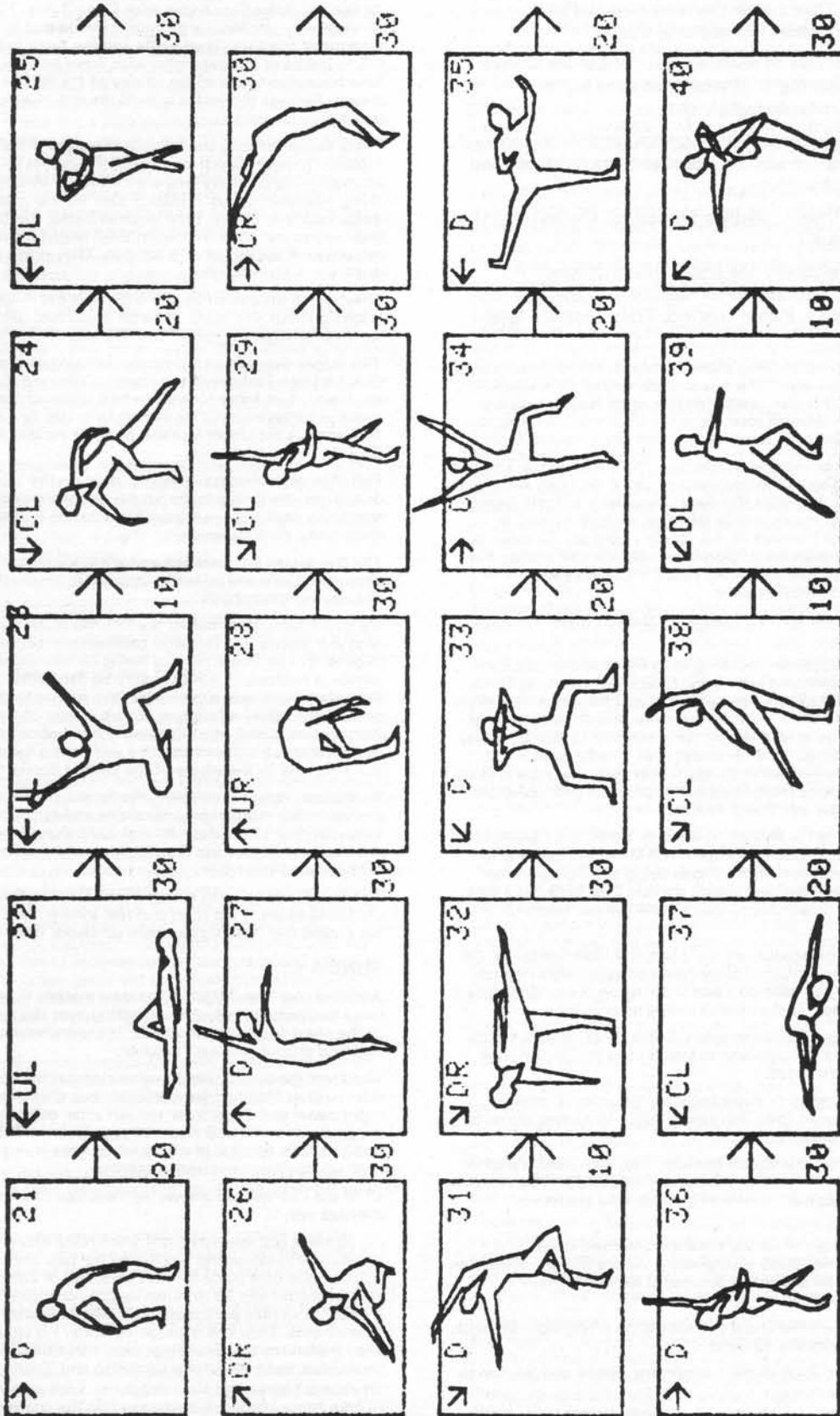


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FROM A DIARY: ELECTRONIC MUSIC

SATURDAY

Today is another grey day ... I wish I was in Raasay.

There was a storm last night and the studio roof started to leak. It has leaked every year since it was built and every year it is repaired. Water is dripping onto the computer section. Part of the ceiling looks as if it is going to collapse.

Should I have left the machines on all night? But then they tend to get too hot. Dare I turn them on now without investigating whether water has got into the racks?

I try the system. It seems to work except for the DECwriter which broke down last night. It won't read the correct characters although it types out alright.

I phone CFM with whom we have a computer service contract. There is an answering service. This probably means that they will not come until Monday.

I gather towels and sheets together to mop up the water and I turn on the fan heaters.

VOCAB has a fault whereby the lightpen won't select the correct co-ordinates. Perhaps water has got into the Hewlett-Packard power supplies. Please God no. They took six weeks to repair last time.

In the Russian film 'Andrei Rublev' there is a scene where the church is sacked by tartars. Rublev says "There is nothing sadder than when it rains inside a church". It is also pretty terrible when it rains inside a computer room. (When Boswell loses his spurs from the boat over to Raasay from Scalpay, Johnson remarks that this was a very wild act.)

I think about the talk I am to give in Glasgow for Musica Nova. I decide that what I want is to discuss the problems of decisions in an advanced electronic music studio. To relate the decisions to why so little music can get done and why so much time is taken up with peripheral or preparatory activity. For instance in this studio I dare say 10 times as much music could have been completed if we had not had floods, done programming, had to sell machines to support the salaries and developed sophisticated new hardware.

All the same we have done about 15 pieces in the last 3 years — some of them major.

I try and get the radio keyboard working as an input to the computer but when I switch it on nothing else in the system works. I ring David Cockerel in Paris at IRCAM. It turns out that I had forgotten that there was an 'interrupt disable' switch on the interface board. I also arrange with David that he comes in on Monday for a meeting to discuss a new commercial synthesizer that we wish to develop. It must have a keyboard, memory, very few controls, use a microprocessor, be able to play around with frequency modulated tones, produce percussive and brass-like sounds and cost less than £1500.

I'm glad David is working for Boulez. It is much better than working at foot pedals in New Jersey. But I do hope IRCAM doesn't become a white elephant like Stockholm. Jim Lawson being their programmer and David their electronic designer makes me feel that EMS has a very special connection with it although I don't think we can have much direct influence there.

When Boulez came to this studio he didn't like it. I have heard that he thought that the only type of sounds we could produce were ostinati. I think this must have been because I was working on Harry Birtwistle's Chronometer at the time. Clocks have ostinate mechanisms.

At 11 o'clock our Eastern European agent, Denis Tyler, telephones to ask whether he can bring 3 Bulgarians to look at the studio and have our new Vocoder demonstrated.

It's often that people turn up unexpectedly on Saturday. Probably because there is no office to steer them away and I can never refuse to see people when asked directly.

All the more reason to get the studio in order. The imminent arrival of the Bulgarians puts me on my mettle. I always feel sympathetic towards Eastern Europeans. I suppose I mistakenly think they are nearly Russian.

I try and edit the first page of Candy's numbers derived from Stravinsky's Symphony for Wind Instruments. We are doing a computer version of it as an exercise and if it is successful we might make something strange out of it.

There are a lot of numbers that have to express the pitch, duration and amplitude of every note of the 22 parts.

I find too many errors to do it alone. I telephone Candy and ask her to come and help when she can.

