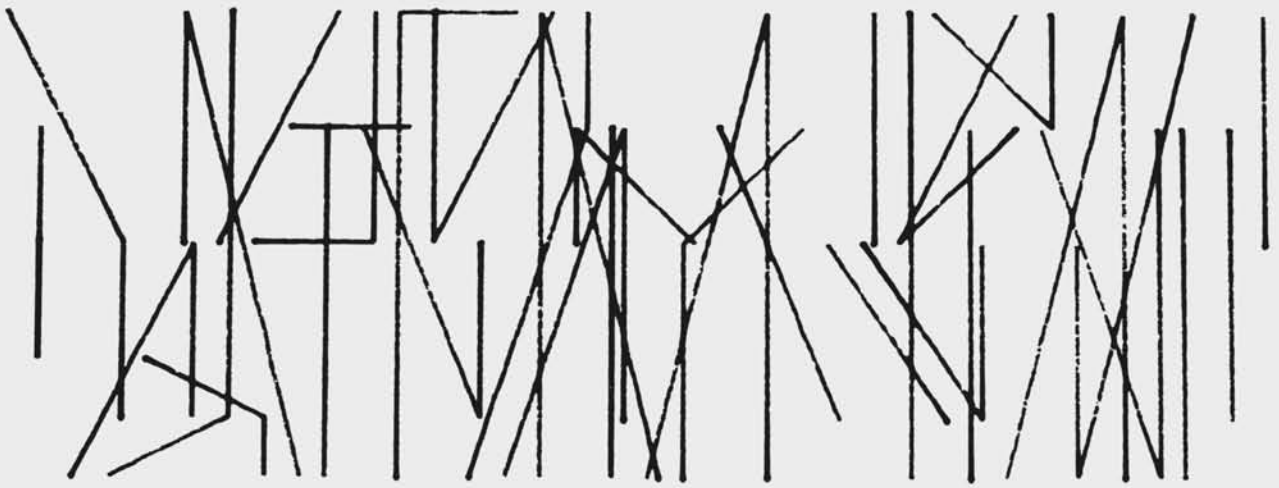
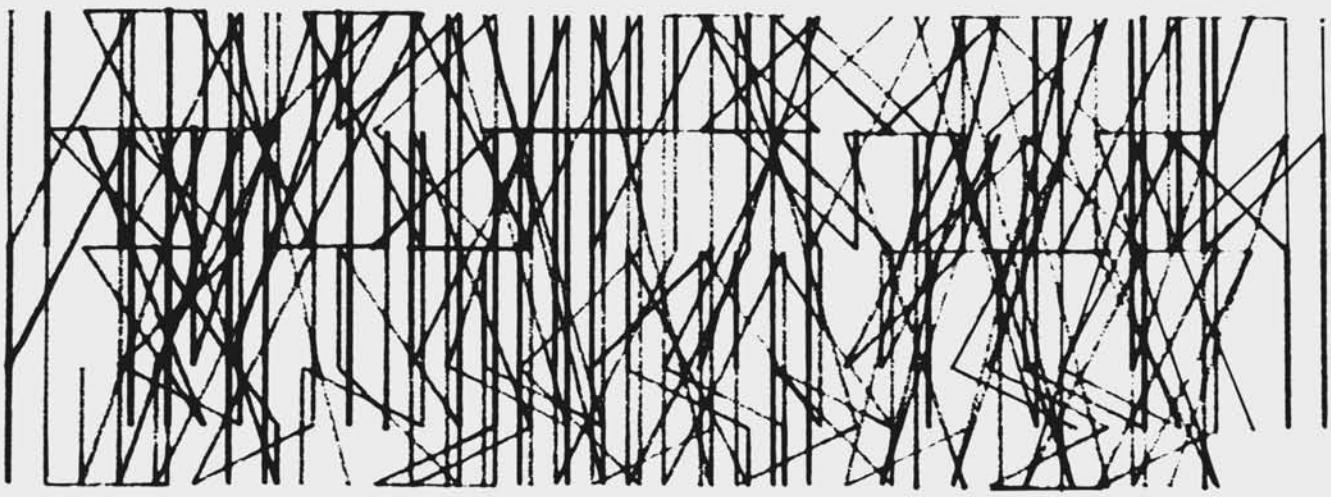
PAGE47

COMPUTER ARTS SOCIETY QUARTERLY JAN 1981





VERA MOLNAR

THE ROLE RANDOMNESS CAN PLAY IN VISUAL ART

PAGE

Number 47 January 1981 Editor: Dominic Boreham

COMPUTER ARTS SOCIETY QUARTERLY

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PAGE provides an international forum for the exchange of information, views and theories relating to the creative use of computers in the Arts. Publication of articles does not imply that the views expressed by contributors are necessarily shared by the Editor, nor should they be taken to represent the general policies of the Computer Arts Society Committee.

PAGE acknowledges financial assistance from the Arts Council of Great Britain.

Apologies to Manfred Mohr and Tony Longson

The Editor and the printers of PAGE45 wish to apologise for the poor quality of several printing plates for that issue, which affected illustrations of works by Manfred Mohr and Tony Longston. In particular, Manfred's drawing P-190/B on page 11 is misrepresented to the extent that the width of line appears to increase towards the centre of the drawing. In the original, all lines are of equal thickness.

