Bulletin 0f the Computer Arts Society Autumn 2011

Oramics to Electronica

Revealing stories of electronic music

The Science Museum's exhibition on the history of electronic music

Tim Boon, Head of Research and Public History, the Science Museum, London

Overseeing the production of the Science Museum's temporary exhibition 'Oramics to Electronica' has provided me with an opportunity to see the long history of electronic music in a new light. My eyes and ears were opened very early in the project when we viewed the 1969 BBC Programme *The Same Trade as Mozart.* For someone who first started buying records at the experimental edge of rock music around 1975, to see this is a revelation. Even in 1969, synthesizers were becoming accepted – if slightly exotic – parts of pop's sonic armoury. Very quickly from the late 1970s, with the arrival of cheaper analogue, then truly inexpensive digital, synthesizers from Japan, the dominant forms of electronica in pop culture came to be kinds of electropop and ambient music. This was the kind of electronic music I knew. But that 1969 programme revealed to me how very different the electronic music scene had been less than ten years before I became a listener and amateur practitioner. The programme, through a set of interviews and performances, portrays electronic music as stretching from the sonic experimentalism of Karlheinz Stockhausen and Peter Zinoviev (the two performances we see), via Tristram Cary's home studio to the cheerful tonal tape splicing of John Baker at the BBC Radiophonic Workshop. This is not quite the received account of the subject that I knew, and yet it was teasingly familiar, as is unavoidable for anyone brought up on weekly helpings of *Doctor Who* with its Radiophonic scores. Mainly, the 1969 programme provided me with a gestalt: it allowed me to see the forms of electronic music we ended up with as contingent, and to reflect that we might have ended up somewhere else.

It is striking to see, both in the programme and in Louis Niebur's excellent new history, Special Sound (OUP, 2010), how very constrained the composers at the Radiophonic Workshop in the sixties were by the means at their disposal: test oscillators and acoustic sound sources including swanee whistles and lampshades, all source material for tape manipulation. The arrival of an EMS VCS3 in 1970 was a liberation that changed their practice for ever.

It is striking for someone of my generation to see within the programme that computers were incorporated into music this early. The programme reveals – in the work of Peter Zinovieff especially – that the free sonic imagination which led some musicians at that time to explore new ways of making sound also had a compositional element. Just as electro-acoustic musician Hugh Davies pressed an egg-slicer into service as a musical instrument with particular sonic qualities, so computers were becoming the obvious route to take for those

musicians with compositional and structural tastes. This is perhaps particularly clear in the example of Zinovieff's 1967 *Partita for Unattended Computer*, performed at the Queen Elizabeth Hall.

Another manifestation of the tendency to explore new sonic worlds is found in Daphne Oram's 'Oramics Machine', which has recently been acquired by the Science Museum, and is a core exhibit within 'Oramics to Electronica'. If a computer is by definition a device that can carry out different tasks dependent on the program it runs, then the Oramics Machine was not a computer. Yet it has a kind of stored program in the ten strips of 35mm film that controlled the melodies the machine produced, and the sonic qualities of its sound. Indeed, the pitch control was digital, though decimal rather than binary. Clearly both Oram's and Zinovieff's 1960s experiments in composition and control of musical scores were alternative routes to a comparable imaginative territory of new sounds. Yet where EMS's founder became deeply interested in the compositional possibilities of computer programs that incorporated stochastic elements, in the programme Oram confesses that 'I get a bit lost when computers come along and, taking random number tables, give us music by the yard'. She seems to have favoured a more intuitive approach, where she could intervene gesturally in the performance of a piece of 'Oramic' music.

The subtitle of the 'Oramics to Electronica' exhibition is 'Revealing stories of electronic music', a pun that gestures to the curatorial philosophy behind the project. The exhibition is part of the Museum's 'public history initiative' which aims to enhance the museum's display of its historical artefacts by involving potential visitors of many kinds in the production of exhibitions. So, in part, the project has been an exploration of how various groups think about the history of electronic music. Those groups have included at the most knowledgeable end of the spectrum, people such as those at the heart of Electronic Music Studios in the 1960s and 1970s, and the BBC Radiophonic Workshop. We have also worked with the responses of women writers, and young people on an access course at the National Youth Theatre. In between has been an expert group of twelve current day electronic music practitioners and enthusiasts. Working with Museum staff over five sessions, they developed a three-part overall account of the history of electronic music which, in the exhibition, occupies three showcases. One is concerned with the exploration of sonic and compositional frontiers; another explores the ways in which musicians have built their own equipment or modified existing devices to produce interesting musical results; the third looks at how the means to create electronic music have become progressively cheaper, so that now anyone with access to a laptop can achieve results that would once only have been within reach of the wealthiest rock stars.

It is an assumption of our curatorial philosophy within the public history project that, if you explore people's views and understanding of a subject, you will receive differing – even contradictory – accounts of the same subject. This is particularly true of the subject of electronic music, which is a passion for so many. Why not come along to see the exhibition, and see whether the accounts there match your own understanding? And, if not, why not get in touch with us?

publichistory@sciencemuseum.org.uk

'Oramics to Electronica' opens to the public on 11 October 2011 and runs to December 2012.

Recollections of Daphne and Delia and what came after

Alan Sutcliffe

In the winter of 1958/59 I attended a weekend workshop with Daphne Oram In her Kentish oast house home and studio. She had recently left the BBC Radiophonic Workshop, which she helped to found. About six of us learnt about making electronic music of the time, though I think we all had some experience: generating sounds, recording, and tape splicing. We saw Daphne's Oramics machine, which scanned one transparent sheet and converted what it found into a waveform. On the Sunday afternoon we each did a project – I was given the theme of Icarus. Daphne later sent each of us a disc of our piece. In all things she was kind, thoughtful and well-organised. I am sorry that I did not keep in touch with her.

In 1962 I went on a composition course given by Luciano Berio at the Dartington Summer School. Delia Derbyshire was seconded from the Radiophonic Workshop to help him with the electronics. We became friendly, and my wife left me while the affair lasted, well into the next year, when Delia and I realised we were not so well suited to each other. When I moved south in 1966, Delia and I met again and she told me that there was this remarkable man that I must meet. She took me down to Putney to meet Peter Zinovieff and his family, and his wonderful studio in the shed at the bottom of his garden, on the brink of the Thames.

At the time I was manager and builder of New Series Branch of ICT (later ICL) in Bracknell looking into the software aspects of ICT's next range of computers. I had been programming for five or six years. Peter's house was a few hundred yards from ICT's main office by Putney Bridge, where I went to meetings every few weeks. I got into the habit of going to see Peter after such meetings. Among other things, we talked about Peter's idea of putting all the studio equipment under the control of a small computer, much smaller than anything that ICT made. If I helped him at all, it was by reassuring him that if he could conceive, build and operate his already complex array of electronic music equipment he would not find it any more difficult to install and program a computer. And so it proved to be. I left ICL and joined EMS as a part-time director, with a similar post at System Simulation: happy times.

