Crash Symposium 11.02.05 Shoreditch Town Hall London

Thank you very much for the invitation, I have to say that I am rather intimidated by the presence of so many skilled experimentalists, programmers and hackers. Nevertheless, perhaps I can say that I also prefer to work, in my very limited way, in the command line, enjoy the strong connection between text and code and do have a tendency to avoid pre-given graphical user environments whenever I can. I feel extremely put-off by the "no-user- serviceable-parts-within" nature of closed source. And I very much enjoy the fact that as soon as you start to unpick the workings of hard- and software you are inevitably led into a fabulous labyrinth of notions connecting linguistics, information theory and perception, as you try to deal with the problem of wondering what possible interface could be built to analyse the problem of the interface itself. This I do not see as redundant or merely self-referential, but rather that it opens deep questions about how we might fit into the world and co-exist, And this is, of course, a direct reference to the work of Otto Roessler. My actual activities are mostly bound up with the Academy of Arts and the Media in Cologne where I have a seminar on some of the historical and theoretical (or perhaps speculative) reverberations of sound and acoustics from the orality/literacy shift to Edison and the links between recording and computers.

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So I thought to bring along a couple of media archaeological tales from the history, which find expression in art works that have sprung from my time in Cologne.

I hope it is not too cryptic, but I would like to start by reading a description of a piece of equipement, and I hope that the sense in mentioning it will emerge over the coming 20 minutes or so.

A 1945 presentation of Turing's Automatic Computing Engine.

"The design relied upon mercury-filled acoustic delay lines for high speed storage, a technique developed for processing radar signals by comparing a series of echoes to distinguish things that had moved, and later applied to an early generation of computers. A series of electrical pulses, about a microsecond apart, were converted to a train of sound waves circulating in a long tube of mercury equipped with crystal transducers at both ends. About a thousand digits could be stored in the microsecond it took a train of pulses to travel the length of a five foot "tank".

Viewed as part of a finite-state Turing machine, the delay line represented a continuous loop of tape, a thousand squares in length and making a thousand complete passes per second under the read-write head. Turing specified some two hundred tubes, each storing 32 words of 32 bits, for a total of about 200,000 bits "comparable with the memory capacity of a minnow".

(Unfortunately just now I cannot recall the source of this quote).

What is being described here is not the hypothetical Universal Turing Machine but a component of an actual machine being built by Turing. This component is called the Mercury Acoustic Delay Line and may be considered as one of the very earliest forms of Random Access Memory, that is a refreshable and limited storage for the workings of the computer, allowing it to move and compare information.

So to summarise, in its military beginnings, the function of Mercury Acoustic Delay Lines was to cause a delay to an incoming signal in order to create a recent history which consequently allowed for better projection into the future (something that was invaluable for the early development of radar). The signal was split into two paths, one going directly to the display, the other to a crystal transducer which transformed the electrical information into mechanical motion. The movement disturbed one end of a long tank containing mercury, and wave patterns were propagated down its length. At the far end of the tank a second crystal transducer would receive the motion from these waves and transform their energy back into electricity which was then re-joined with the direct signal on the display but arriving some milliseconds later depending on the length of the tank.

The object, with its voluptuous ingredients of crystal and mercury and its powerful ability to hold time, appears at least to me, as a piece of sculptural, audio-visual and transformational art and science that permits us to imagine a happy marriage between not just sound and vision but an even more embracing amalgam of time and space.

[I am prompted to make this observation, in the context of the old audio/vision debate which many think is now resolved. I would suggest that the domination of the eye remains very much the case in most areas of so-called media art and particularly in critical approaches to it. I find it interesting to recall that Woody Vasulka (in the Transmediale Berlin last week) said the two (audio and vision) belonged to seperate worlds and that bringing them together is impossible but fun to try.]

So I sometimes find myself turning to experimentation in the sciences, with examples of both audification and sonification such as the acoustically wired atom scanners of nanotechnology, for the kind of coming together that might be wished for. To perhaps clarify a little bit what I mean by Audi- and Soni- fication which may be better described under the traditional heading of "AudioDisplay" as used in the seminal conference in Santa Fe 1996, I would like to mention a quote that was sent to me by David Jennings who did a great job of helping to organise the Cybersonica event in London a while back. He wrote...

"Dear Anthony, I happen to be on the editorial board of a journal, Interacting with Computers, and last year I refereed a paper that demonstrates how sequences of programming code could be represented aurally as 'musical' sequences. The intention was to aid programmers in finding bugs in the code. The full reference is

Paul Vickers and James L. Alty "When bugs sing" Interacting with Computers, Volume 14, Issue 6, December 2002, (Jim Alty, you may know, has been doing research linking music and user interfaces for a decade or more now.)

Abstract

In The Songs of Insects, Pierce (1949) described the striped ground cricket, Nemobius fasciatus-fasciatus, which chirps at a rate proportional to ambient air temperature. Twenty chirps-per- second tell us it is 31.4C; 16 chirps and it is 27C. This is a natural example of an auditory display, a mechanism for communicating data with sound. By applying auditory display techniques to computer programming we have attempted to give the bugs that live in software programs their own songs. We have developed the CAITLIN musical program auralisation system (Vickers and Alty, 2002b) to allow structured musical mappings to be made of the constructs in Pascal programs. Initial experimental evaluation [Interacting with Computers (2002a,b)] showed that subjects could interpret the musical motifs used to represent the various Pascal language constructs. The results of the experiment indicate that a formal musical framework can act as a medium for communicating information about program behaviour, and that the information communicated could be used to assist with the task of locating bugs in faulty programs." (end of quote)

A living acoustic thermometer then!! I would like to continue by mentioning the work of Florian Dombois who is maybe known to some of you, he is a geophysicist who works with acoustic seismology. That is, he has some rather sophisticated methods for listening to information output by sensors giving high resolution seismographic data registered in 24 bit format which Dombois intercepts before it arrives at the printout. I believe that for some 10 years now he has only been listening to the data and understanding problems of tectonic plate movement and earthquakes by their sound characteristics.