Cover: Vera Molnar, series: "10 Points", 1979. class: 3, interval: 3
Vera Molnar, series: "10 Points", 1979. class: 10, interval: 3

THE ROLE RANDOMNESS CAN PLAY IN VISUAL ART
by VERA MOLNAR

The task of the painter is to cover a surface with forms (in picture processing and other theories of picture transmission colour is also considered as a form) in a very particular way, in order to obtain an aesthetic situation, called a picture. This situation is generally described in terms like "harmony", or "beauty". Since we do not know what these terms mean, I will try to avoid them. We don't know either what "aesthetic situation" means, but at least this notion is less used and has fewer philosophical or literary connotations.

One of the best definitions of painting was given by the French Nabis painter Maurice Denis, who said: "Se rappeler qu'un tableau — avant d'être un cheval de bataille, une femme nue ou une quelconque anecdote — est essentiellement une surface plane recouverte de couleurs en *un certain ordre* assemblées". Some 600 years before him, Giovanni Boccaccio said almost the same thing in astonishingly modern terminology: " . . . sforzasi il di piutore che la figura dipiuta da sé, la quale non è altro que un poco di colore con certo *artificio* posto sopra una tavola, . . . "

So the first problem in making a picture is the choice of forms and colours, that is to say the constituent elements. There are at the disposal of the painter elements of various types. For example, elements taken from nature: human, animal, vegetable, mineral forms, and elements of landscapes. All these can be articulated by means of all imaginable transformations, transpositions, deformations, schematisations and combinations. Another type of constituent elements for picture making are abstract forms having very little or no relation at all with the representation of the visual world. They may be simple and regular geometric forms, or more complicated, irregular ones.

The choice of elements seems to be arbitrary, every painter's selection is a function of his artistic taste, of his temperament, of his field of interest or of the school to which he is affiliated. We might admit that a valuable artwork can be built up using any type of element.

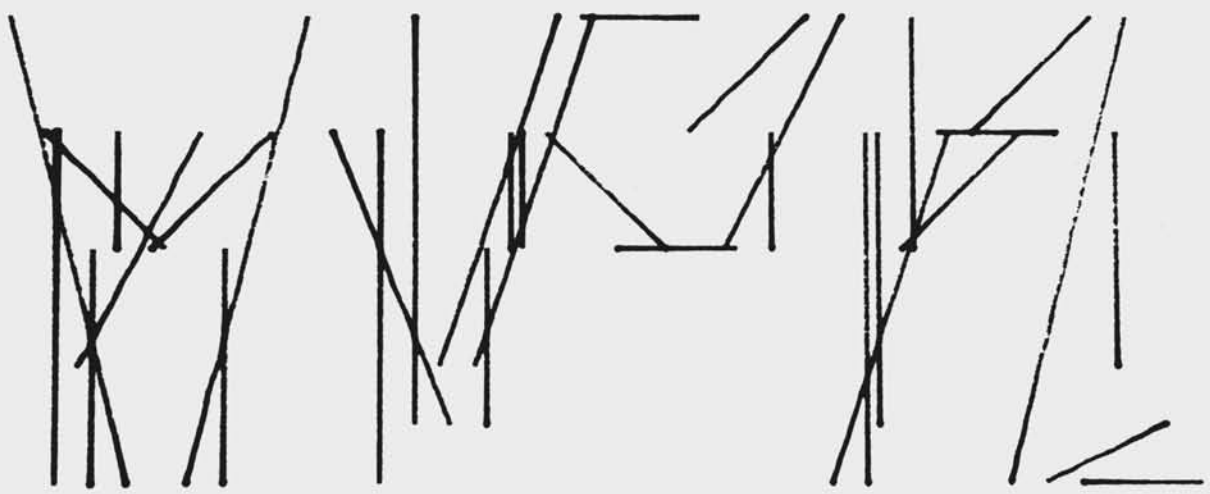
So, if I have chosen at the very beginning of my painting activity the most simple and regular geometric forms, this fact is not due to the conviction that they are "better" or "more beautiful" than other forms, or that they are privileged forms having the qualities necessary for building up valid visual art. This cohice is to be considered first as the result of my subjective taste: I like the plastic strength of geometry, I like the rational purity of mathematics.

There is also another, less emotional reason for my choice: these elementary forms are easier to describe, to manipulate, and control. One can more easily proceed with their construction, following rules which the painter gives to himself.