Just How Free is Free?

Dick Mills, BBC Radiophonic Workshop 1958-1993

"Computers bring complete freedom to any creative activity, especially in contemporary arts."

A very likely statement from any newcomer to the genre. But maybe beneath this emotive statement things aren't all that they seem.

Having enjoyed the privilege of working at the BBC Radiophonic Workshop for many years, I can tell you that things don't always work out as you might wish. Let's put the proposition to the test.

Rather than being in broadcasting (radio or tv, matters not) imagine you are an artist seeking commissions. Along comes a 'customer' whose very appearance sends the £ signs flashing before your eyes. His commission, however, is so broad-based that it poses some problems.

Subject? Anything you like.
Oils, Acrylic or water-colour? No preference.
Size? Please yourself.

The absence of guidelines – this so-called 'complete freedom' (not even a deadline) – can actually be the stuff of nightmares. Deep down, you realise that whatever you produce is more than likely to be criticised even though the client had expressed no original preferences!

In the end, you are forced to set yourself artificial guidelines just so that you can make a start. All creative people will tell you that it's the first brush stroke, the first few words or the first musical notes that set the style.

Of course, not every one of these first contributions may stay the course of the whole composition but it becomes a primitive initial target against which consequent additions may be judged.

In the field of modern music, perhaps the nearest thing to 'free performance' might be Stockhausen's Zyklus for Percussion. Here, the solo percussion player has a set of instruments and a pre-written score but is at liberty to begin the piece not only at whatever point he chooses but also can decide in what direction – forward or backward through the score to continue, as long as he ends up at the same point as he started. Add to this, the spirally-bound score can also be read upside down (and read from right to left if preferred) and you can see that there is quite a lot of freedom to be interpreted!

It was illuminating, to me, to see the effect of this potentially-liberating gift of creative freedom had on many of the people coming to work at the Workshop, especially those coming from radio's 'Serious Music' department.

Dick Mills live at the BBC Radiophonic Workshop Reunion at the Roundhouse, London, on 17 May 2009
Photo by Kevan Davis, copied from Wikipedia

Faced with no need to be bound by traditional staves, bar-lines, regular time-signatures, treble or bass clefs, how would they react? Surprisingly, they found their element more in sound manipulation rather than in music-based compositions. Unless you've been in the presence of a serious musician trying to turn himself into a herd of charging rhinoceros for the Ionesco play of the same name then you can't imagine what a liberating experience it must have been for them.

There are a couple of truisms which are often quoted:

'We're not experts, so we don't know what we can't do'
'We are grateful for the opportunity to fail.'

The first is surely the pioneer's mantra. Not for the faint-hearted is the usual admonishment – 'You can't do that, it's never been done before.' Fortunately, success often comes as a surprise rather than as a premeditated conclusion.

The second, not always used as an excuse for a less-well received result, very often produces well-earned lessons for future research. Unless opportunities to experiment occur then creativity can be truly stifled.

Returning to the subject of 'complete freedom' a second modifying factor might need to be taken into consideration. It is far easier to maintain the illusion of

utter freedom if you are 'composing' to suit your own requirements rather than for somebody else's brief, but even here you will need to construct guidelines if the final result is ever to emerge to your liking.

Faced with a non-existent deadline, it is very easy to keep pursuing that elusive perfection; in the end you are merely polishing the polish! It takes a certain discipline to recognise that things aren't necessarily going to improve with further work. One guideline at the Workshop was often to stop at the point when you thought it was pretty good … and then go back one stage earlier.

Of course, another issue in creative activity, especially where technology is concerned, is the reliability or suitability of the hardware.

This throws up a combination of situations either working for, or against, you at any one time.

You may well be full of enthusiasm, creative ideas and the like, only to find that the machinery won't behave as you want it too. Conversely, you may arrive at an impeccably-behaving studio only to find that you haven't a workable idea in your head!

Such have been the technological advances of recent years, it is difficult to imagine when there weren't any purpose-built synthesisers, samplers, sequencers and computer software programs, all now everyday tools to the modern sound designer or wannabe composer. In complete contrast, the Workshop had to struggle on, for several years, pressing into service any unlikely piece of equipment to make the required sound or to achieve the desired sound treatment.

When the introduction of synthesisers eventually came at the Workshop, we were extremely fortunate in that the designers behind the EMS VCS3 had made every control on it manually variable, rather than calibrated in fixed steps. Certainly more than a cursory 'nod' towards complete freedom, and much appreciated by the Workshop staff.

Interestingly, in a recent group conversation, Steve Marshall, the audio journalist, revealed that a survey of synthesisers returned to manufacturers/dealers showed that none of the factory presets had been altered by their owners; so much for creative freedom.

'Work-arounds' are an intrinsic emergency measure in many walks of life but it is the ability to side-step any problem that sets aside the successful from the ordinary. Apart from helping to achieve the desired result, such lateral thinking often opens up other avenues of possibilities which can come in very helpful in future difficult situations.

In short, creativity cannot be turned on from 9 'til 5 any more than 'complete freedom' will do the job for you but, when everything synchronises together, there is no other feeling like it in the world.

Ada, Lady Lovelace and the origins of computer music

Alan Sutcliffe

The operating mechanism [of the Analytical Engine] can even be thrown into action independently of any object to operate upon (although of course no *result* could then be developed). Again, it might act upon other things besides *number*, were objects found whose mutual fundamental relations could be expressed by those of the abstract science of operations, and which should be also susceptible of adaptations to the action of the operating notation and mechanism of the engine. Supposing, for instance, that the fundamental relations of pitched sounds in the science of harmony and of musical composition were susceptible of such expression and adaptations, the engine might compose elaborate and scientific pieces of music of any degree of complexity or extent.

So wrote Ada, Lady Lovelace in her extensive notes to Menabrea's report on a lecture given by Babbage in Italy. Her notes are about four times the length of the lecture and are the best contemporary account of the Analytical Engine.

She seems to be the only person who saw at that time that the machine was not limited to processing numbers, the purpose for which it was designed.

It is a widespread misconception today that computers only process numbers – millions of people use the word digital without knowing what it means. Information is stored, moved and processed in computers largely as physical elements that have two states. These can represent zero and one, but equally true and false, black and white, off and on, dead and alive, good and bad, you and me.

Sketch of
The Analytical Engine
Invented by Charles Babbage
By L. F. MENABREA
of Turin, Officer of the Military Engineers
from the *Bibliothèque Universelle de Genève*,
October, 1842, No. 82
With notes upon the Memoir by the Translator
ADA AUGUSTA, COUNTESS OF LOVELACE

ZASP is such a scientific piece as Ada envisaged. There are four voices. Each note has a simple envelope and waveform. Details of these and all other aspects of the piece, from its total length and number of movements down to dynamic levels, are determined by the algorithm. No aesthetic is assumed, romantic, abstract expressive or otherwise.