I also telephone Tim Orr and tell him about the Bulgarians and the Vocoder demo. He is going to come in anyway to work on the analogue delay line that he is developing for our module series.

I do hope that I won't have to spend a day going to the factory at Wareham this week. I had said that I might but I now decide not to.

The Bulgarians ring. They are at the BBC. Can they come later — at 6? Yes, but it makes me feel at a loose end.

The children are away and the house is as gloomy as I am.

I edit my program VOCAB and add subroutines that will cater for the Video Camera interface that Richard Monkhouse is to install next week.

First good thing of the day: there are no compilation errors. Not that this means that the program will work or that the additions haven't disturbed things elsewhere. I have added about 200 instructions. That means, on my reckoning that there are at least 4 programming errors somewhere.

At last the Bulgarians arrive with Denis Tyler. They are 6 not 3. They all seem very similar. Large, moustachiod and with huge baggy turnrpped trousers. They smile and say hello in Russian and bring out a 2 litre bottle of yellow vodka with some herb in it. I reckon they must have been given cups of tea all day at the BBC. I go upstairs to get glasses. Perhaps the vodka will do instead of a demonstration. I wish I spoke Russian better.

I hate demonstrating the computer system. I feel rather like a conjuror. I usually choose speech as a source to analyse and change. Often I end up destroying carefully prepared tables or settings that I am currently using. However, today is clear. I turn on the Radio Microphone; the Bulgarians talk into it; they laugh as I alter the tone and character of their voices and then transform their laughter into a marvellous rainstorm. Rabbits out of a top hat. They don't understand much. We drink some more Vodka.

They are all impressed by the VDU and the mechanised curtains in the listening room. It's going to be an important decision what to do when we lose the listening room later this year.

Tim comes down from his room. He looks very scruffy. "Been raining then" he says looking at the floods, "Who are these geezers?", "Boozed up, I see". Tim helps himself to half a pint of Vodka. "What's this muck — camel's piss?" He always talks like this when there are foreigners. Like Uncle Mathew he can't believe that foreigners talk English.

Tim then gives a smart demonstration on the Vocoder. His most serious design yet. He is able to do similar transformations of speech to those that I can next door — except his machine is analogue and is unable to distort any time parameters.

The Bulgarians are sweating and are obviously exhausted. Technological demonstrations and scientific apparatus are much the same east or west. Chicago or Novosibirsk.

We go upstairs. Rose has lit the fire. We drink some more Vodka and raise our glasses to friendship between our countries and Radio Stations in general. The Bulgarian flag flying on the flagpole at the end of the garden is noticed. It will probably be this rather than anything the Bulgarians have seen downstairs that will make them buy a Synthi 100 or Vocoder. They admire my Polish poster of Lenin and we talk about Warsaw Radio and Josef Patkowski with whom they are friends. Soon every Eastern European country will have a Synthi 100 while there is still only one in the whole of the United States.

We discuss, rather drunkenly, the future of synthesizers and how organs are becoming more like synthesizers and synthesizers more like organs. I explain that I have decided that EMS should not try and compete in this market but that we should continue to stick to educational and sophisticated machines.

The Bulgarians leave in a huge black car. There have been many problems today. I am tired and feel lonely. Very gloomy. Another day has passed and nothing has been achieved. Backwards.

SUNDAY

Another grey day. MOM. Mind over matter. It rained during the night but I had put out polythene sheeting over the roof. I still got up twice in the night to check the studio. It's unbelievable that such a solid building should give such trouble.

I had left the computers doing a print-out of VOCAB with the new sub-routines that I added yesterday but stupidly I had forgotten to add more paper and the printer ran out after only an hour or so. The whole program takes about 8 hours to type out at 30 characters per second and so I have to do it at nights when Alan is not working so as not to take up machine time unnecessarily.

CFM are still only an answering machine. They can't have got my message yet.

At 10 there is a telephone call from Hans Werner Henze in Italy. He would like to come and work here for two days later this week to make a little electronic piece for an exhibition of china sculptures. It must be very beautiful and 10 minutes long. Like china. He has planned to ask Yamashita to play percussion and David Monrow to play old instruments. They can manage Tuesday. We would record them and then transform the recordings onto something else. The same techniques as in the Violin Concerto and Tristan.

Of course I agree and I am delighted. I am always pleased when famous people come and work in the studio. The machines seem to work better and I am at my best. It's like horses running better under good jockeys. The jockeys also know how much to leave to the horses. More inexperienced people try and take on too much and it's not so exciting. It's this capability for making the right decisions that has contributed to the success of the famous anyway.

I am especially pleased that Hans has decided to work here once again. After the dreadful performance of Tristan at the Queen Elizabeth Hall I thought that I would not be given the chance to work with him again. I know he was very disappointed although I have heard that there have been successful performances of the work in Germany since.

In the London first performance all the electronics went wrong. Even with hindsight I don't see what one can do to avoid it in future. Indeed I don't see that it will ever be possible to combine electronics and orchestra in the London Halls until they install some sort of amplification system themselves. As it was we had even decided to subcontract the amplification to Electrosonics so as to have the maximum professional speed. I regret that decision. We were not allowed to start setting up until 8.30 on the morning of the concert. We had four track tapes to play and therefore four separate amplifier and speaker systems. Also cue lights and talk back for Colin Davis. The wires had to be run according to fire regulations along very circuitous routes. The orchestra was due to rehearse at 10. They would not give a moment's quiet from tuning up for the speakers to be tested. Impossible. As it was, even at the performance in the evening, two speakers were faulty — one had a wire pulled out at the last moment — Colin Davis missed an electronic cue and even the wonderful rich and poignant Tristan chords which were meant to make everyone weep sounded thin and distorted. It is difficult to get musicians to understand the importance of technical rehearsals when electronics are involved. Especially as the electronics have the power of destroying a whole performance — much more so than bad players.

I tackle the studio late in the morning. It must be tidied. Sofka will help me later and Rita will polish it tomorrow. While I clean up I try and rationalise the new Henze composition. We must not be too ambitious. Two days is a terribly short time to complete anything of any complexity. All the more so in this case as it involves the pre-recording of live musicians. I very much favour this method of working because live sounds can give such rich and varied patterns and harmonics and also an overall discipline that is much more difficult to come to in pure synthesis of tones. Of course rarely do we use any of the original material at all and it is all entirely re-synthesised by the computer system.

Already the 2 minute telephone discussion this morning with Henze has given me a sort of form. It is already a Henze piece although at this stage all of the problems and decisions are Zinovieff's. Some people find it curious how pieces always turn out to belong to the composer rather than the studio engineer. I don't. It's because it's the idea and gross discipline that counts for 90%.

Thinking on these lines stirs me to redo the Agnus Dei that I am to play at Glasgow. Stephen Arnold suggested that as I was giving a talk I might play some electronic music of my own. The sugariness of the Agnus Dei might please those who don't like electronic music. Actually I know no-one who really likes electronic music. Perhaps it's like piano duets — fun to do but almost always intolerable to listen to.

I finish my alterations to the Agnus Dei in about 4 hours. I have re-synthesised some of the voices and used phasing and frequency shifting effects derived from the Delay Line that Tim has let me try out. I shall only play the 2nd movement.