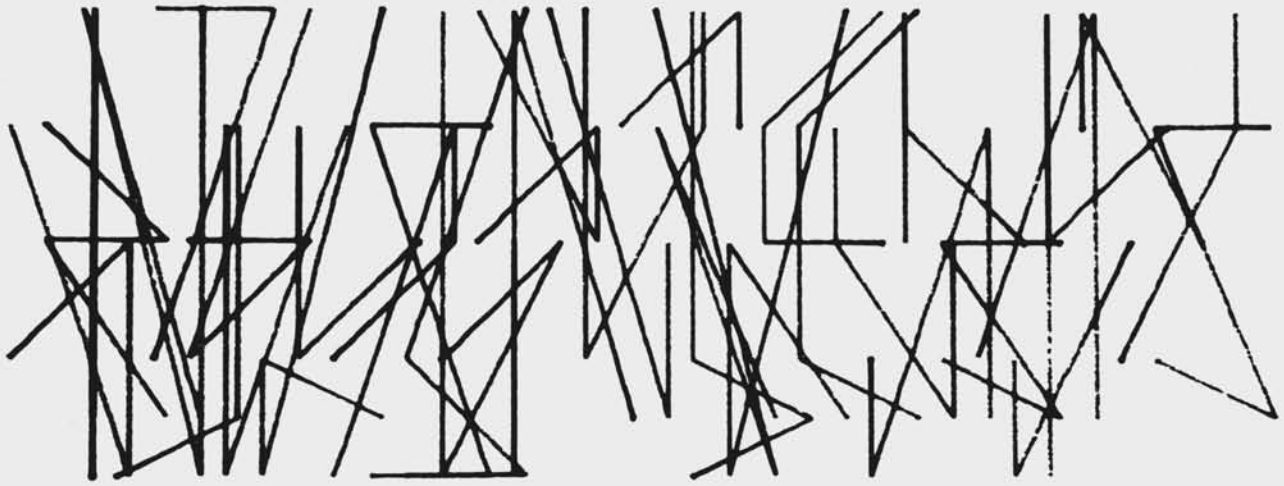
The third reason for my cohice is that it seems to me that elementary geometric forms are less likely to be interpreted in a representational way by the onlooker, who often tends to project all kinds of semantic content which are irrelevant to the purposes of the painter.

When the initial selection of the constituent forms is done, the second question arises: how to decide the procedures for assembling the chosen elements? Are there constraints, or is the painter free to take up all kinds of assembly rules? In the case of using elements representing nature, there are obviously constraints: a human body has two legs, two arms, one head. He can move and behave only in a limited way; even a monster has an anatomic constitution. In a landscape, the trunks of the trees are under the foliage, there can be only one sun shining above them (from a compositional point of view, two or even three suns would often be more satisfactory). It is a fact that painters from the early Maniéristes of the XVIth century to the Expressionists rebelled against these "natural constraints".

Working by means of non-figurative (abstract) elements, the painter's freedom is apparently total, he can do anything he wants. But is this freedom really actual? "Un certain ordre" said Denis; an "artificio" said Boccaccio. Every painter has



Vera Molnar, series: "10 Points", 1979. class: 2, interval: 3



Vera Molnar, series: "10 Points", 1979. class: 4, interval: 3

daily to experiment in trying to make an assemblage of forms, to build up a composition. The result, at least at the beginning, is seldom satisfactory. But after a series of unfortunate essays, suddenly something satisfactory appears. He realises this "ordre", this "artificio", emphasized by Denis and Boccaccio. What is the reason that this particular assemblage is better? More precisely, what has the painter to do to find satisfactory solutions among the millions of possible solutions? This was — and is — the central question for every painter, at least since the Renaissance.

If we put aside the Romantic way of thinking and don't admit that the artist guided by his genius can intuitively always find the perfect solution, we have a few methods giving us some guidelines in picture composition.

The first and very obvious one is to turn toward classical rules of composition which we learned at the Academies, in the Museums and in the old aesthetic treatises, such as the law of regular repetition, the diverse symmetries, composition in the form of a triangle, of a pyramid, balances, rebalanced equilibrium, golden section, Fibonacci series, modulor, etc. But following an attentive analysis of these "recipes", we realise that they are restrictive and arbitrary; they correspond only to a narrow fringe of the plastic sensibility. In any case, they constitute an arsenal of used laws, rehearsed over the centuries.

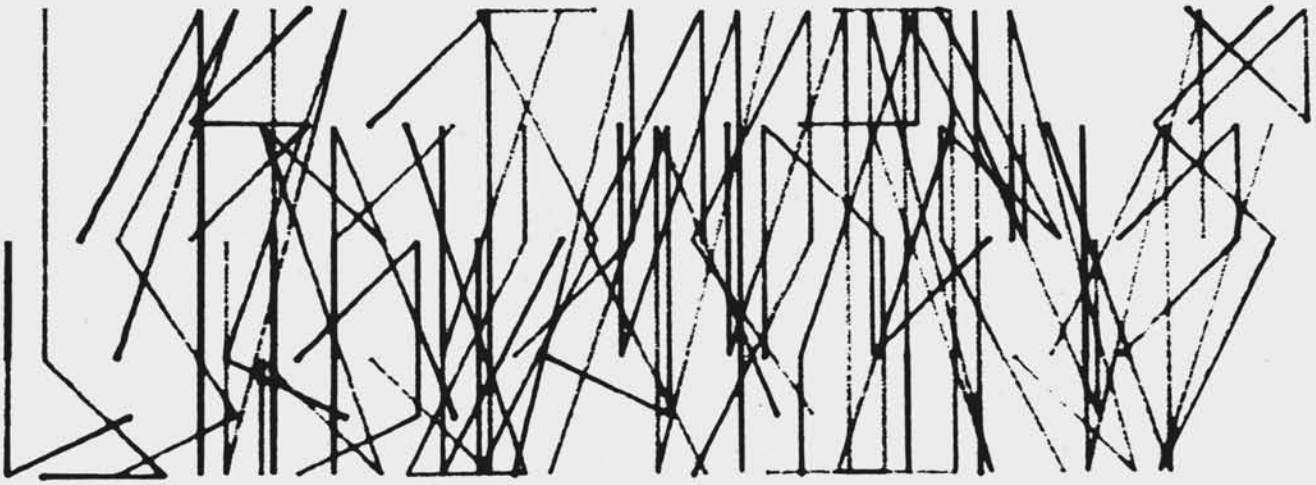
Most artists cannot accept these laws, which have very few connections with the problems, the taste and the imagination of the present. They desire — and this is a natural desire of all creators — to realise something new, something never seen. In a quite spontaneous way, they try to work "against" these rules, to do something contrary to that which the Ancients advised. Paul Valéry said: "On construit seulement contre"; "Countercomposition" is the very significant title Van Doesburg gave to some of his works. But one can hardly go against the classical rules because of the psychological constitution of man: things which were once known or seen reappear naturally with great vigour. Social factors intervene also in creation: history gave such power, such "prestige" to old rules, that they loom up again and again in spite of the wish of the artist.