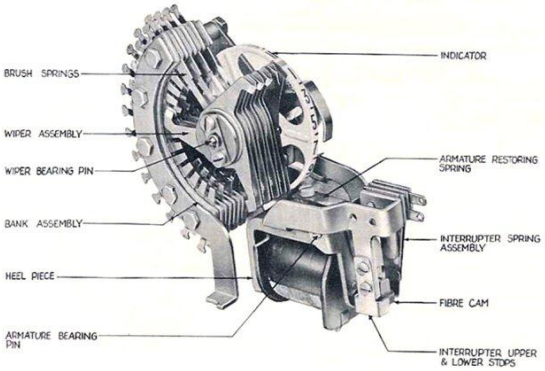
EMS MILESTONES

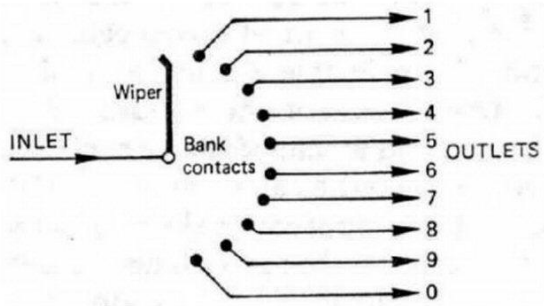
Peter Zinovieff

1 Sequencers
2 PDP-8/S computer
3 Oscillator and filter bank
4 First sampler
5 Cybernetic Serendipity
6 ZASP
7 VCS3 and other synthesisers
8 MUSYS
9 QEH Partita for Unaccompanied Computer
10 VOCOM
The Analytical Engine lead to the Mask of Orpheus
and the development of recent software 2009-2011

1A Uniselector sequencer

The search for a good sequencer started with my great distaste for tape splicing after lessons from Daphne Oram. First by uniselectors switched fixed manually controlled oscillators.



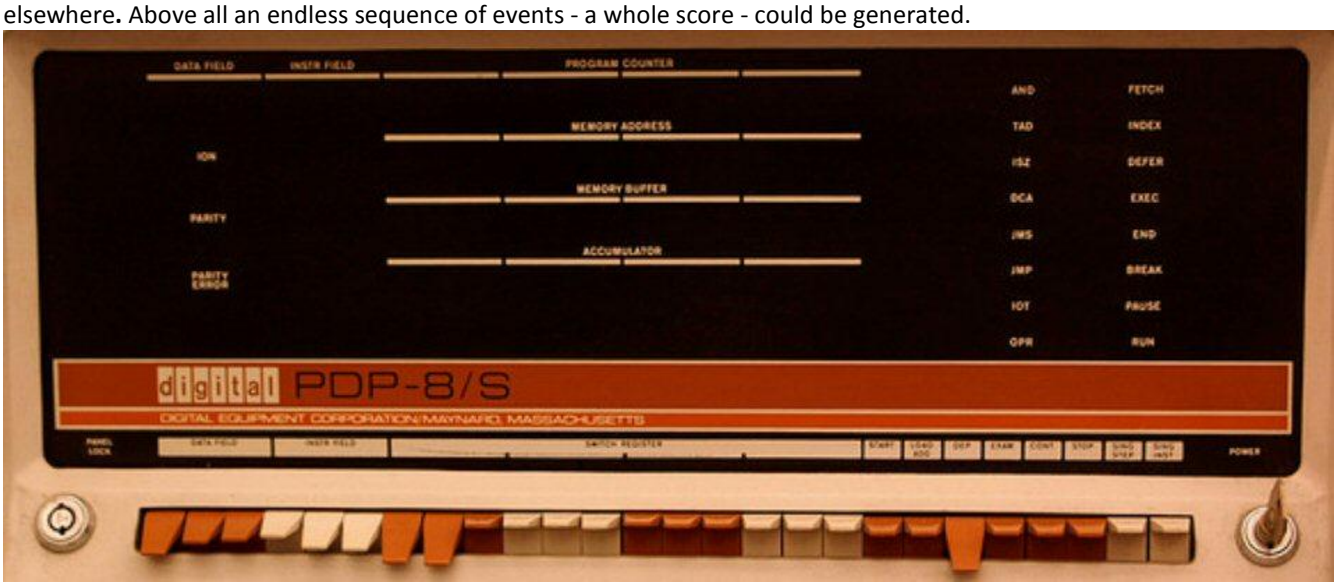


1B First Transistor Sequencer

1C EMS transistor and digital sequencers

2 PDP-8/S computer

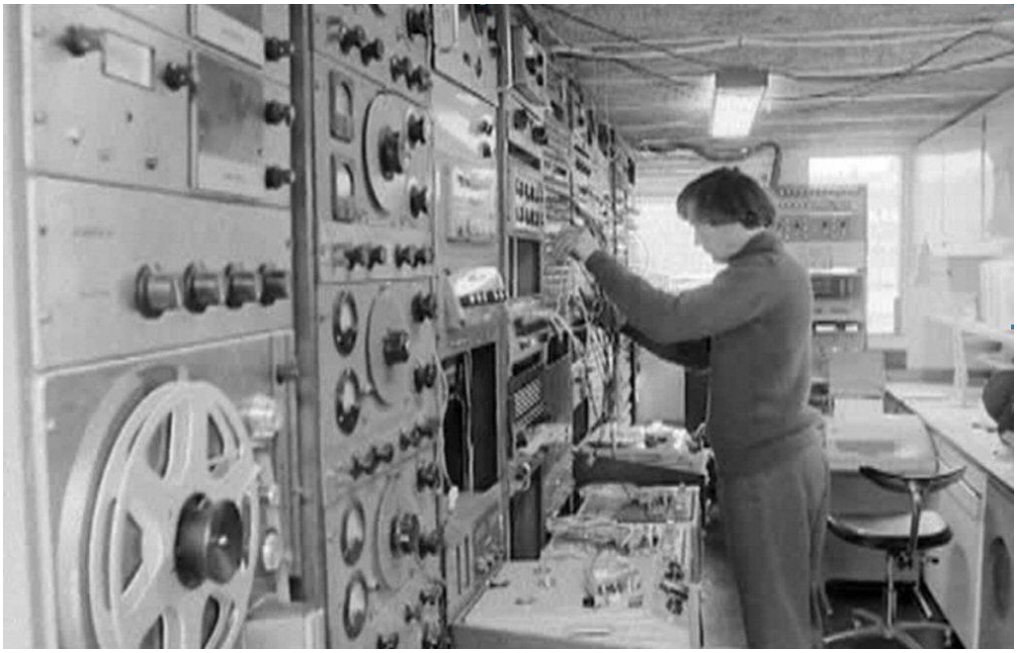
The next stage in my sequencer development was the acquisition of a 4k PDP-8/S Digital Equipment Corporation (DEC) computer. This completely revolutionised the capabilities and potential of the studio. Anything could be designed to be controllable by the computer. The computer could get data from any source: video camera, keyboard, touchpad, lightpen, typewriter, relays, tape recorders, punched tape, digital tape, hard drive and so on. And of course all the other electronic music sound producing equipment designed by David Cockerell. Countless oscillators, filters, amplifiers, envelope generators and so on. Many of these devices and interfaces were completely innovative and had never been used elsewhere**.** Above all an endless sequence of events - a whole score - could be generated.