At 5 there is yet another call from William Lennox. He wants to come and use the studio. He thinks he has a right to do so. He has telephoned several times and our conversation is always the same. I stick to my rules for outsiders and the non-famous. Firstly I must personally find the composer's project interesting. It must take the studio forward in some way and present a problem that we have not solved. Secondly the applicant must have found some financial source to cover his expenses. This could be from the Arts Council or his own pocket but ought to be at least £200 a week. Lennox doesn't want to give me any idea of what his composition is. I call it a project — he calls it a composition. He asks if a written definition of musical composition is what I want. I explain that the studio is too good and too costly for someone to merely come in and play around hoping for inspiration. Lennox threatens the ombudsman. How different were the 2 telephone calls of Henze and Lennox.

The children arrive at 6. I play piano duets with Sofka. We go to the Great American Disaster. Early bed after some Schubert songs. I am addicted to them and cannot even type without them.

Tomorrow must be a strong day.

Just as I fall asleep Ludwig rings up from the office. He has arrived from Germany. He comes over and I light the fire. Raasay peat. He has brought some red wine from his father and apple cake from his mother. Rose makes tea.

I tell Ludwig about the terrible week that has just passed and the exciting constructive week that lies ahead. Ludwig tells me of the bad financial state we are in and how the studio is too expensive for EMS to support and how I'm too extravagant. I can tell he is tired. I suggest that we discuss it at the EMS meeting tomorrow. Already then the meeting is diluted from microprocessors and Bessel functions into one of financial fussing. Another decision.

Later Ludwig quietens down. Nothing better than tea and cake, wine and a peat fire. We really get on very well. It must be a nightmare running EMS' financial affairs. We get to bed at about 1. I am glad Ludwig is back.

MONDAY

The Bulgarians arrive as I am having a family breakfast. Would they be allowed to photograph the studio? They had forgotten to bring their flash before. I show them downstairs and offer coffee. No thank you but they give me another huge bottle of vodka. I make as if to open it but they shake their heads and laugh — keep it, it's for later. Their black car is outside. They are on their way to the airport.

What an idiosyncratic place they must have found EMS. Chickens in the garden. Computers in the basement. Children rushing around the kitchen. I wish Sofka to school on the Honda. I meet Robin half way down Putney Hill. 400 yards zoom.

The telephone is ringing. It's Deborah Spencer from California. Can she come over tomorrow and work free for EMS. She must be mad and yet I do not really wish her to come. I feel she will be too much of an observer and want to meet pop-stars more than to write handbooks. I pretend that the line is bad and ask her to ring up in a month. I lie and say that I am on my way to Raasay. Would that it were true.

Debbie Skipper, our secretary, rings from the office. Deberly (her assistant) is ill yet again. (What a lot of DEB's all at once — Deborah, Debbie and Deberly.) Deberly wants to get married later this year when she is 17. It's a bad omen that she is ill so often.

Four Americans are coming just before lunch in order to look at the studio. They are on the grand tour that includes Stockholm, Utrecht, Putney and so on. Soon it will include Glasgow and Paris. I have asked them to lunch. This is my usual custom so that people come when there is an unavoidable disruption rather than at more useful working portions of the day. There are bound to be lots of EMS people there for the afternoon meeting.

Lunch is sort of open to people who work here and for visitors. We talk about hardware and philosophy. It's also easy to find out what guests are interested in and usually we leave them with a good impression of ourselves.

The studio itself only takes half an hour to explain — or else it takes a week.

Alan Sutcliffe arrives at 11. He has been working hard recently and looks very tired. He is writing a series of FORTRAN programs to abstract useful musical information from our analyses. Harmonic content, pitch and timing information as well as dynamics. The reverse of what I and Candy are doing with the Stravinsky.

Alan has been working nights: that is why he looks so tired. A pity he was not here the night before last when the flooding took place. He shows me what he has done. I will try it out later. In this way obvious enhancements are revealed while the program is still fresh in Alan's mind. It's a luxury if someone can start to use your program almost as you write it. Alan and I keep it pretty well divided that he does the complex mathematical programming — usually in FORTRAN — while I stick to the assembly language ones. This works quite well except that Alan does not get a chance to become sufficiently familiar with the hardware itself. Most of his time is not really spent solving problems of an artistic or intellectual nature but, like me, with problems of handling the system. Files are too long. Discs become full. The actual hardware has errors. The original DEC programs are faulty and so on. We really extend the small computing system to the limits of its capability. I am very lucky to have Alan working with me. He is very interested.

We discuss the Glasgow Hospital project. This is an application that has been submitted to the Wolfson Foundation for a large amount of money to be spent on the computer interrogation of patients and the computer diagnosis of their illnesses. Apparently the right 12 questions could diagnose any known disease. The idea is that the patients will be asked questions in regional accents by the computer. They would then respond by pressing a set of simple keys. "Yes", "no", "sometimes" etc. EMS will provide all the hardware and the hospital would provide the doctors. It would be very interesting if it works. Alan will be in charge of the project.

I ask Alan to leave the computers free until after Henze has left. This will minimise the likelihood of system failures. I shall keep the computers warm but unused.

CFM arrive with a complete DECwriter. This is the first time they have replaced a whole piece of apparatus. Not surprising in this case really for we have had at least 23 calls for service and lost about a month's work from this alone. Yet another 6 weeks was lost when the two Hewlett-Packard power supplies overheated and spare parts had to be obtained from the USA. Even then they had to come back to Putney and fail twice more before they were ready.

These failures in hardware cause an immense amount of disruption. It's very difficult to decide to change from the middle of one job to another. Coupled to this there is the eternal hope that the fault will turn out to be an easy one to cure. In the end hours are spent hanging around to the annoyance of the service engineers.

Lunch. 12 people. That's quite usual. Most of EMS are here and the Americans. They can't stop gabbling on about the golden child of electronic music — John Chowning. It always irritates me. Each conversation is so like the last and we cannot progress. I'm sure John Chowning gets irritated even more. I hear he has patented his ideas in Japan. That sounds clever.

I must stop the EMS people drinking too much at these lunches. Peter Easty will be slurred and cantankerous this afternoon if he has any more.

All the EMS team are very high powered. Even though some — like David Cockerell, Richard Monkhouse and Alan Sutcliffe are friends and consultants, they still play an enormously important role in the company. We are extremely lucky.

After lunch we go to the listening room. Robin prepares leads and microphones for tomorrow and listens in. This is the agenda:

1. The cost of the Computer Synthi has escalated from about £6000 to more like £15,000. We are bound to lose heavily on the first three for which we had deposits. We must try and get the customers to pay more. Most people can't understand the problems of estimating prices for developing new products. The designers are always optimistic and the production people have nothing else to go on. Even if one allows for large contingencies they are still not covered.
2. David has come over from Paris to discuss our new computer controlled commercial synthesiser. Richard is especially interested in this as he has been building Video gear using a microprocessor. In fact he has now built a whole computer.
3. The cost of the studio is miles too high at about £20,000 per year. Ludwig says we cannot spend that amount. I agree. What can we do?
4. We must define a hardware module that will perform MUSIC V type manipulations. It will be self contained and be able to be chained to other similar modules. Apart from reverberation which is very costly to do digitally it will be able to behave exactly as a MUSIC V instrument. This is to be Peter Easty's next project. We must get people away from using giant computers at great expense.