But there are also some painters who don't want to reject or forget ancient laws. They are in concord with Juan Gris, who said that the value of a painter depends on the quantity of past he is carrying. This assertion seems to be true and not true at the same time. Of course — everybody will agree — all real artists have to be acquainted with the historic chain of art works and art theories. This knowledge and this understanding makes the difference between the work of real artists and the works of all these technicians trained, for instance, in computer manipulation, having some spare time to make "artistic" amusements. The difference between the production of an artist and that of a "kitsch-maker" is at least partly the result of the degree to which the artist has mastered his cultural luggage.

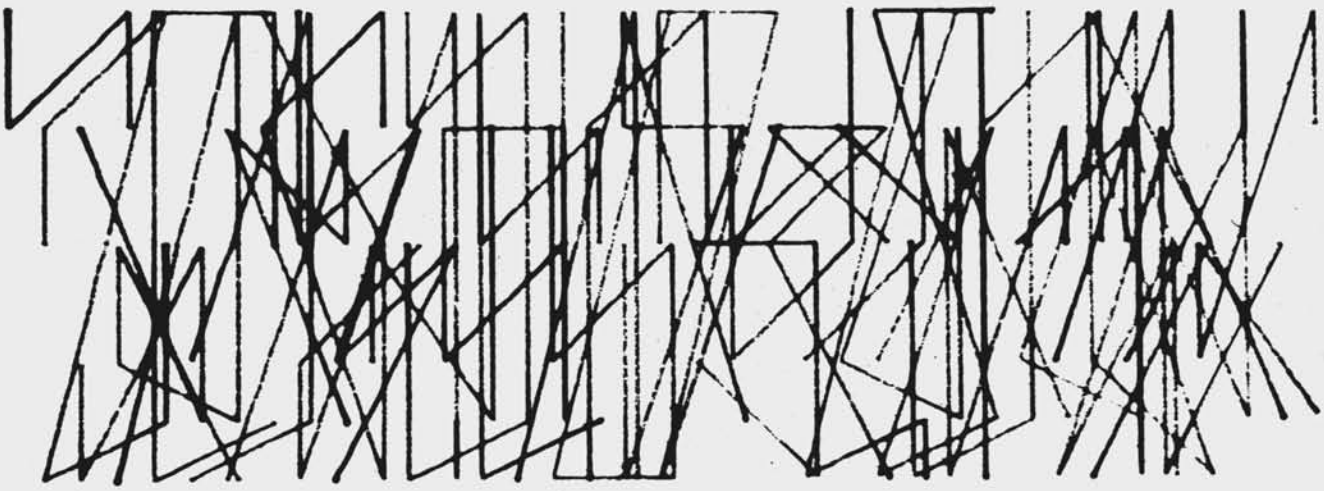
The symbol of this double orientation of artistic creation is the Roman god, Janus, having two faces: one is looking backward, meditating on ancient beauties, but the other face turns away from the past and is looking forward, toward new, never seen images. This double phenomenon is perhaps not so contradictory as it seems, it is, rather, complementary.

For Janus, looking forward, the cultural heritage is limiting and heavy. Instead of helping in creation, it may hinder it. One can maintain also the contrary of Juan Gris' idea. "We will fight with all our power" — said Majakovszkij in 1923 — "against the danger that dead art might bring his methods into modern art". But which is the method able to win this fight? How to exceed this cultural heritage of pictorial composition, how to get rid of these "mental ready-mades" which are fettering all imagination with their encumbering presence? How can we organise forms and colours in a way we have never seen before?

There are two ways to resolve such a problem. The first of them would be to execute all dispositions of the chosen elements which combination can produce, without discarding even one. In this way we will realise them all: these we have already seen and also these we have never seen. But even if we choose a set of a very few and very simple elements, such a project is obviously unrealisable. The number of virtual pictures is so high, that even assisted by a computer — an ideal tool for such a systematic investigation — one cannot have them all executed and, a fortiori, a human being is not able to glance through them and to compare them all.