This 4k PDP-8/S cost £4,000 in 1966, as did the addition of 4k of memory and later a 32k hard drive. [At that time, a new graduate would earn less than £2,000 in a year.]
Later, more compuers were added: a PDP-8/L and a PDP-8/E, and also two DecTape digital data units.
Today I have 16gb memory and 20TB hard drive. Many million times more than in those days.

3 184 oscillators plus a 64 filter/oscillator bank

Three banks of 184 digital oscillators (DOB) could be individually switched on at any amplitude and with a choice of waveforms. This allowed sounds to be made by addtive synthesis. A limitation was that the centre frequencies were of fixed frequency, unlike the 12 voltage controlled oscillators.
The analogue 64 filter bank enabled an analysis of sounds through 64 variable q filetrs.
This data could be replayed by turning the filters into oscillators. This was the method used to generate speech and some pretty good recreations of real sounds.



Various method were able to control the oscillators.

- teletype keyboard
- light pen
- touch pad (the Feely) really the first mouse
- programmable piano like keyboard with touch sensitive resistive foam and 64 programmable keys
- colour video camera interface
- geiger counter and a luminous watch dial to obtain random numers
- remote control unit which could programme any aspect of the studio from a kilometre away and the results could be heard over headphones and loudspeakers

Data could also be entered manually using custom made programs in assembler or other languages. (See the Musys Manual)

3 Oscillator and filter bank

When EMS moved to Oxforsdhire in the 1970's it acquired several manufactured Fast Fourier Transform Units. Potentially these would give better anlytical data than the analgue filter bank. Alan Sutcliffe wrote Fortran DSP programmes for these devices but the main drawback was that they provided only 512 logarithmically arranged samples.

Peter Eastty was commissioned to build EMS' most expensive project - *The Analytical Engine* - which had 256 digital, variable, filter and q filters. At the end of the day it worked for a very few seconds thereupon Eastty left for Ircam in Paris and that was the end of this £40,000 project.

The Studio in 1970

Clockwise from bottom left, with equipment racks listed from top to bottom:

- Telephone
- Analysing keyboard (outputs to computers)
- Synthi AKS; Tannoy loudspeaker (behind)
- KSR-33 Teletype
- Rack 1: filter controls; audio-frequency oscilloscope; DEC tape drives; DEC PDP-8/L “Leo”
- Rack 2: high-frequency oscilloscope; filter controls; potentiometer bank; frequency counter; Wavetek oscillator; 32k hard disk drive
- Rack 3: amplifier controls; DEC PDP-8/S “Sofka”; various audio devices; main patch panel
- Rack 4: digital analogue controllers, including the “button panel” for interaction with MUSYS programs; reverberation units
- Monitor and keyboard for programming computers; Tannoy loudspeaker (behind)
- Synthi 100
- Ampex 4-track tape deck with Dolby noise-reduction units on top
- Ampex 4-track tape deck without Dolby
- The main mixer, built by Robin Wood, who acquired control of the rights to EMS equipment in 1995
- Custom unit for 4-track spatial effects
- (Centre) Valuable Persian carpet

The method of working was that I would think of hardware that was needed. David Cockerel would realise his fantasy and deliver a module or circuit board that could be digitally controlled . Then came an elaborate process of me writing the machine code and assembly language drivers that could be incorporated into the system before any music work could be done.
One of the real problems with the EMS studio was that it was always in flux and tomorrow was always going to better than today. Each new endeavour took weeks to incorporate successfully.

4 First Sampler

The now 8k memory, 32k hard drive and the DecTape units were used to sample and replay sounds. This was the first ever sampler. Sampling became a leitmotif of EMS and is the basis of my current work. It epitomises the difference between pure Electronic Music and Musique Concrete
http://www.historyofinformation.com/index.php?id=2717
http://answers.yahoo.com/question/index?qid=20090104084651AANyjQq

5 Cybernetic Serendipity

This was the first public showing of my studio. The exhibit was extraordinaryly difficult to prepare and maintain. An onlooker whistled a tune. The computer detected the frequency by counting the time interval and number of zero crossing in the waveform. It then replayed the tune with variations using voltage controlled oscillators and other devices all controlled by the PDP-8 computer.
http://en.wikipedia.org/wiki/Cybernetic_Serendipity
This CD cover of sounds from the exhibition was part of one of my scores.

6 ZASP

In 1967 ZASP (anagram PZ and AS) - a computer composition - was made in collaboration with Alan Sutcliffe. This was the first piece composed on one computer (ICT 1900) and realized on another (PDP-8). It explored acoustics generated by algorithmic patterns and textures uniquely inherent to the electronic music equipment. In 1968 ZASP won second prize at the IFIP (International Federation of for Information Processing) Congress.

Data was transferred from one computer to the other in the form of paper-tape carried across Putney footbridge from ICL to EMS. The piece now sounds very primitive but the technology involved and the programming at both ends of the process was very complex.