The meeting goes quite well. I have asked Alan to chair. He is quite good at keeping the subject going although he speaks very slowly.

A telephone call from the Bulgarians at the airport. How long it is since yesterday! They have left their flash behind. I go and check up. Yes it is here. Someone from the embassy will come over for it. They are sending me another bottle of vodka. I hope they think that we are drunkards! I wish I could have been in a better mood when they were here. They were an episode.

Candy arrives to discuss the Stravinsky. She sets to work editing on the VDU. As she derived the numbers she is much quicker than I at detecting the errors. We use MUSYS to add up the timing data.

I can now alter and add to MUSYS. In fact I am slowly absorbing it into VOCAB. I think of VOCAB as my life's work — even more than Orpheus. I have now spent about 4 years at it and it has become a gigantic program. I am often envious of Alan's neat and elegant programs. However, in the end it is the weight of paper that measures the hours of tedium. All programming decisions are of the same intellectual requirement. I can't believe that anyone finds programming difficult or easy.

Harry Birtwistle rings up. He doesn't like to hear that Henze is coming to work. He thinks that in a way the studio is his. In two days he will bring some people to do an Orpheus recording. We discuss briefly recitative and aria. Land and sea. We are both longing to go to Raasay. Harry is bogged down at the National Theatre. He says that he used to be a composer. I hope he doesn't continue to think that with the whole of Act 3 of Orpheus to finish.

I am so happy that he has bought the ruin at Eyre from me and turned it into a home. Recitative and aria; myth and man; up and down; land and sea.

Ouranos ano, ouranos kato. Astra ano, astra kato. Pan o ano touto kato. This and "like a kid I have fallen into milk" are probably the only Orphic fragments left. Willie Charlton says that they can't be as they don't scan.

Two pop stars arrive with a roadie at 7. They meet everyone going off from the meeting to play pool at the pub. David and Tim are experts at billiards. In Raasay we found an old bagatelle set. I hope it pulls them back there. David walked in snow for the first time in his life at the new year in Raasay.

It soon turns out that the roadie is the greatest pop-star. He's from Tangerine Dream. One of the others wears a long furry earring. "Call me Indie" Robin recognises him from Chicago. He says he's travelling incognito. It's a good earring he wears for that.

German pop-stars always seem more workmanlike than Americans. English ones fall into one or other camp but usually are dressed up. The Germans wear scruffy jeans and shave. They have come to look at the Vocoder. We also show them the latest modules that Tim is making.

Robin soon takes them off for who knows what with some friends. Rose, Leo and I go to a newly-opened Russian restaurant in Putney. I become maudlin for the gypsies and the islands of Petersboorg that I never knew.

Bed. Tomorrow is a music day.

TUESDAY

Up at 6.30. Today is going to be a strong day. As Cage says "Every day is a beautiful day": I prefer "Think Mushrooms".

The studio is spick and span. I test the microphones and above all the mixer which is the weakest link in our recording chain.

Robin arrives at 8. He is in a rotten mood and rather surly. It's always a sign of tension with him. It might also be because I am clucking around him like an old hen.

I start up the computer system. I allocate sliders and switches on "SQUEEZE ME" and in the light pen routines. I load waveforms and other function tables into the Digital Oscillator Bank (DOB) and the bandwidths into the analyser. We have a working system.

I ask Tchort — the god of machines — for a trouble free day and offer him the temporary sacrifice of the Synthi 100 which we won't be needing.

At 9.30 sharp Hans arrives looking well and elegant. He is very cheerful and immediately Robin cheers up too. He explains what he wishes to do. But above all we must complete the job by tomorrow night as he has to return to Italy then.

The piece is to be like china. It will first be used at an exhibition over and over again and then it will become an integral part of one particular sculpture. The sound must surround you and so there must be 4 speakers.

Henze uses words like "taut"; "nostalgic"; "smooth".

He wants to use fragments from an old 14th century melody called Tristan's Lament as a melodic glue to the whole. Monrow will play variations and fragments of this air on different wind instruments. The main body of the sound will be transformed percussion sounds. We will transpose the sounds so that they are very high in pitch but still retain their harmonic complexity and dynamism. We will alter the speed that they are played so as to stretch out these harmonic changes. These type of transformations are very easy using the digital system. Impossible using tapes or the Vocoder say.

Henze does a funny drawing of what he calls a 'structure for dynamics'. I must beware of spending hours of preparing something difficult in the programming when something simple would do just as well.

David Monrow and Yamashta both arrive more or less at the same time. They look as incongruous together as the sounds that they make from their separate instruments as they set up. Yamashta has extraordinary coils and springs which he will tap and stroke and shake. Monrow takes ancient weird medieval instruments out of their cases and also a Tromba Marina.

Soon we are recording. Hans is with the players half conducting. He gives them instructions "Low pianissimo sustains"; "2 minutes of very high isolated sounds"; "Orgiastic"; "Something soothing". They take it in turn to play.

I lay the tracks against each other with Robin. Rarely do we do a retake — it's usually if David Monrow is dissatisfied with his way of playing. I think they have no idea of what is to happen to their playing once the computers get a hold of it.

Finally we have a selection of beautiful, ugly, fast and slow sections. These are the threads from which we will weave the final composition.

We finish recording by 2pm. Monrow goes off for another rehearsal. The rest of us go upstairs where some friends of Hans have already arrived and where Fausto and some friends of his have cooked a wonderful Italian meal.

The garden looks pretty and the river is high. It is very important to be able to breathe properly when one is involved in electronics. It's so easy to get smothered by the technology.

After lunch we try out various transformations. I give the controls to Hans. I let him vary pitch, speed, waveforms and envelopes. At first he is excited but then he gets bored. The controls are too coarse. It doesn't matter, I have got the hang of what he wants and I would now prefer to work alone and prepare some examples for him to comment on.

Hans goes off and will return tomorrow at 9.30.

I work at the music for about 4 hours and prepare 2 very different versions. Hans can then say what aspects he likes and dislikes and I can then finalise it in an hour or two tomorrow. Robin manages all the recording — of which there is a lot. We will certainly be able to finish tomorrow.

The day ends with a late dinner of Italian left-overs with the children and Rose.

Today was the first positive day for more than three weeks.

WEDNESDAY

Up at 6 again. I made some decisions about file names that we will adopt as studio practice. P for primitive, S for secondary and F for final data.

I go over the versions of China music. They seem more sketchy today. Perhaps I had hoped that one would do as a final version. Now I can see that neither is rich enough. I hope Hans will be pleased with the amount of work I have done — like a schoolboy thinking the latin master will be pleased with the amount of homework he has done.

Hans arrives a little late. Already there are telephone calls for him. I debate switching off the telephone and decide that I had better do it secretly later.

I play the two versions. Hans listens quietly. He likes them both and wants features from both. He doesn't like the hiss. As soon as he says this he is able to specify what he doesn't like about the music. Not dramatic enough and not moving enough. He makes excellent and workable suggestions for changes. Good. The versions I made have acted as catalysts and have therefore done their job.

The hiss is another problem. It is a perpetual failing of our tapes that they hiss. Even in cases like this when there are only two generations of recording involved there is still hiss. I shall use the Nagra which reduces it quite a lot.