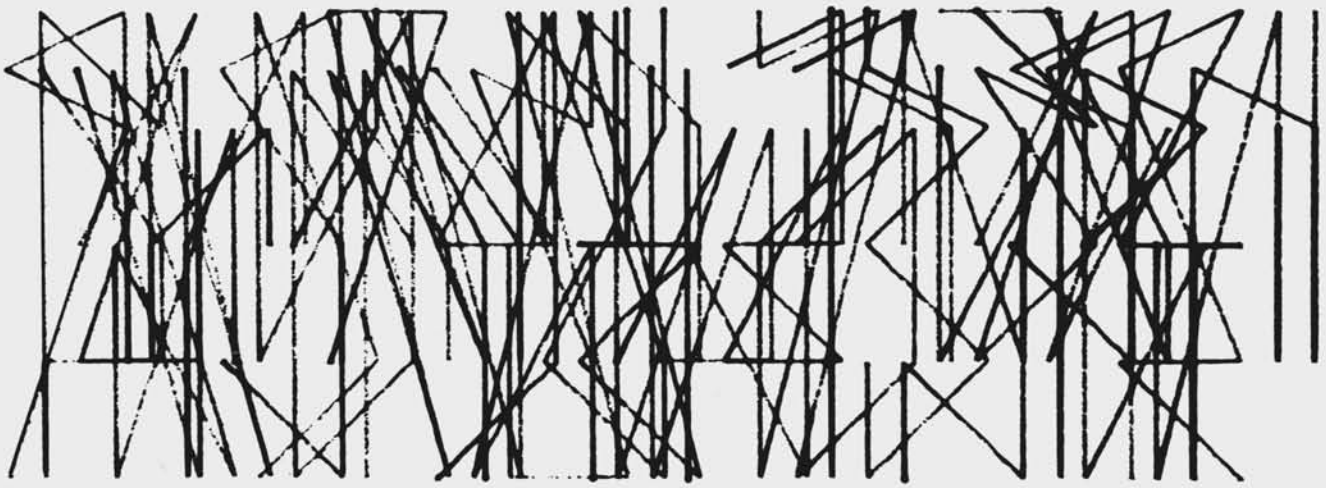
Vera Molnar, series: "10 Points", 1979. class: 5, interval: 3



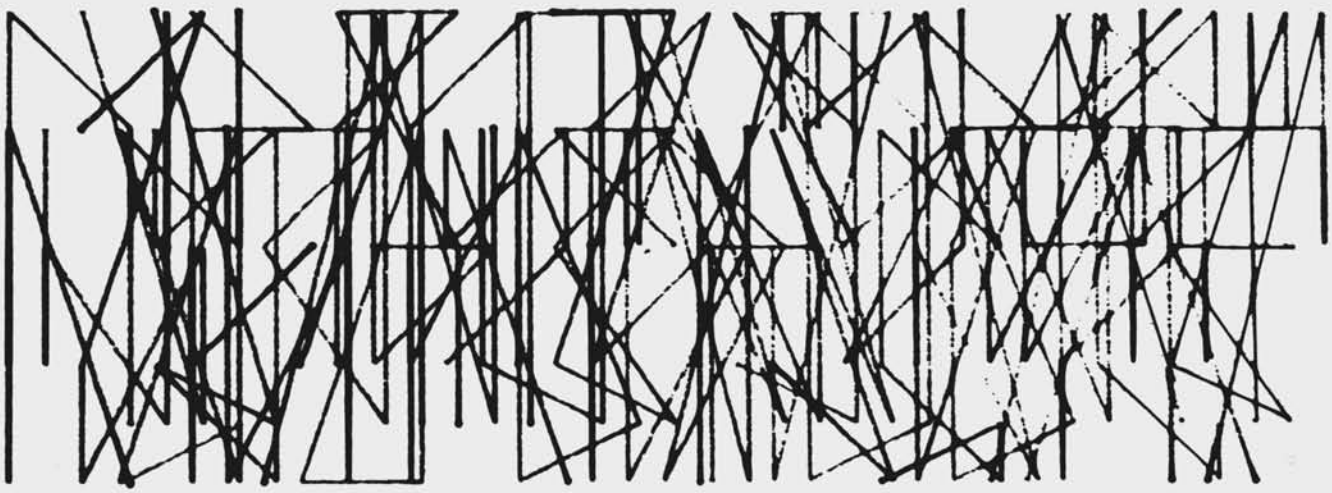
Vera Molnar, series: "10 Points", 1979. class: 6, interval: 3

There is a second method which will be, by the way, my proposition: the sounding by ordered samples. Since we are not able to examine all the images that are possible, we determine in an arbitrary way a limited number of areas covering the whole field of possibilities, and out of every area we visualise a certain number of images chosen at random. It is very important to employ a random procedure. In fact, if the choice is not done randomly, we reintroduce criteria of classical art. Today, this technique can be realised easily using a computer, and all the randomly chosen images can be visualised on a CRT screen in order to make comparisons. The number of extracted images can be determined by what seems necessary for our work. The second step is to determine, inside the area to which we gave our preference, a limited number of smaller areas, and inside these areas we continue the selection further and further, using the same method of sounding by ordered samples to try to find the part — the domain — inside of the preferred area corresponding to our interest and our sensibility. Going further inside the part of the part . . . of the preferred area, we can finally find the pictorial domain for which our fuzzily working imagination searches.