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To help in bringing together some of the things I have been speaking about, I want to address one work from the artist, Yunchul Kim, called "Hello World". With this work (which like the mercury acoustic device has time-delay as its vital component), the artist, recently graduated from the academy in Cologne, has been highly successful in bringing together sound, image, plasticity and computer science.

Basically, for any computer to run a programme there needs to be a temporary time storage in order that the machine can calculate the difference between its preceding state and its present one. This is refreshable, short-term memory and there is a constant stream of code being sent to it. At this fundamental level the code is simple binary machine code which, for the purposes of writing, can be translated into ASCII code (with the familiar, and some not so familiar, symbols of a standard computer keyboard). What the artist, Yunchul Kim, then did was to assign a hearable pure tone, a sine wave of a particular frequency, to each different symbol of the ASCII code. Two important qualities of sound waves now came into play. One is the coherence of waves that means you can superimpose them on top of each other and yet their identities will still be discernably different. This indeed was put forward by Fourier and eventually allowed the development of telegraphy and telephony by permitting many signals to be carried by a single wire. The second vital property is the speed of sound in air, approximately 300 metres per second. So Yunchul constructed a fabulous, glowing tower of brushed copper pipes all joined to each other with U-shaped joints like the sliding brass tube of a trombone. The pipes were clustered together, around 2 to 3 metres tall and taking up an area of roughly one square metre, giving an overall length of about 200 metres. A loudspeaker feeds the musicalised code into one end of the pipe and at the other end a microphone picks up the sound more than half a second later. Now, just like the function of the second crystal transducer in the mercury acoustic delay line, the process needs to be reversed. The music is analysed back into its constituent frequencies, the individual tones are then converted back into ASCII code and the binary information is fed back into the computer thus allowing the programme to run and the letters "HELLO WORLD" to appear on a monitor. Well, of course there is some instability in the system. If you go up to the sculpture you can hear the music travelling through the copper piping, but if there is a loud sound in the exhibition space or if there is vibrational disturbance from passing traffic or low frequency rumble, then this effects the lettering on the screen and "HELLO WORLD" starts to tremble as the quality of the signal degenerates and recovers.

For me this is an outstanding work which is highly satisfactory on the visual level, as sculpture, on the acoustic level as both an instrument and a piece of musical sound and as an opening up of the black box known as the computer.

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Now briefly I would like to address a second work which I shall be playing during the lunchbreak in case anyone happens to be staying in the building. LMS is Joerg Lindenmaier, myself and Peter Simon and together we have realised various projects ranging from works with performance to experiments with the musicalisation of mathematical measurements.

With "Turing 2", the most recent LMS piece, we set out to create a homage to certain crucial figures and to explore the early history of computing and the evolution of algorithmic rules enabling machines to understand instructions and process information, a development that leads up to and indeed beyond the Universal Machine of Alan Turing. To do this, LMS decided to build an "orchestra" which would be designed to function not only as an acoustic map for the movement of information, but also as a percussion ensemble consisting of 64 individually sounding "instruments". The chosen instruments are in fact old, Siemens relays encased in their metal housings and giving off perceptible musical tones when triggered.

We hung the relays from four long strings in rows of 16 each. This gave us the magical number 64 which was also significant for the connection to the number of hexagrams in the Chinese Book of Changes, The I-ching. It is reported that Leibniz was beginning to lose heart over his project to re-think numbers. Just about this time, 1697, he was introduced to the ancient Chinese text by the Jesuit, Bouvet, which reawakened his interest and led to the completion of his universally significant binarisation of the decimal number system in which the rows of digital 1s and 0s first make their appearance. For LMS this makes Leibniz the earliest in a family of names that includes Charles Babbage, Konrad Zuse, Vannevar Bush, Alan Turing, Claude Shannon and John von Neumann.

So imagine an array, a matrix, or even a vineyard if you prefer, of these suspended, electro-mechanical relays spreading out over an area of some 30 square metres. The "orchestra" is spatially grouped into four parts, left, left- mid, mid-right and right. Each group consists of 16 instruments or relays. There are various probability curves that are dynamically triggered and imposed across the entire four-part field of the orchestra. Each new condition or state is named a "mode". Each Mode results in a different spatial behaviour resulting in more or less activity across the stereo image.

Added to this there are a range of tempo bands facilitating changes in the speed of firing. Both mode changes and speed changes occur when particular relays, assigned the extra function of being switches for these changes, are triggered by the weighted-random numbers streaming from the engine. These "hotspot" also change their position and when they are triggered one of two electrical tones sound, one for the speed shifts and one for the spatial changes. Also noticeable are the filtered sounds of ventilation fans which refer to cooling problems and an acoustic world for the machine, but for us it had more to do with the pragmatic problem of signal to noise ratio because the relays were so quiet. In other words a dubious instrumentalisation of unavoidable noise! ;-)

Although there are a number of set pre-conditions, not only in the weighted rules of probable behaviour but also in the limited choice of tempo bands, nevertheless the piece will never repeat, never be the same twice. The programme that gives impulses to the relays is written in C, piped through to PureData for convenience rather than programming the midi in C, and runs on Linux. The MIDI output is then converted to voltage.

Organised into 5 movements, or rather 5 overloads and rebootings, the work commences and the music of the relay orchestra is captured by a number of carefully chosen microphone positions offering extreme variations in the acoustic depth of field.

Well, I think I had better conclude here with what has been a rather overlong talk, thank you very much.

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