an excellent teacher as well as artist and I credit him in large part for making me aware of the many developments in visual arts.

Also starting in 1976, I also had the good luck to work with David Tudor on his large sound installation "Rainforest" and through him I became familiar with the very elegant work of Takehisa Kosugi. "Rainforest" was a large installation that drove sound through large found objects of metal, wood and other materials to process the sound acoustically. Its sculptural dimensions inspired me to get out of the electronic box and work with a broader range of materials. Several visual artists (John Driscoll and Bill Viola) collaborated on this project and this also expanded my sense of the sculptural in sound. Later on, in the late 70's I collaborated with fellow composer and electronics experimenter David Behrman on several projects, including "Sound Fountain" and "She's-a-Wild." And Frank Oppenheimer influenced my thinking about art in public spaces and about interactivity.

3 (speech melodies)

You have been strongly interested in language and speech. Could you give

some thoughts about the underlying philosophy in "Music as a Second

Language" (1991) and other projects?

The feeling of music in language appeared to me quite early. One experiment we did with my father was to hold down the damper pedal of the piano and sing a note into it, to hear the sympathetic vibrations. I spent many days shouting all sorts of words and sentences into the piano to hear the music they made. Also I remember falling asleep, in June 1956, with my parents and sisters quietly talking in the room, and hearing their voices transformed into the whistles of large birds. This is the central image in my piece "Beneath the Numbered Sky."

In most of my speech melody pieces I used found voices, rather than recording voices in the studio. Although this presented big problems technically - my pitch tracking did not work well with a lot of echo or background noise - it was the only way to get authentic speech melodies. Studio recordings of actors, or worse, nonprofessionals made with the idea of speech-music in mind tend to have a very false sound. By rummaging through the bins of cassettes at junk stores I was able to dredge up a wide variety of material spoken by hypnotists, evangelists and salesmen - convincing voices that carry a great deal of melodic and rhythmic content. Too, this brought me in contact with a broad variety of material that I never would have known about had I hired an actor to read, for example, a poem of Eliot.

4 (technical details)

The sleeve note of "Music as a Second Language" CD reads, "I have treated

speech melodies as musical material. By a process of computer analysis and

resynthesis I extract the melodic line of spoken language, involve it in a

variety of compositional transformations, and apply the result to digital

musical instruments." Could you give some technical details of this process? (We heard that you are using MAX.)

The works documented on "Music as a Second Language" (1991) employ a variety of technical effects. For the realtime speech analysis and synthesis and pitch tracking, I wrote the core software in assembly language on the TI TMS320 series of DSP chips, between 1985 and 1989. I based my analysis on the Linear Predictive model because it was then computationally possible in realtime, a necessity for performance. For control and composition I used the MAX language (initially a pirated version of the IRCAM version) starting in 1988. In many of the songs, the original voice is recorded on a cassette and during performance I fed this signal into the DSP, which sends analysis data over MIDI to MAX. I use MAX to process those data and send them back to the DSP for resynthesis, and also to MIDI controlled synths to create the accompaniment. After the intense period of software development in assembly language for fixed-point DSP, I decided not to write any major code for them until they were floating-point and there were efficient high level compilers for them. That time has now arrived, but so far I have only been using SuperCollider on the Power PC for signal processing. I think the future of speech-music with computers lies in additive synthesis. Even though this model bears absolutely no relation to the workings of the human voice, it holds enormous potential for making musically plausible transitions from recorded material to abstract sounds. A work in progress which I presented parts of in "Events" with Merce Cunningham last year uses Lemur for analysis and resynthesis of the voice of Joseph Stalin.

5 (Edison Effect)

Could you give some thoughts about "Edison Effect," one of the most famous

projects you ever did, especially its basic philosophy?

In 1986 I was fooling around with a laser I had just built, and decided to try playing an LP with it. I didn't have a photodetector, though. It was the middle of a snowy night in upstate New York and the nearest RadioShack was 6 hours away. So I wired a spare EPROM to an audio amplifier, (reasoning that silicon exposed to light emits electrons,) trained the beam of the laser onto the disc and moved the EPROM around until I could hear the music in the record. Over the next 3 weeks I wrote down a large number of designs for pieces based on this possibility. I began what I initially called the "Laser Disk" project in January 1987, converting the laser and detector optics from a surplus supermarket bar-code scanner for the job. Using some stepper motors controlled by my PC, I was able to position the beam accurately, play the record forward and backward, access parts randomly and repetitively. Analog recording had just died, so the territory was very fertile. During the years 1988 to 1993 I created the almost 20 pieces that comprise "The Edison Effect."