Hans sticks to the telephone while I prepare a version according to his instructions. It's remarkably simple and easy when the instructions are so emotional. If it was a score (like the Stravinsky) there is so much more time spent in editing numerical data.

In the final mixdown, Hans controls the mixer — "sadder and sadder" and it is finished. 27 hours. But Henze doesn't know the enormous time that has been needed in other things to provide these accident free moments. Neither does he know how very much longer it would have taken anywhere else in the world.

If it wasn't for the distractions and breakdowns then there would be an enormous output from the studio in musical terms. Perhaps it is better this way.

I still stand by my old offer to the SPNM and the British Society for Electronic Music which we hardly keep going at Putney. This was to give my complete studio — machines and programs — to any institution in this country able to take it on. That is from a research as well as a musical point of view. It would also have to be housed in an enviable space and not in a dingy backroom as was suggested at Southampton. The important thing is that the cost of running and continuing the research is too much financial burden for EMS to bear.

It is now the first time that I have no hardware or software ambitions. I don't think this is because I am getting older but that the effort of the last 6 years or so has now come to bear fruit. In fact I suppose that quite a lot of development takes place in any case.

In the afternoon I go for a walk in Richmond Park. I meet Kolinka from school. I shall spend time with the children this evening and potter around the house until bedtime.

THURSDAY

I have a late breakfast. Hans rings up. He is pleased with the way things have gone. Good. I read the papers. It seems a luxury.

At 9 the office buzzes over. A party of school children are on their way for a demonstration of the Synthi 100. What a bore. Where is Robin. Because if I hate demonstrating the computer system I hate even more demonstrating the Synthi 100 which I never use and therefore find very cumbersome to set up. Robin, on the other hand, is pretty slick at it.

The school class arrives. Greasy grey worsted trousers. They are smoking. I tell them not to, and open the windows. Robin arrives just in time to take over.

I discuss the television camera interface with Richard. He will bring it tomorrow. I am very excited about it.

I finish copying the Henze files and the documentation of China Music. This is in case a revision is needed later.

At midday Harry Birtwistle and two young musicians from the Academy arrive to do a recording of part of the 3rd Scene of Orpheus. It is a shout-through — a terrible invention of Peter Hall. He found Harry's score too massif when he was going to produce Orpheus and felt that any sort of setting of the words to the music would help. He must be wrong because the words often don't illustrate the action, and the music is often inexpressible by piano and flute.

Orpheus is the main project towards which the studio is pushing. We must have a producer who does not think in operatic terms at all. In fact Orpheus is not an Opera. Its title is 'a lyric tragedy'. We now have a date for September 1978 at the Coliseum — or so I believe. It has changed venue and time so often.

There is really very little time in terms of what electronics there is to complete. Also Harry has the whole of Act 3 to do.

There are 6 self contained electronic pieces of about 2 minutes each, live transformations, pre-recorded voices, tapes with signals and so on. I hope Harry doesn't under-estimate the time needed to do it properly.

We start recording. Harry is embarrassed by his music. I am embarrassed by my words.

At one point Harry croaks "ANSWER!" His voice cracks. The tension is broken and we all laugh. We romp through the rest of the recording. Mistakes are meaningless. It was idiotic to be so serious in the first place. The enterprise is useless anyway.

Perhaps there are some clues of the torments that are in store for us over Orpheus. It is such a huge work and so much of one's soul goes into something of this order. I feel eaten up — and have done for the last three years — by Orpheus. When Harry is working at it, it must be ten times more so for him. Perhaps this torment is necessary in a modern Opera. The days of the Magic Flute being written and composed in 6 weeks must now be over.

After the recording Harry and I go to the first part of a dreadful concert given by tibetans at Smith Square. We leave early and have an Italian meal with Sheila and Rose. We hanker after Raasay and Arezzo.

A lot of Italian influences this week.

I think of the 8 salmon we caught in the monofilament net in a single afternoon last summer in Raasay. It was at a low spring tide.

I have structured the whole of Act 3 on the movement of tides.

Today counts as a medium day.

FRIDAY

I had a terrible dream last night about my neck being cut away leaving my head stuck rigid on my body. I woke rather sick. It must have been too much wine at dinner. Suddenly I realise that it is pouring with rain and that I had removed the polythene sheeting from the roof for Hans' lunch the day before yesterday. That is why I had nightmares and why I feel sick.

My worst fears are justified. Water is once again pouring into the studio. Two panels have fallen off the ceiling onto the computer racks.

I go and get boatman. He clears the roof of water and covers it with the polythene. I cover the equipment with sheets and towels and I place buckets under the worst flows of water.

How can I have been so stupid.

Billo and Robin arrive at 9. Strange to see Billo up but it turns out that they have been playing music all night at their studio underneath the office with the pop-stars who came the other day.

They want corn-flakes and then they tackle the studio with complete equanimity. Perhaps they can see the anguish in me and fear that I might really cut my neck off.

I go over to the office to try and deal with some of the urgent letters that have piled up over the past week. I haven't been over there once for more than a week. The letters are mainly those which Ludwig doesn't want to deal with. GLC and friends and lawyers. About midday there is a buzz from the studio. Would I come over. It's urgent. I don't want to; the idea of the shambles and the water is literally nauseating.

When I arrive the place has been transformed. The racks are dry. The panels back in their place, the glass tables polished and new bulbs fitted to the coloured lights. It looks as if there had been no disturbance to the urbanity of the last week.

We open a bottle of Champagne. Ludwig thinks I am extravagant.

After lunch Richard comes with the video camera interface. It works as soon as he plugs in the board. My programs have been adapted and we are able to test it straight away.

With this invention I am able to derive patterns from a video image. At the simplest these images might be a waveform drawn on a piece of graph paper but at a more complex level I think I will be able to derive very useful musical patterns from more random video images. For instance say I point the camera at a flower and say I apportion density of image to harmonic content and I scan from left to right across the stem of the flower. Then imagine that these sounds are pretty mediocre. Dull. Say then that I turn the camera slightly to the left or choose another flower. Will the sounds be more or less interesting? They certainly won't be the same. What images will give the best sounds. In a way it is getting a video picture to provide a pattern for improvisation.

We try it out. I point the camera into the garden. I run VOCAB and I assign the Video parameters to control DOB.

Suddenly the most marvellously rich, varied and amazing sounds come pouring out of the speakers. They ripple and change. They are the first absolutely fantastic sounds that the oscillator bank has made. Everyone is moved. At first no-one believes that they are not pre-composed but as I turn the camera the sounds change. They are convinced. In some ways we are frightened. It's like in the story of tuning in to the death cries of roses as they are cut.

We call over Ludwig. He rings up Germany. I ring David in Paris we hold the telephone to the loudspeakers but there is probably little chance that they can hear what is going on. The children come down. I dare not alter anything. Perhaps the program has got into a random loop. I save it and restart it. Wherever I point the camera there is another set of sounds. Each more rich and varied than the last.

I must keep this a secret. I shall give it to Harry for Orpheus. We must not allow these marvellous things to be heard for a year or two. Apollo's gift to Orpheus was music. I wonder where these sounds come from. Perhaps it's not fluke that we have been working on Orpheus for 3 years. This is our reward.