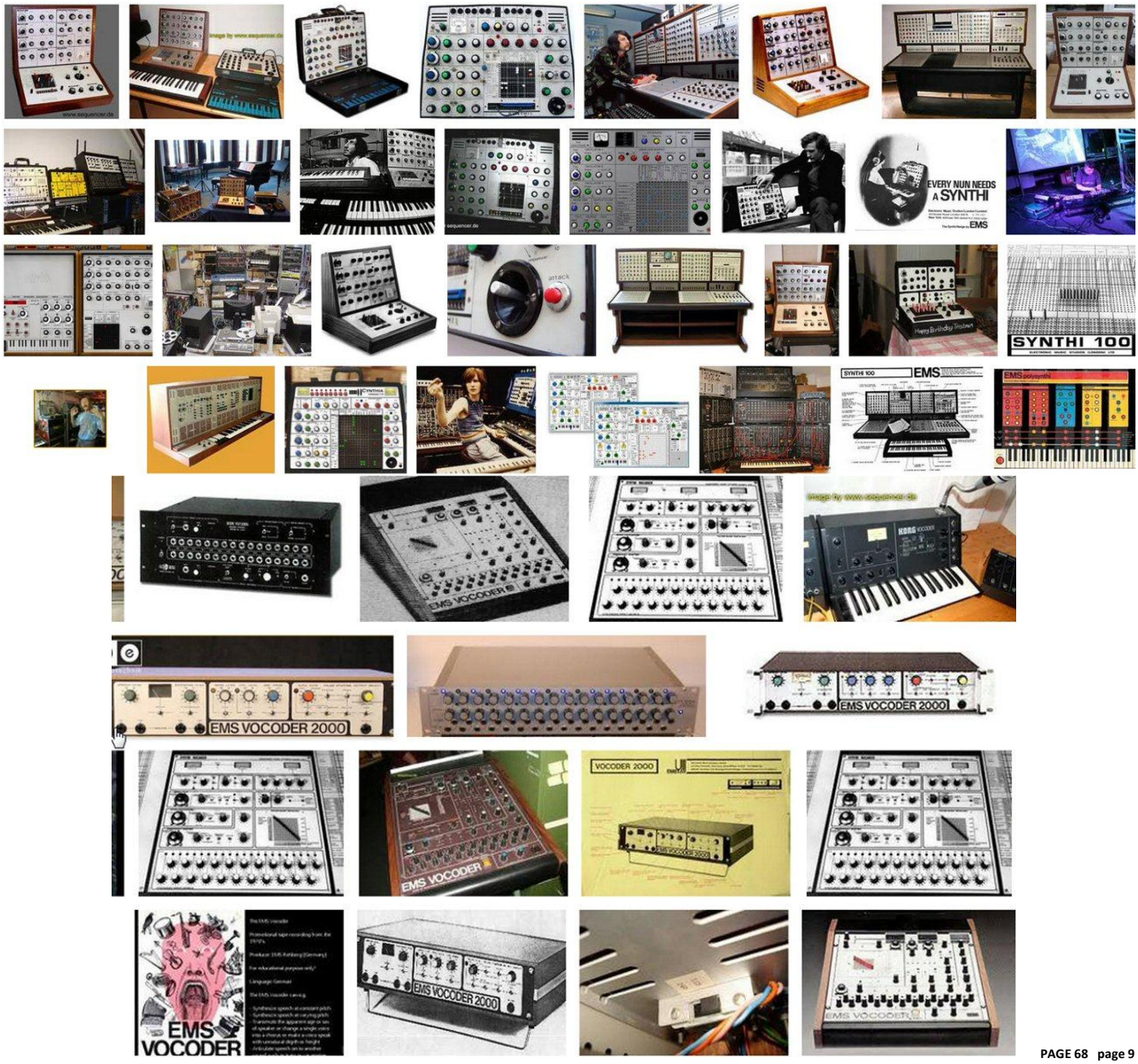
Winning this prize gave Alan Sutcliffe the impetus to found the Computer Arts Society and bring out its first issue of PAGE ZASP also led to the formation of EMS as a company consisting of Peter Zinovieff, Alan Sutcliffe and Tristram Cary.

http://www.ems-synthi.demon.co.uk/emsstory.html#begin
http://www.ems-synthi.demon.co.uk/emsstory.html
http://www.ems-synthi.demon.co.uk/emsstory.html#team
http://www.ems-synthi.demon.co.uk/emsstory.html#putney
http://www.ems-synthi.demon.co.uk/emsstory.html#users
http://www.ems-synthi.demon.co.uk/emsstory.html#oxford
http://www.ems-synthi.demon.co.uk/emsstory.html#nonproducts

7 VCS3 and all the other synthesisers

In order to finance the studio EMS produced a large array of synthesisers and modules ranging from the portable Synthi A to the gigantic Synthi 100 and the computer Synthi as well as many Vocoders.

Development of these continues both by the manufacture of the original VCS3 by Robin Wood and by the design of computer emulators, for instance by Xavier Oudin.



SYNTHI 100

EMS

Electronic Music Studios London Limited,
49 Deodar Road London SW15 2NU
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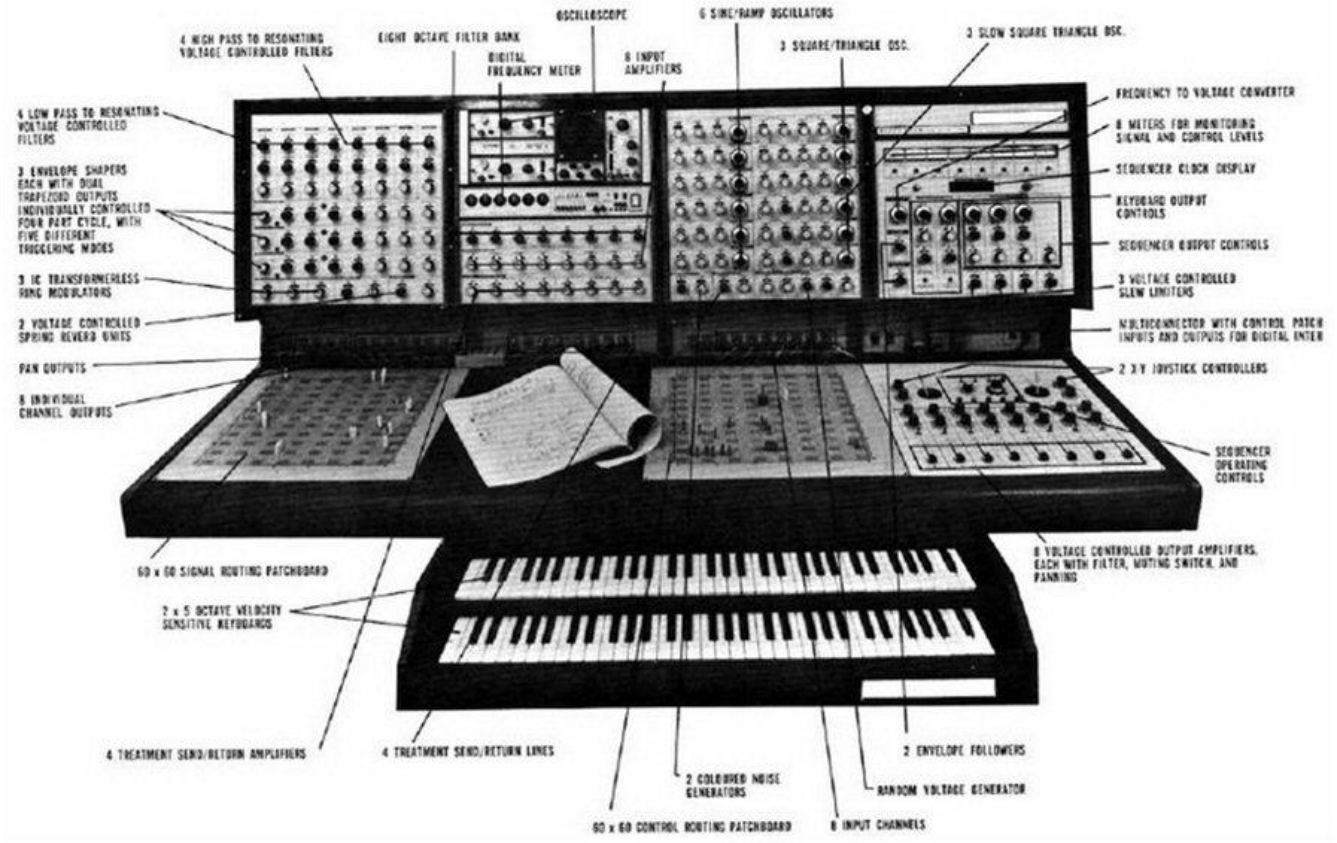