Combining the systematic work by precisely determining the areas, proceeding always by the same sounding inside each area, and their exploration by randomness, we can expect to achieve two objectives. The first of them is the elaboration of really new images; groups and series of images we would never be able to generate following the classical rules of picture composition. Secondly, we have introduced an important and useful method into the process of artistic creation. Since we can explore selected areas of pictures within very precisely defined parameters, we can reach in their finest details the new images we had only in a quite uncertain, blurred way in our mind. By employing this technique, we might be able to combine originality with an extremely high subjectivity. And originality and individuality have always been two important objectives of all artistic activity.



Vera Molnar, series: "10 Points", 1979. class: 7, interval: 3



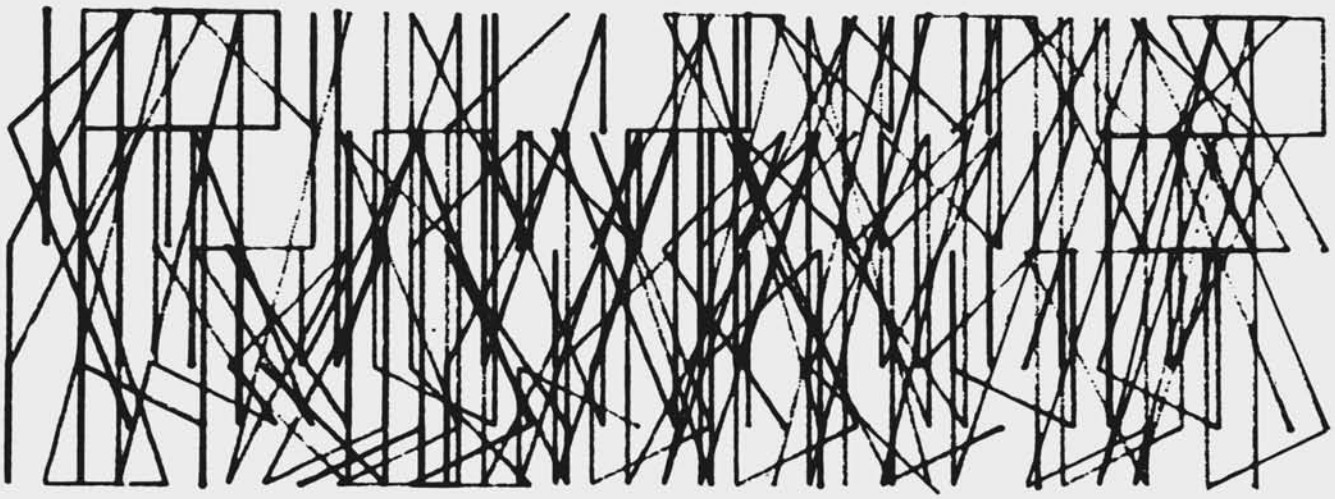
Vera Molnar, series: "10 Points", 1979. class: 8, interval: 3

A first objection can be raised. The pictures produced by this random-aided investigation are finally chosen and judged by the painter, who is — as we said — at least influenced if not bound by his cultural heritage. His choice will still be influenced by classical criteria, even if he doesn't want it to be. We have to agree with this objection, but we can say that the pictorial propositions, generated by randomness, subject to the painter's choice, are not an outcome of shabby cultural routine. They may be totally new propositions which never existed before, either in museums or in nature; we might call them "unimaginable images".

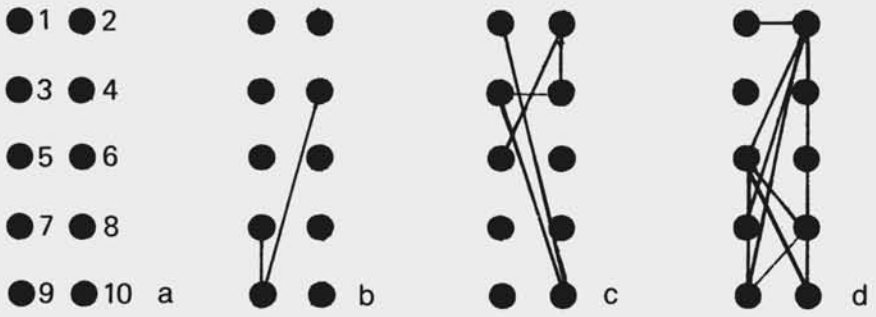
The use of randomness in the praxis of visual art is not an evasion of responsibility, it is not a lazy or escapist attitude. There is no doubt that the painter remains — as he has always been — the sovereign decider of what and how he will create. Randomness is only a tool or a technique to help the artist in his investigations.