What a day! Perhaps all days will now be magical again!

I shall use the last seven days of this journal for my Glasgow Musica Nova talk.

Peter Zinovieff
Summer 1976

ON THE RELEVANCE OF MECHANICAL MANIPULATION TO THE PROCESS OF PERCEPTION

It can be fairly assumed that the central issue of Artificial intelligence is the discovery of the methods by which natural systems do, and artificial ones might, exhibit what is generally accepted as intelligent behaviour. I purposely avoid saying 'exhibit intelligence' because that would imply that we know what intelligence is, and we do not, at least we do not know how to define it in an absolute way, any more than we know how to define memory, perception, knowledge or understanding. All these notions are subjective and relative. It is possible, however, that even though they cannot be defined they might be capable of being demonstrated. This is another way of saying that, although there probably is no definition of intelligence acceptable to all, most people know what they mean by it and can recognise it when they see it. They do not recognise it directly, however, since it is but an attribute of certain cognitive systems, but they infer it from the behaviour of such systems under certain specific conditions. A minimum number of elements in these conditions can be identified and may be listed as the cognitive system itself, its environment, sensory perception, motor output and some overall appreciation of the condition of the system. This last is important because if we cannot tell what is 'good' for the system we cannot tell whether any response it may make is sensible, and intelligent behaviour would seem to require responses which make sense. Moreover, they must make sense within the frame of reference of the system itself without any reference to external criteria, for there is little point in designing systems to demonstrate intelligence if the only intelligence capable of being demonstrated is that of the human designer or programmer. For instance, it is sensible for an electric tortoise to look for electrical outlets to recharge its batteries, but to prefer going through a red door instead of a green one is not.

What it amounts to is that in our search for understanding of intelligence we should perhaps, instead of searching for rigorous, scientific tests of intelligence, rely on our intuitive sense of it and evolve experiments where it can be utilised.

It is clearly possible to invent artificial systems containing all the elements which have been stipulated as essential and it is also possible to invent games for such systems to play which would imitate natural behaviour patterns. What is difficult to do is to decide what relevance such games have for our understanding of intelligence or what can be learned from them which is helpful in the design of practical systems.

We need to be realistic and appreciate that although it is unlikely that technology already exists for simulating all of the processes of perception, proprioception, motor action and decision-making which are likely to be required, it is equally likely that the degree of complexity which would be required in any system capable of either performing any truly useful tasks or enlightening us on the subject of cognition is quite beyond us at present.

Is it then merely a question of complexity? Consider the proposition that if it were not for the complexity of the problem we should be able to deduce the complete structure of man's anatomy from the consideration of the periodic table of elements and the laws of nature.

The example is far-fetched, but the reason why we find it absurd is that we know that it is not mere complexity which would defeat us. It is also the lack of knowledge principally of methods employed by nature to produce cells out of compounds, animals out of cells and intelligence out of reflexes. Doubtless the methods in operation during the later stages of evolution are exceedingly complex in themselves, but it is reasonable to assume, unless we believe in Divine intervention at every stage, that they too have evolved in some logical manner in the course of events.

It may help, therefore, to treat the whole problem as an exercise in the simulation of evolution and try to design a system which, although simple to begin with, could learn from experience and could then pass this experience on to us so as to enable us to improve it.

We could say that we are interested not so much in machines that can learn but in machines that can teach, or at least in machines that can teach, having learnt.

The difference between learning and evolution may again be merely one of complexity for it is possible to think of learning as just an accelerated process of evolution, that is of evolution occurring within the life-span of the individual. Certainly both processes share what seems to be a very important characteristic, that is, the need to perform some physical action in response to changes in the environment as a means of optimising some criterion necessary for their survival. Where the two processes differ, although the difference may prove illusory, is that learning situation pre-supposes in addition to the sensory inputs and motor outputs some mechanism for deciding whether, when and in which way to act. Such mechanisms with their seductive analogies to human thought have understandably been the centre of attention of most of the past A.I. work. In most cases, however, they have been considered in isolation from the physical realities of total situations and were thus often reduced to sterile exercises in data processing. In any case such abstract information processing is beset by insurmountable difficulties not the least of which is the lack of any criterion for the choice of form the information should take inside the system. There is in fact serious

doubt whether what is being manipulated inside such systems can be properly called information. Such systems simulate both the stimuli and the responses and invent their own criteria for success and thereby exclude completely the one area which must be now appear the most promising, that of physical interaction between a system and its environment. It is true that such interaction *could* also be simulated in a computer, although to make it realistic and reliable would need considerable computing time and effort, but in fact it almost never is.

An ability to respond to a stimulus must be a very basic characteristic of life and an ability to select the best response, an equally basic characteristic of evolution but, most significantly, the most common form of response in nature is one of mechanical movement. Granted that in very early stages of evolution the responses would have been primarily chemical, but it is possible to think even of chemical actions as mechanical in that they involve on a molecular level changes in time of the relative position of elements which is the basis of mechanics.

It is reasonable to expect mechanical information to play an important part in the process of perception because plants and animals are mechanical objects operating in a world of mechanical objects and if they are to be aware of anything they must be principally aware of the laws of nature appertaining to mechanical objects.

Consider, for instance, the simple process of cell division in the case of a plant's seed. In order to perform its very first division satisfactorily the cell, apart from doing this at the right time, must do it in the right plane, that is perpendicularly to the direction of earth's gravity. The bottom part will then give rise to the root system and the top part to the stem. The cells may have "learnt" how to do it as a result of natural selection without recourse to gravitational information, with those cells not dividing correctly simply not surviving, but the process nevertheless has relevance to the problem of perception. Most seed cells do in fact divide correctly and can therefore be considered to have the necessary sensory ability and so we are free to speculate that perception can develop as a result of some chance motor ability if that ability can improve the system's chances of survival. A chance sensory ability could prove profitable only if the corresponding motor ability already existed or had occurred simultaneously, a circumstance much harder to envisage. It would appear therefore that motor action, far from being an optional consequence of perception is, in fact, its precondition.

There is evidence that some similar process operates on the higher levels of life for animal behaviourists have shown that if animals are prevented from moving during certain crucial stages of the development of visual perception their vision fails to develop altogether. The reason is easy to appreciate intuitively, for why should an animal develop any interest in any aspect of its environment, which it might possibly perceive, if it is incapable of affecting it in any way!

The implications for artificial systems are important and may explain why interpretation of visual images is so difficult. It is simply that in nature the vision is not given, evolutionally speaking, to any animal until it has established by other means, usually tactile, a thorough understanding of its three-dimensional environment. We tend to put the cart before the horse by attempting to construct a three-dimensional "image" of the universe from its two-dimensional projections. The above considerations would suggest that if such a three-dimensional image is indeed required it should be constructed from mechanical rather than visual information.

The term 'mechanical information' is meant to convey more than tactile information, the latter implying dependence on the sense of touch, and being as such mainly restricted to the detection of shape and texture while the term 'information' is meant as something more than data which can be thought of as the raw material of information. Mechanical information is what our brain uses to identify objects in our pockets, the layout of a room in the dark or to distinguish a can of beer from one of baked beans without reading the labels. It is based on data about position, mass, force, acceleration, velocity, inertia, stiffness, friction and texture. It cannot be obtained passively in that we cannot tell the weight of an object without lifting it nor any other of its mechanical characteristics without disturbing it in some way. Although quantum theory tells us that this is true of any form of measurement, it is particularly significant here for it means that if such information is to be used in an artificial system, then mechanical manipulation needs to be considered an absolute necessity.