XILS 3 developed by Xavier Oudin is a very complete VCS3 with a sequencer.
http://www.xils-lab.com/products/XILS%203-%3A-iLok-or-eLicenser-protected.html

Above XILS 3 (software module)

8 MUSYS

MUSYS won first prize at the ISCM 1970 (International Society for Contemporary Music) for a computer music program. A very complete manual decsribes in detail all aspects of the studio hardware and software at this time. A similar approach was being developed at Bell Labs by Max Mathews in his system 'GROOVE'.

MUsic **SYS**tem was used to describe the whole studio as well as the specific program developed by Peter Grogono at EMS. This was a rather high level assembly language allowing macros, lists and control of the computer output to the voltage and digitally controlled devices (see an example in the VOCOM section). All the later serious work at EMS used this ever-developing system, for example works by Henze and Birtwistle.

http://120years.net/machines/ems/index.html

At this time a number of important pieces were made in the studio 'TRISTAN' with Hans Werner Henze. Here live recordings of prepared piano were mixed with oscillator bank ensembles controlled by a Sony colour video camera. Premiered on 20 October 1975 under Colin Davis at the Royal Festival Hall in London.
http://www.discogs.com/Hans-Werner-Henze-Tristan/release/2092602

Also 'CHRONOMETER' with Harrison Birtwistle.
http://www.myspace.com/peterzinovieff
http://www.universaledition.com/Chronometer-for-2-asynchronous-4-track-tapes-Sir-Harrison-Birtwistle/composers-and-works/composer/64/work/8049

9 QEH Partita for Unaccompanied Computer

At this concert in the Queen Elizabeth Hall in London a computer played my "Partita for Unaccompanied Computer". Hardly a laptop but the first real-time performance on stage of any Electronic Music not using tape.
During this period EMS put on a yearly concert at the QEH and Royal Festival Hall. These were the first purely electronic music public concerts.
http://www.musicweb-international.com/routh/Contemporary.htm

10 VOCOM Voice Synthesis

An important project at EMS was the development of VOCOM. This was to revolutionise telephone transmission by analysing speech and retransmitting it a very low bit rates and then reconstitute it at its destination using DEC PDP8L's and a derivative of the 64 filter bank at each end .

SCV1 SINGLE CHANNEL VOCOM UNIT

A GENERAL PURPOSE UNIT FOR DIGITAL SPEECH TRANSMISSION AT LOW BIT RATES

GENERAL DESCRIPTION

The SCV1 is the complement of a Modem which allows digital signals to be sent over an analog line.

The SCV1 accepts telephone quality speech and produces a digital output at very low bit rates. This output can be transmitted on low capacity digital lines or stored very compactly in any digital memory. In receiving mode, the unit accepts the same digital input and reproduces the original signal without loss.

The maximum theoretical compression of digital speech is by a factor of about 1000, for the meaning of each word to be conveyed. Where the subjective sound quality must not be impaired, the SCV1 offers a saving of about 10 times. Where intelligibility is the only criterion, savings of up to 100 times can be achieved with the SCV1. Thus digital lines previously incapable of carrying speech can now do so, and higher capacity channels can now carry better quality speech. Factors above 100 can be achieved in special situations, for example where good sentence intelligibility, as distinct from good word intelligibility, is adequate.

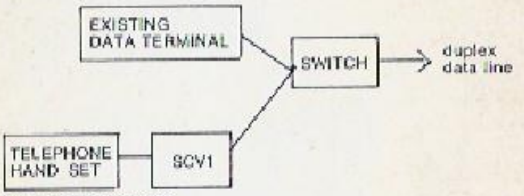
APPLICATIONS

The first main application of the SCV1 is in enhancing the quality of speech already being transmitted over a digital line. The unit is then placed between the voice input and the existing digital line.

The second main application is for transmitting speech over a digital data line that is not otherwise capable of carrying speech, for example a 2,400 bits per second data link. In this case the SCV1 is connected to the line through a switch, which will cut out the existing data terminal while speech is being transmitted.

Because of the way that the SCV1 codes speech digitally, it offers a secure method of transmission, which can only be interpreted using another SCV1 unit. For high security operation an option is available that incorporates special dynamically changing coding which can then only be interpreted on a matching SCV1.

SPEAKING ON A DATA LINE

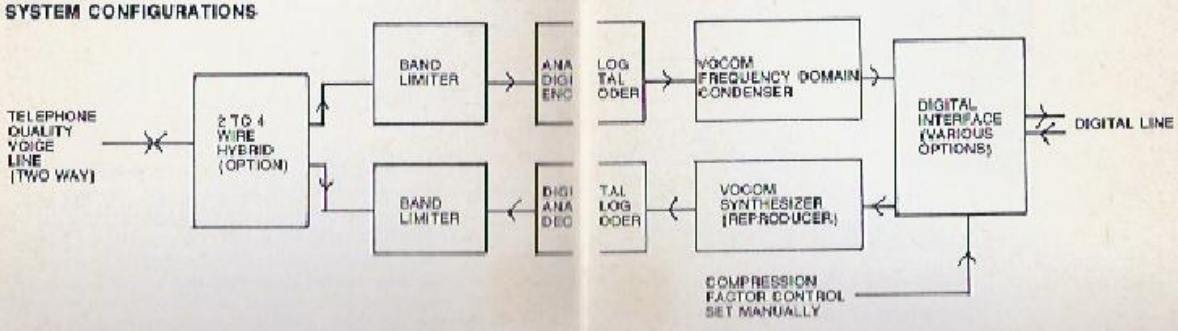


SPECIFICATION

The unit is housed in an enclosure measuring 19" x 10" x 16" for normal static applications. A miniaturised version measuring about 3" x 4" x 5" is being developed for mobile applications, though some state-of-the-art components have not yet shown sufficient reliability.

The compression rate on a particular unit can be altered in a few minutes, so the system can adapt to changing line conditions or speech quality requirements.