These pieces treat the transformation of sound by the recording medium. As I have pointed out elsewhere, early phonographers discovered that when they recorded a sound that three sets of sounds emerged from the phongraph when the record was played back. The first was the intended sound itself, usually a voice or musical instrument. Second were the environmental sounds, present but unnoticed at the time of the recording. The phonograph helped make people aware of these sounds and led on the one hand to studio recording practices and on the other to the whole field of environmental sound-art. The third sound the early phonogrpahers heard was the scratching and rumbling of the machine itself, inextricably registered along with the sound it was supposed to faithfully preserve. Unlike the environmental sounds, these sounds would not exist if the recording had not been made. I call this the shadow of the technology, and it is this shadow world that I examine in "The Edison Effect."

Like most of my works in the last decade "The Edison Effect" concerns itself with the re-deployment of human sensory apparatus within the recording media. In earlier times, all sensation was thought to be based on touch. The experimental apparatuses of the 19th century shattered that unity and gave rise to the earliest devices of media technology - the cinematograph, the telephone and the phonograph. The central image in "The Edison Effect" is of the fusion, or conflation of looking and listening. The beam of a laser for me is much like the visual ray that was, in ancient times, believed to emit from the eye permitting the viewer to see by touching with his eyes. It's interesting that this extromission theory was advanced by the Greek philosopher Plato. This totally alters the meaning he must have intended by his famous "allegory of the cave!"

6 (Gray Matter)

Could you give some about your recent project, "Gray Matter" (1995)?

Can it be said a speculation on alternative development of sound technology?

"Gray Matter" too, extends this notion of touch and explores a very strange phenomenon discovered by the inventor Elisha Gray. In these pieces the viewer must interact with a vibrating electrical field to create the sound. It is slightly painful to do this, and also imparts to the body a palpable vibration, very different from listening to a loudspeaker. I stumbled across this phenomenon in 1976 but only recently learned that Gray had discovered it in 1874. We must remember that this was 2 years before the telephone and 20 years before the loudspeaker. Electricity had never made any sounds yet, save thunder, the crackle of sparks and the clicking of the telegraph key. Gray noticed that when he drew his hand, connected to the interrupted current of an induction coil, along the zinc lining of a bathtub, that the tub would resonate at the frequency of the interrupter. This was the first electrically transduced sound, and Gray based his invention the "musical bathtub" on it. The fact that it requires living human tissue in constant motion was perhaps less of a drawback then, since all other sources of music at the time required drawing, scratching, bowing or blowing bits of dead animal, vegetable or mineral substances across each other - that's what's happening in a Brahms symphony, after all. But less than a year later, Gray had improved his invention. With the "washbasin receiver" he had created the first step toward the modern telephone - an electromagnetic coil and a permanent magnet conspired to move the tin diaphragm of a common household washbasin in synchrony with electrical vibrations. The fact that Gray stuck with bathing apparatus for his devices seems amusing today, but as Siegfried Giedion has pointed out in Mechanization Takes Command , all aspects of the human and animal body were being subjected to analysis and subsequent technification during the Victorian era.

7 (Victorian science)

You mentioned "Victorian science" in your essay on "Gray Matter" (c)1995.

What is "Victorian science" and what are the differences between today's

science?

In the 19th century science took the mathematical tools of the18th century and applied them to the whole world, in particular to the world of nature and the human body. There occurred a kind of dissection in which each of the sensations was divided away from the others - where, as I mentioned earlier, touch had been the unifier of human perception, now vision, in particular binocular vision, and hearing in the matter of the sensations of tone, were split apart into separate fields of inquiry. This happened not only with perception, but with all bodily functions - even bathing, as we learn from Siegfired Giedion was scrutinized. It was only natural that Victorian science, in turn, would try to forge a crude sort of synaesthesia and I refer to these primitive efforts at fusion of function at "chimeras" and I use this word in a particular sense, that of a creature that is a blending of two often incompatible beings. The proliferation of inventions that combined improbable technologies offers many insights about the cultural meaning of science and mechanization. It is only because we are too close to similar developments in our own information culture that we fail to see the amusing absurdity of so many of them, and the real cultural aganda they serve.

8 (sound recording and reproduction)

Could you give some general thoughts on sound recording and reproduction,

one of the biggest invention of Victorian science?

It is hard to imagine, little more than a century after the fact, what a radical departure the recording of sound was. That one single device could capture, store, and reproduce the vast repertoire of music, of natural sounds, left the civilized world in shock. The first wave of reports of the phonograph range from akin to witnessing a miracle to declaration of fraud. In particular they focus on the recording of the spoken voice, and for a variety of reasons: the ease with which the voice registered on the first, primitive machines; the importance of the voice for preservation of exact communication; and what was then a timely issue - communion with the dead. before this time it had been thought that in order to reproduce speech some simulation of the human vocal apparatus was needed - a sort of mechanical talking head - and these had indeed been demonstrated with varying degrees of success. They emerged at the end of the 18th century from the seedy world of automata and mechanical musical instruments into the venues of carnivals and freak shows- personally, I feel a kind of esthetic revulsion at such things. But the phonograph showed that the most intimate and individual tremors of the vocal folds could be recorded, multiplied and played over, even the words of the greatest statesmen and philosophers. It was no modest goal that Edison proclaimed ten years later when he set out to make the cinematograph, that it would do "the same for vision that the phonograph did for sound." The last century has revealed a host of technologies that replay sensations for us and each one is based not on making a semblance or physical or visual imitations of things as we know them in everyday life, but in recording the abstracted signals that science understands our perceptions are based on.