Considering this approach in a superficial way, there might appear some resemblance between the method I propose and the attitude of some surrealists using "automatic" techniques, action or gestural painters, abstract expressionists, etc. But this would be a misunderstanding. I am not interested in randomness for its own sake, just the contrary; I propose to channel randomness and to use it as a tool in research whose aim is to elaborate some exact knowledge in art. It may seem to be a paradox: I employ randomness in the elaboration of my work at a very precise moment in order to help me ultimately to work in a well-defined, lucid way, beyond randomness and as far as possible free of cultural clichés.

To clarify the method I have presented, I should like to illustrate the procedure step by step, to explain the development of the drawings reproduced here. These drawings, actually kinds of structures, are built up by the



Vera Molnar, series: "10 Points", 1979. class: 9, interval: 3



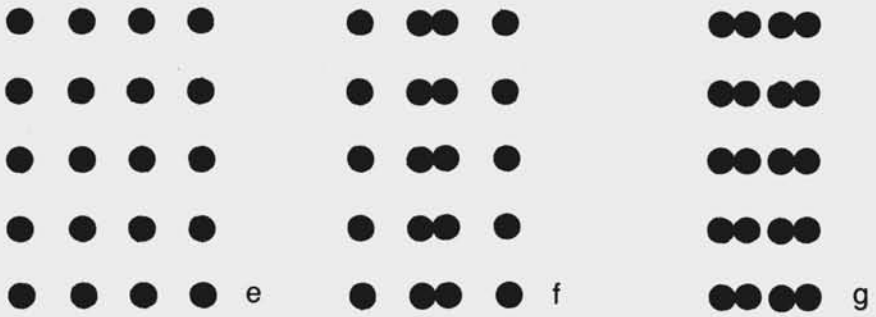
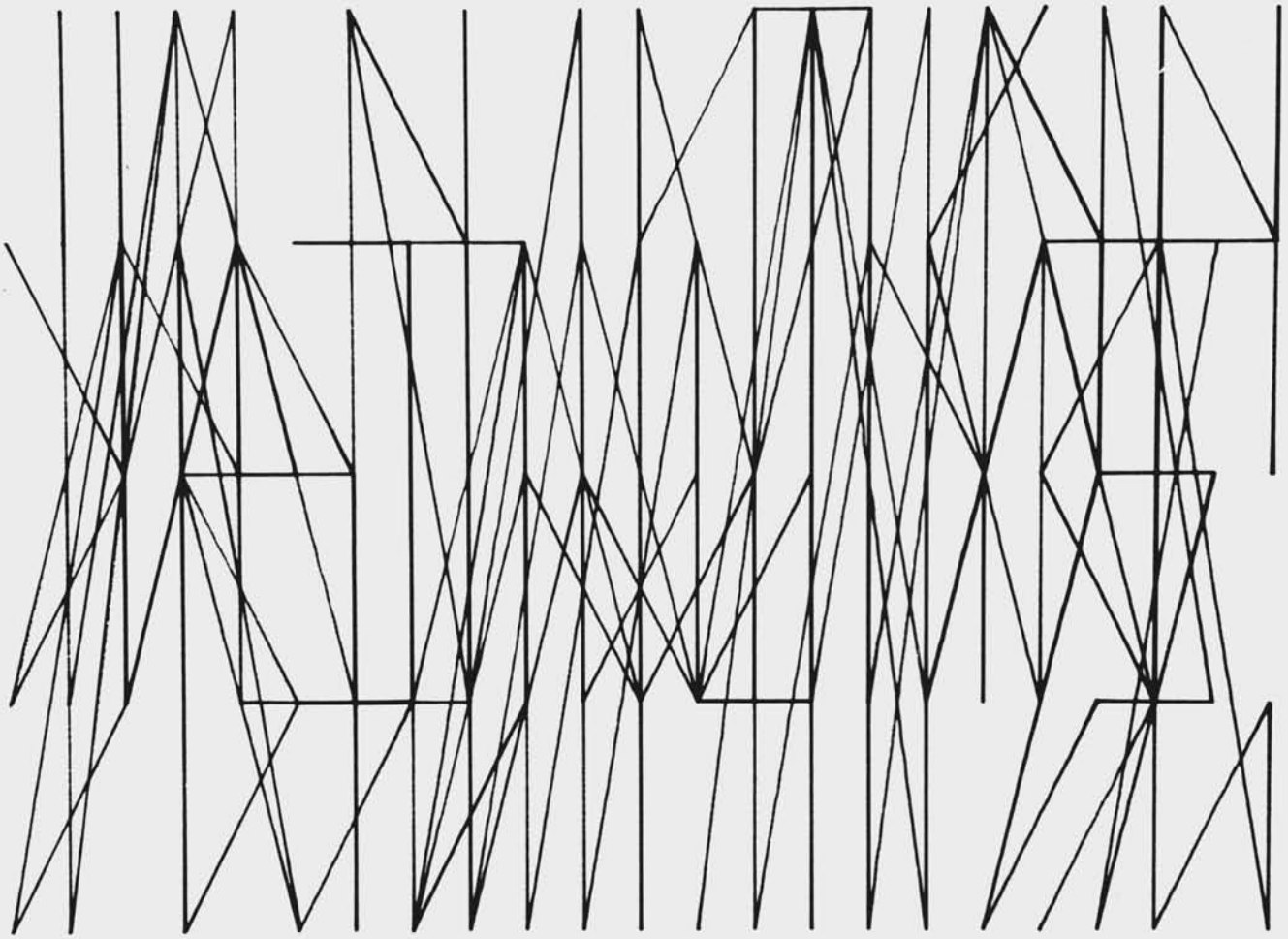