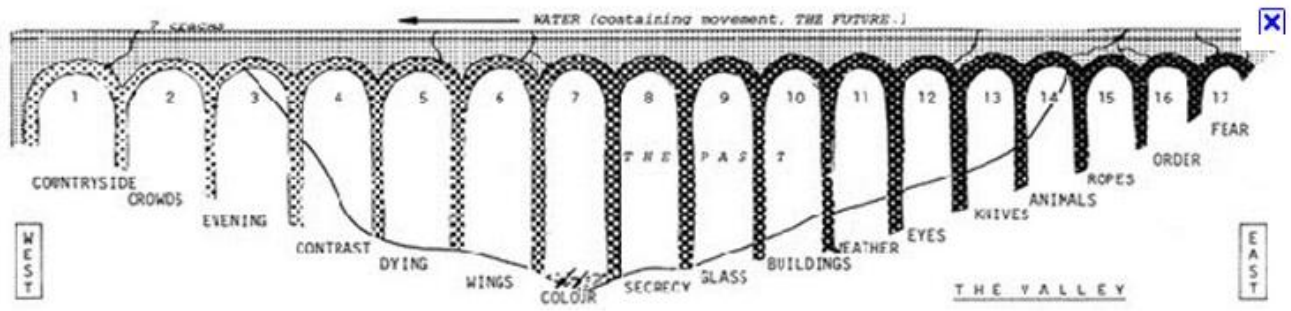
SYSTEM CONFIGURATIONS



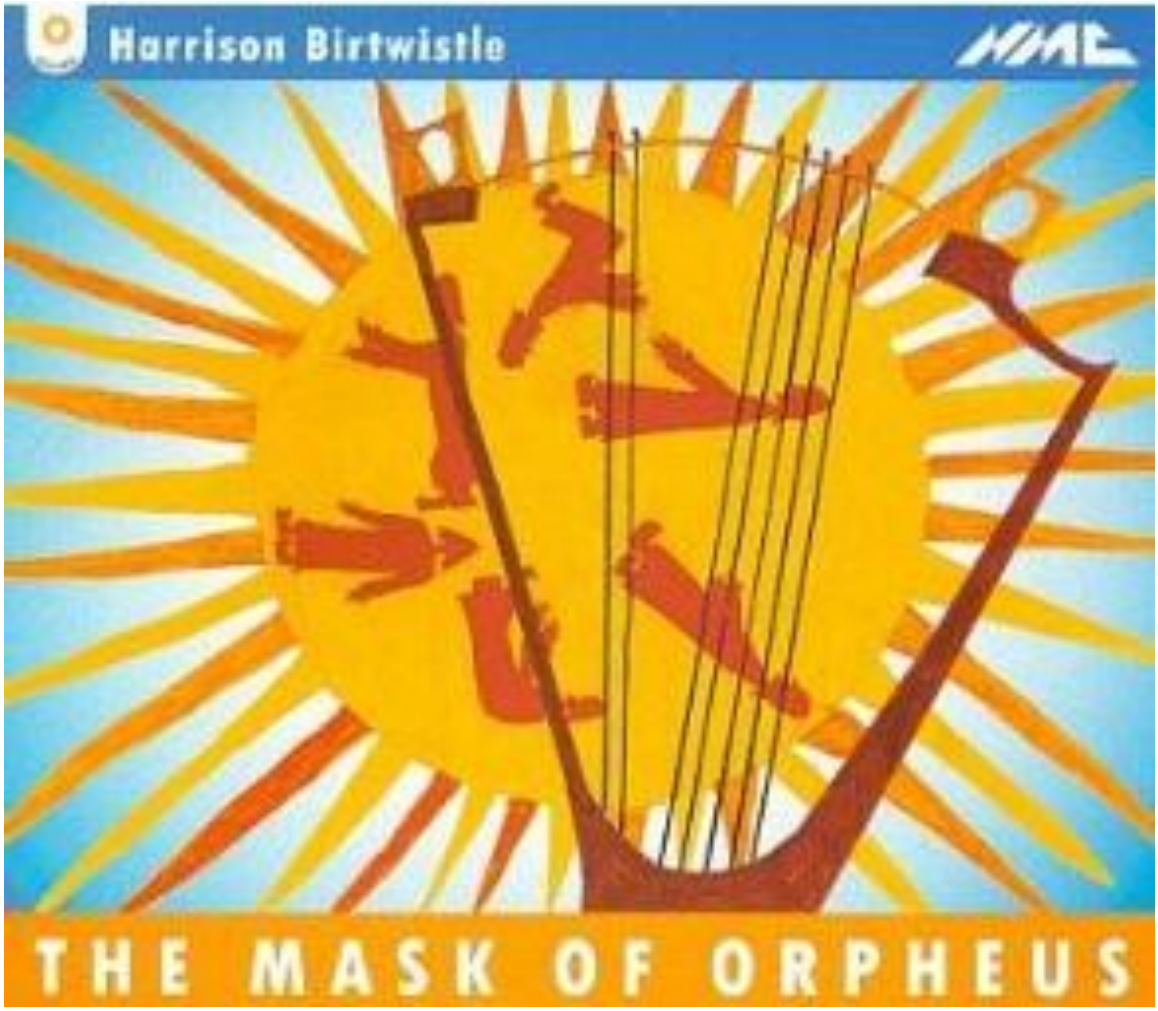
An example of a computer generated poem using Vocab

```
This programme is written in "VOCAB", a
computer language specially developed for VOCOM.
VE
/L
0001 1"TODAY WAS A WONDERFUL DAY"
0002
0003 1"SPOKEN POEM NOVEMBER 1972"
0004 1"START AT DISC ADDRESS 544 WITH DATA TAPE BLUE 5 ON UNIT 5"
0005
0006
0007 0.0:                                   Tell the clock to speak it quite fast.
0008 "DJ70 3700 !"
0009 .=
0010 "VA" #C01 ;"VA" #C02 ; "VA" #C03 ;
0011 " ! " .= " ! "
0012 "VP" #C01 ;"VP" #C02 ; "VP" #C03 ;     Get the words and
0013 "V$"                                   file them on disc.
0014 "  ".="  "#CR ;
0015 "VN" #C01 ;"VN" #C02 ;"VN" #C03 ;
0016 "  ".="  "#CR ;
0017 "VV" #C01 ;"VV" #C02 ;"VV" #C03 ;
0018 " ! " .= " ! "                         Perform some
0019 "DJ10 3700 VATEST  VPTEST  DJ70 3700 V$ ! ".= " ! "   test routines
0020 "!!!!!"
0021 10<
0022 #PL ;#L1 3^;#L2 3^;#SP ;#NT 20;#CR ;
0023 #PL ;#L3 3^;#L5 3^;#L4 3^;#SP ;#NT 10^;#CR ;   Get a pattern of
0024 #PL ;#L6 3^;#L5 3^;#L4 3^;#SP ;#CR ;           words from the disc.
0025 #PL ;#L7 ;#L8 2^;#SP ;#NT 10;#CR ;
0026 #PL ;#L7 ;#L8 2^;#SP ;#CR ;
0027 #NT 30 ;#CR ;
0028 #L10 ;#CR ;
0029 #CR ;
0030 #CR ;#CR ;#CR ;#NT 200;
0031 "!!")
0032                                        These macros store the words.
0033 "V$"
0034 $
0035 C01 #L1 1;#L1 2;#L1 3;#L2 1;#L2 2;#L2 3;#L3 1;#L3 2;#L3 3;#SP ;#CR ;@
0036 C02 #L4 1;#L4 2;#L4 3;#L5 1;#L5 2;#L5 3;#L6 1;#L6 2;#L6 3;#SP ;#CR ;@
0037 C03 #L7 ;#L8 1;#L8 2;#L9 ;#SP ;#CR ;@
0038
0039 L1 %A'"LOVE ","PATTERN ","EARTH ",'@
0040 L2 %A'"CHANGES ","HOUSES ","WORDS ",'@
0041 L3 %A'"DESTROY ","ALLOW ","PERSUADE ",'@     Vocabulary used in
0042 L4 %A'"ERRORS ","EYES ","SEAS ",'@            this experiment.
0043 L5 %A'"SACRED ","HAUNTED ","FORGOTTEN ",'@
0044 L6 %A'"RUSH ","FRAME ","CIRCLE ",'@
0045 L7 "SUCH "@
0046 L8 %A'"KNOWING ","WEEPING ",'@
0047 L9 "ORPHEUS "@
0048 SP " "@
0049 CR "!"@
0050 WT "VV" %A\ @
0051 PL "VV" @
0052 L10 "VPORPHEUS  "@
```