Manipulation is the only practical way of obtaining mechanical information and since, if the general line of the present argument is accepted, it is the basis of all other forms of perception, its quality will determine the quality of the entire system.

This idea is not far-fetched. Grown-ups do not need to manipulate objects in order to recognise them but young babies do, and blind people recovering sight in middle-life never do learn to use their eyes properly, the necessary links between tactile and visual sensing never having developed. As far as machine perception is concerned we are still at the babyhood stage and therefore need to take manipulation seriously.

The difficulty is that although technology exists for acquisition of mechanical data in that we have excellent transducers for measurement of such things as position, force or acceleration, the conversion of such data into information requires the use not only of precise and efficient manipulators but of sophisticated, interactive control strategies. This is because the manipulators need to be used not merely to execute motor instructions but also to provide mechanical information

through interaction with the objects investigated. Although some information can be gained through simple prodding, the on-line, real time computer control offers us a possibility of continuous, supervised exploration and interrogation of the environment and of development of manipulative skills designed specifically for the purpose of identification.

It is tempting to speculate that such methods, superceding as they do the simple analysis of records of past events, might help us in understanding the mechanics of perception.

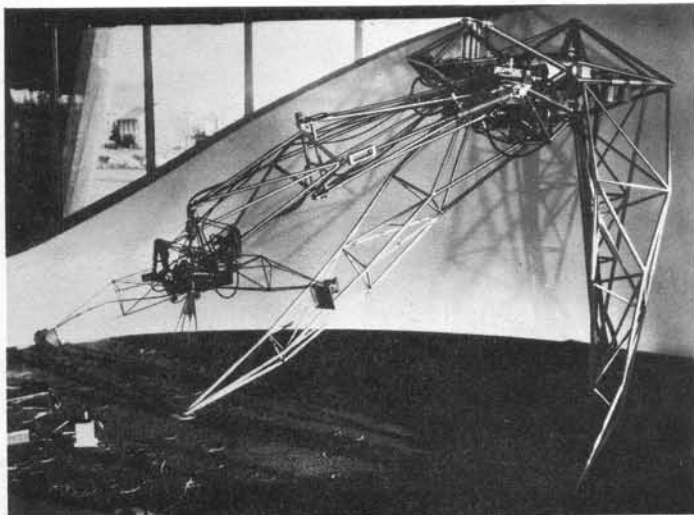
Edward Ihnatowicz
University College — London
1 April 1976

NEWS AND EVENTS: PAST AND PRESENT

JOHN LANSDOWN has recently completed work on a computerised lighting system which is currently being used for a play at the Oval Theatre in which the lighting scheme cues the actors who then improvise within this framework.

JOHN LANSDOWN is also working on dances which make use of his computerised dance script system. The company is Another Dance Group and performances are scheduled for March '77 at the Oval Theatre, London.

RUTH and JAY LEAVETT from Minneapolis will be visiting Britain in August. Ruth is looking for dealers to show her recent paintings and prints and they would both welcome opportunities for lecturing. Ruth works with Computer Graphics and Jay uses computers for Literary Studies, at the University of Minnesota.



IN MEMORIAM THE SENSTER

Edward Ihnatowicz

One of the foremost works of art and technology lies disconnected somewhere in Holland. Any offers?

AIMS AND MEMBERSHIP

The Society aims to encourage the creative use of computers in the arts and allow the exchange of information in this area. Membership is open to all at £2 or \$5 per year, students half price. Members receive PAGE eight times a year, and reduced prices for the Society's public meetings and events. The Society has the status of a specialist group of the British Computer Society, but membership of the two societies is independent.

Libraries and institutions can subscribe to PAGE for £2 or \$5 per year. No other membership rights are conferred and there is no form of membership for organisations or groups. Membership and subscriptions run from January to December. On these matters and for other information write to Alan Sutcliffe.

Please send items for PAGE: news, views, pictures to John Lansdown or Alan Sutcliffe.

SEVEN YEARS OF ARTISTIC COMPUTING

By some astounding oversight I didn't go to Event One, but I had gone to Cybernetic serendipity in October '68. At that time I was interested in Kinetic Art, and I remember being most impressed by the electronically controlled objects and environment. I didn't pay any attention to the computer graphics until much later.

I came to London to 'study' sculpture at St. Martins School of Art, but I quickly found out that the contemporary forms of sculpture bored me rigid. My main interest, Kinetic Art, was heavily technologically dependent and hence expensive, certainly well beyond the resources of a student grant and the school materials allowance. So I set about looking for an alternative. I tried using animated films simulating the effects I wanted directly, thus avoiding the expense, technical problems and limitations of building mechanisms. This worked up to a point, but I then had a problem with the labour involved in hand animation; I did not like it. At about this point in time ripples arising from the impact of Event One started coming my way. Malcolm Le Grice, a tutor at St Martins, was involved with the embryonic Computer Arts Society and with the Robert Street Arts lab or "Institute for Research in Art and Technology" (IRAT). Somehow or other Time Sharing Ltd had lent them a teletype and an account number free. Malcolm suggested that the images I wanted could be generated by computer, and demonstrated this terminal to me. At about the same time I went to see George Mallen at Systems Research in Richmond, and he recommended the forthcoming Computer Arts Society weekend programming course at ... Time Sharing Ltd! Well, I went along, and I liked it enormously. From then on I regularly tried to write little programs, then medium ones and so on. In the process I learnt to type, which is very useful, and re-learned my maths. That was the only programming course I ever went on, after that the computer did all the teaching.

You may well be wondering what happened to the sculpture course — I remain eternally thankful for the tolerant attitude of the tutors at St Martins. They could have insisted I was there to learn about sculpture, but in fact they let me go my own way and gave me a 'First' at the end.

From St Martins I went on to the Royal College of Art to do a 2 year project on Computer Animation. I was able to set up a relationship between the Atlas Computer Laboratory at Chilton and the Royal College of Art, thus allowing me access to the lab's computer and microfilm plotter.

Two years later I had made several short film sequences and had collected an MA. Then came the problem of finding a job.

I wanted to pursue both the Research and Commercial sides of Computer Animation, so a full time job was not on. Luckily, the Computer Aided Design Centre in Cambridge took me on on a 4-day-a-week basis for 15 months, while I pursued various project proposals via the Royal College of Art during the other 3 days a week.

I am still based at the Royal College of Art, and continue to use the facilities at the Atlas laboratory. I have recently finished a film project which was co-sponsored by the Science Research Council and the Arts Council.

The project was unusual in that it had two aims; one aim was to make a number of animated sequences for an Arts Council sponsored film called 'Relationships'. (The film explores geometric forms found in nature and their use in early religious architecture and symbolism.) The other aim, which was the SRC's interest, was to use the Atlas lab's own Sprogs animation system to generate these sequences. As Sprogs hadn't been used to make a complex film before this project was to be a guinea pig. At the end of the project Sprogs had been improved by the addition of a scanning writer and a number of high level animation routines, and I had a number of useful ideas and test-case problems.