9 (invention)

It can be said that you are an inventor. (e.g. installations, instruments

and devices for performance, and we heard that you invented many devices

for Mr Ashley.) Could you give some about this? Do you think what is the

meaning of invention in art and science?

My pieces deal, in part, with the way technologies mediate the relationship of people to their memories and to question the situation of technology in our lives, the mythos of technology The fact that I use technology itself to delineate these themes means that I must develop alternate or sometimes "impossible" technologies. Without overly stressing the apparent impossibility of making a hologram of a record play the music in the record's groove, or making a clay pot recording of a voice, or making a bathtub make music, I must admit the many of the technologies in my pieces did not exist when I set out to make them. I have had to invent them. It is an important requisite of my art that the pieces actually work. I wouldn't be comfortable with a piece that created an illusion by conventional means. For me the real illusions are the ones that still mystify even when the technology is revealed and explained. Nor would I be satisfied if the works stopped there. There are many other cultural and personal themes woven into them.

10 (science and art)

Could you give some general thoughts about the relations or interactions of

science and art?

Before the 19th century science had very little impact on life and culture. Our cultures' myths of creation and origin - how the world came to be and where we came from - were based on ancient legends about heroes and gods. During the course of the last 200 years these myths have been replaced by new ones created by science - the Big Bang, evolution, DNA.

Art is a response to belief and acts as a consolidating force within culture. It gives place, time, image and sound to myths. But the myths of science are not content to be represented by picture, poems and symphonies. The scientific revolution threw away the idea that things were connected by appearances and replaced it with the idea that things are connected by how they work. Thus the artist's role is to animate with the imagination the way things work.

Germane to my own work, however, a discussion of the relation of technology and art is also interesting. I think of technology as having a dual-being. It is simultaneously a dream, or product of our dreams, and the medium in which our dreams are exchanged and elaborated. By the first part, I mean to say that I think of technology as a meeting ground where our dreams - what we imagine or would want to be - meet the daylight realm of the physical world . That is, they encounter and are born into the laws of physics. To extend the metaphor, a seashore on which the dreams that surge within the ocean of our human imagination are tossed up on the shore of hard physical functionality. The second part is easier to say because it has been said before - that technology is also the exchange medium of our dreams - the movies, T.V., etc. Much has been said about the vast power for abuse of this aspect - the "ruling taste" so to speak.

To disentangle these two functions of technology is difficult. One could , of course, stand aside and take an anti-technological approach. I have chosen what is perhaps a more difficult path - to use technology itself to express and investigate this dilemma. I try to do this by standing technology on its head. Exploring alternative technologies, using physical principles that have not found any place in the dominant technology, re-connecting the dream and the mechanism. Thus, phonograph recordings in holograms and clay pots; music made by stroking electrified bathtubs. Stood on their heads, the technologies reveal absurd aspects in the manner of pataphysics or bachelor-machines, but inasmuch as my pieces actually function, they also reveal some part of the original - the dream - that lies beneath the technology.

Part of my examination concerns the site of a given technology - it's place in the domestic scene, workplace or some exotic site. For example, does telecommunication technology belong in the parlor or the bathroom? Alexander Graham Bell thought the former, Elisha Gray the latter. Do electric wires and water pipes belong together? Big questions.

The promise of technology enabling us to be conscious masters of our experience, overlords of the material world is long past. We have more the impression of being swallowed by our own doing. We're now so deep into this dream - it's all enveloping. It generates and mediates our every next step. For example, we rely on satellite data and broadcast forums to make decisions on rain-deforest-ation and ozone depletion caused by our technologies. There is no way out, but we are hopefully capable of an occasional lucid moment within our dream where we can savor and marvel at the whole process even as we are swept away by it, that being the nature of our experience.

11 (current and future plans)

Please tell us about your current and future plans.

I have a whole sheaf of projects that deal with these themes, extending them to other areas of technology. In particular I'm now preparing a project using water as an acoustic gain medium, and several pieces dealing with the prehistory television, the first of which ("Blind Snaxe Grind Apes") was presented earlier this year at the San Jose Museum of Art. In addition, I am at work on a new piece of music for CD based on the voice of Joseph Stalin that will be realized with additive synthesis. The only problem with making my living as an artist is that it's necessary to be very project-driven. Although I am able to work full time on art, it takes a very long time to fully elaborate a whole theme because I must prepare individual pieces on a demand basis. The researching and inventing involved take a lot of time, and most often museums and art dealers aren't willing to take the risk commissioning new works. It's a real trick to convince them.