The development of the extremely complex digital voice transmission system Vocom and its user language Vocab as well as the complex scores that I had been writing directly and, of course, the many collaborations with Harrison Birtwistle directly led to the commision by Covent Gardent Opera to write the libretto of The Mask of Orpheus. This was a mammoth, almost 10-year, project culminating in its production by the English National Opera in 1986. http://en.wikipedia.org/wiki/The_Mask_of_Orpheus



From the libretto



Design by Sofka Zinovieff

Orpheus and EMS

Alan Sutcliffe

Peter Zinovieff's libretto for The Mask of Orpheus is the finest work he has done, more significant than building those twin towers of EMS, the studio and the synthesiser business, more significant than his musical compositions. I believe that it drew new developments out of Birtwistle, and is recognised as pivotal in his work. It was Peter's main preoccupation for many years. In a year he sometimes spent five months working on it at his cottage on Raasay, an island off Skye. He had built the cottage from a ruin, years earlier. Around the time of Orpheus, Birtwistle bought a property on the island.

EMS suffered as a result, without Peter's guidance and impetus. But this was not the only cause of its downfall. In the earlier years the synthesiser business had unique products, in facilities and price, and they sold themselves. But the competition began to catch up and EMS was too small to compete. The move to Great Milton in about 1975 was necessary but not sufficient. EMS had 30 products, all excellent but far too many for such a small organisation.

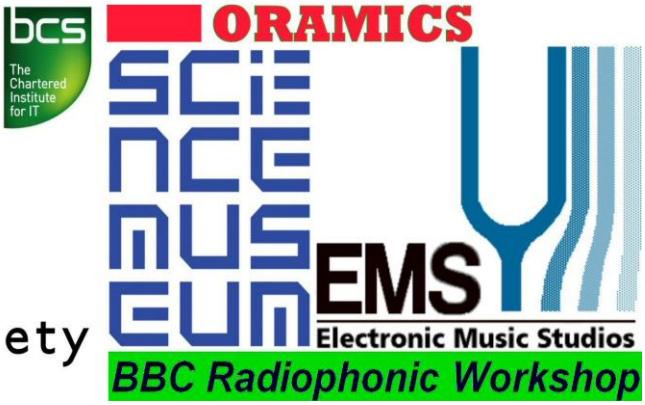
During this time my role in the organisation changed from technical to management. I went with Peter to meetings, first to keep things going, then to rescue as much as could be of the studio and the business. Visits to the factory, to the solicitors, to potential backers and buyers, and to business advisors. A failed trip on my own to New York to see if anything could be retrieved from a man who had issued a guarantee that proved to be worthless: I was bamboozled. Robin Wood kept the EMS name alive repairing and trading in EMS equipment.

Among efforts to find a home for the studio Peter and I had discussions with Robert Sherlaw-Johnson of Oxford University music department. He showed us the large empty top-floor room where the studio would go and we discussed the equipment layout. But nothing came of it. At the National Theatre agreement was reached with a senior manager, no doubt helped by Birtwistle being musical director there. The studio was eventually put into storage there but was never put back together as a working studio. A national disgrace that grieves and angers me still.

These are a few of my recollections, but as Tim Boon explains in his article above, others may see and remember things differently. I do not agree with all that Tim writes. Such is history.

The Computer Arts Society

A British Computer Society Specialist Group



Bringing together artists and technologists
Exchanging techniques and ideas
Formulating needs for support
Helping to get works known
Exploring new forms

ABOUT THE COMPUTER ARTS SOCIETY

Aims

The Computer Arts Society (CAS) promotes the creative uses of computers in the arts and culture
It is a community of interest for all involved in creating, developing, interpreting and understanding the cultural potential of information technology

Membership & fees

Membership is open to all who are interested in the aims and activities of the group
There is an optional annual contribution of £10 (€15 or $20 overseas) for which members receive a printed copy of each issue of PAGE

The British Computer Society (BCS)

The CAS is a Specialist Group of the BCS and receives their support and funding

CAS Website

www.computer-arts-society.org

Publication

PAGE the Bulletin of the Computer Arts Society appears quarterly and can be downloaded from the CAS website

Archiving computer arts

The first period of CAS activity lasted from 1968 until the mid 1980s, and there are significant archives of material from this era, mainly stored in homes and offices of people then active in the group
The CAS worked closely with CACHe, a project in the Art History Department of Birkbeck, University of London, documenting UK computer arts in the years to 1980
This project led to the creation of the National Archive of Computer Art at the Victoria & Albert Museum, under the aegis of Douglas Dodds, Senior Curator of Computer Art

Present & future computer arts

With so many novel and exciting developments in the creative uses of computers in the arts the society will continue its original aims of bringing together those active in this area

EVA – Electronic Visualisation and the Arts

The EVA Conference is an annual event that focuses on the creative use of computers in the arts, industry and academia

Collaboration

The society holds joint events with other BCS Specialist Groups and collaborates with other organisations

Education

CAS continues to make students and practitioners aware of the history of computer art, and supports current student practitioners through its lecture series and conferences

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