My current project is an investigation of character animation (cartoon characters, not letters) and the development of our computer animation techniques to be able to cope with it. Brian Wyvill, who has recently completed a PhD on graphics languages at Bradford, has come to the RCA to work with me on this project. It should be an exciting year.

The Commercial application of Computer Animation has not yet happened. Hopefully that will be the next step. Whatever way things go I hope to continue to make a living by using computers creatively.

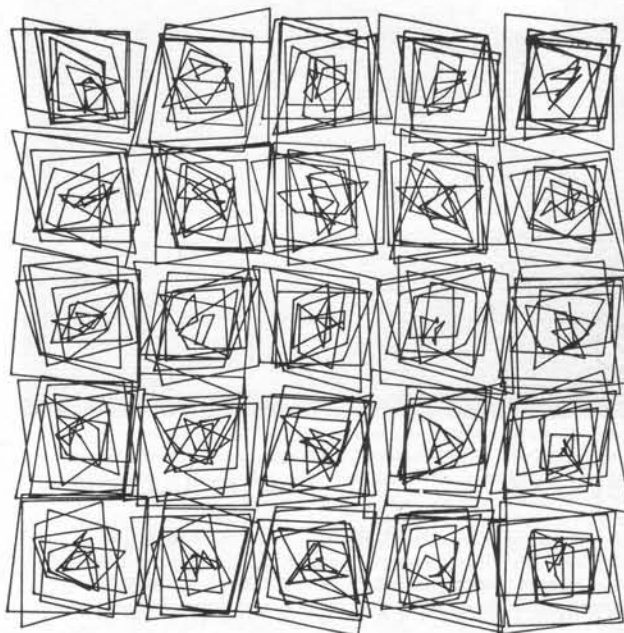
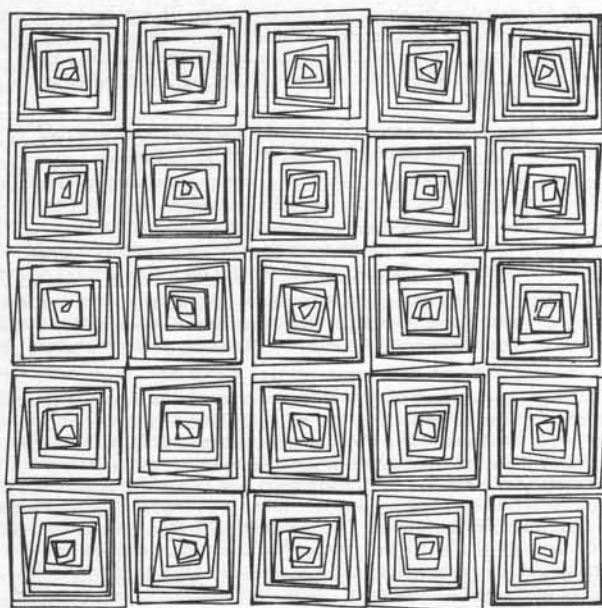
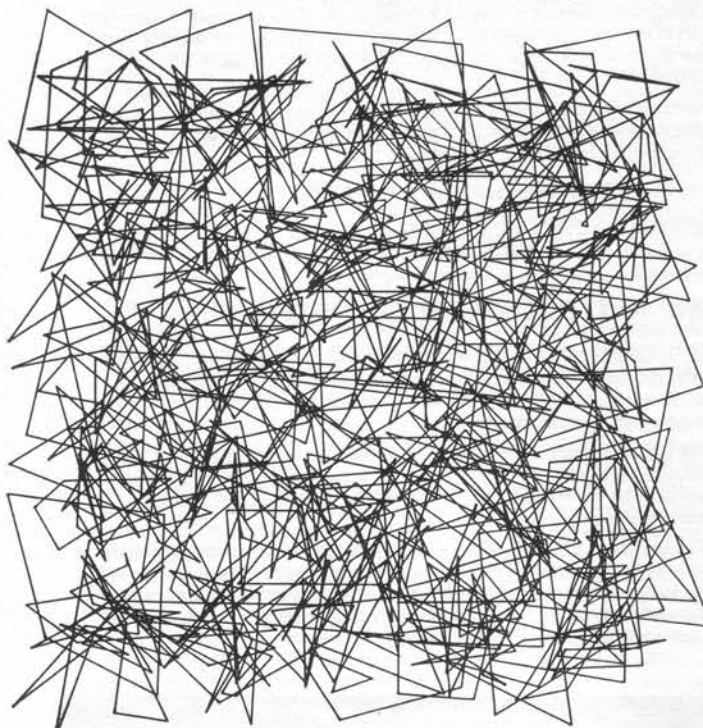
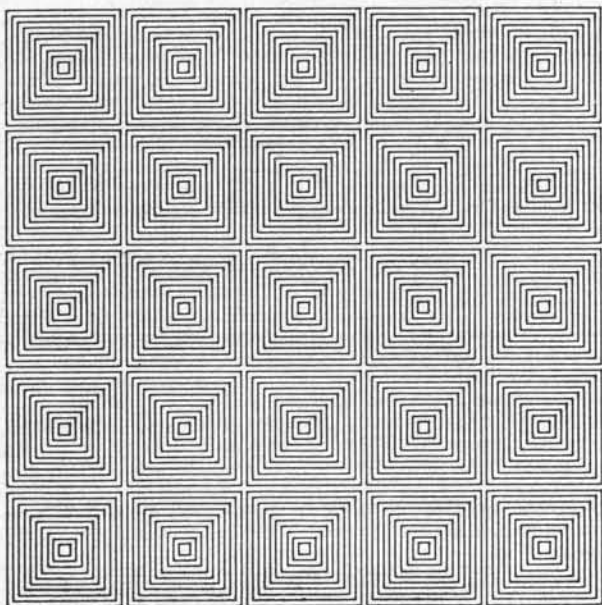
Colin Emmett

COMPUTER ARTS SOCIETY ADDRESSES

Chairman: Alan Sutcliffe, 4 Binfield Road, Wokingham, Berkshire
Secretary: John Lansdown, 50/51 Russell Square, London WC1B 4JX
Dutch Branch (CASH): Leo Geurts and Lambert Meertens, Mathematisch Centrum, Tweede Boerhaaverstraat 49, Amsterdam, Holland.
US Branch (CASUS): Kurt Lauckner, Mathematics Department, Eastern Michigan University, Ypsilanti, Michigan, 48197, USA

LONDON MEETINGS

7.30pm on the 1st Monday of each month at John Lansdown's office, 2nd floor, 50/51 Russell Square, London WC1. Members and guests welcome. No charge.



TRANSFORMATIONS

from a series of 21 graphics

VERA MOLNAR

The images I make consist of an arrangement of simple geometric elements. There are two reasons for this choice. The first of them is my personal preference. I like simple patterns: squares, circles, triangles. It is a statement, a matter of fact, and needs no justification. The second reason is more objective. My aim is - in common with so many painters of the past - to be able to create a valid work of art in a much more conscious way. Conscious way does not mean the suppression of intuition, but its reinforcement by a cognitive process; it does not mean that painting becomes a matter of logic. Art at its inception is essentially intuitive. It is at the phase of elaboration that intuition needs control and aid by cognition.