Figure 1

juxtaposition of single lines, having an appearance of great variety, but constucted always on the same fundamental framework. There is a maximum of similarity of the constituent elements and at the same time a maximum of difference. Each single line has been generated by joining some, or all, the 10 points of the fundamental grid of 5 rows and 2 columns (figure 1, a). I obtained these lines by randomly joining successively 2, 3 and up to 10 points of the grid, that is to say, I produced 9 different classes of lines (figure 1, b : class 3, c : class 6, d : class 10). In order to see how these lines of different classes look, I displayed on a CRT screen 50 samples of each class. To avoid unpleasant repetition, I introduced, step by step some constraints. Firstly, each chosen point must not occur a second or a third time consecutively, (later I also tried and introduced some other constraints). I made a lot of comparisons of the 50 samples of each class. Also, I had the opportunity to obtain the opinions of onlookers, both specialists and non-specialists, since these drawings are easy to project on a screen. Examples from these 9 classes are shown in the accompanying illustrations.

So now, what about the distribution of the grid? To decide on the intervals, I tried to use different values for determining the distance. (figure 1, e, f, g). This time, I did not use randomness; I went from the more sparse to the more dense display by means of regular steps, and realised samples of drawings having different densities. When I found the interval I preferred, I was able, thanks to the computer, to do very small modifications in order to find the exact densities of the drawings which I preferred. So, by an empirical method, I was able to realise drawings which previously had existed only in a quite uncertain way in my imagination.



Vera Molnar, series: "10 Points", 1979. class: 10, interval: 5

ARS ELECTRONICA 80
Artistic Creation by Electronic Means
by Susanne Päch

In 1979, within the framework of the International Bruckner Festival, Ars Electronica was called into being as a special event in the fields of electronics, art and cultural activity. In 1980 Ars Electronica again provided a forum for electronic art in all its aspects, as well as a focus for discussion on how art, technology and society interact. Above all, the event provided the opportunity to see and hear the latest developments in artistic instruments and methods utilising electronic control systems and computers. The population of Linz and surrounding areas could participate in the festival by TV, radio and even by telephone, in addition to the numerous live presentations. Ars Electronica is organised by the Linz Special Events Planning Corporation and the Austrian Broadcasting Company, Regional Studio Upper Austria.

The performances in the evening were the most interesting events for the public. Ars Electronica started on the 8th of September with the "Linz Steel Symphony", a musical performance by Klaus Schulze, (Berlin) and steel workers and machines of the iron and steel concern VOEST-Alpine in Linz. From the workshops, the sound of machines and the images were transmitted live into the concert hall and were used by Klaus Schulze for his composition. Unfortunately, Schulze missed an opportunity. For the first ten minutes the idea of the project was realised, the music and the images from the video-sizer became an impressive composition; but the following fifty minutes had nothing to do with steel – only the end concerned the steel workshops again.

The second day, Anton Bruckner's 4th Symphony was transmitted at the open-air concert in the Danube Park. Although it was raining, 30,000 people came together to enjoy the concert and the sky sculptures by Otto Piene, (Cambridge/Düsseldorf). These plastic tubes were filled with helium and towered up to 80m into the sky.

Recent innovations were submitted for the competition "Grand Prize of Ars Electronica"; the most original new development in the production of electronic sound received the prize. Various new electronic instruments were demonstrated: from physical sounds to electronic and computer controlled wind-instruments. The first prize was won

by Nyle Steiner, (U.S.A.) with his "Electronic Valve Instrument", a wind-instrument of seven octaves, the tonality being controlled by a modulator on the instrument. His performance was accompanied by Thomas Piggott, (U.S.A.) on the "Crumar Computer". Both are professionals; solos by Steiner on his instrument were used on the sound-track of "Apocalypse Now"; Thomas Piggott is a university lecturer in the use of sound synthesizers and has collaborated with Stevie Wonder and Tangerine Dream. Their presentation proved that the music of this new instrument is not based merely on new effects, as we could hear not only new sounds but also some very fascinating new melodic forms and harmonies.

In connection with Ars Electronica 80, a Computer Science Symposium took place in Linz: "Information Systems for the 80's — Trends in Information Technology". Some experts in computer technology, for example Karl Steinbuch, (University of Karlsruhe) and Joseph Weizenbaum, (M.I.T. Cambridge) were not only present for their lectures in the University of Linz, they also took part in a discussion on television.

Three workshop-symposia in the Regional Studio Upper Austria concerned the very special themes of Ars Electronica 80. The moderator of the first workshop: "Electronics in Music: Synthesizer – Computer Music – Digital Technology", was Klaus Hashagen, (Broadcasting Company of Bavaria). Although Oskar Sala, the past master of electronic instruments, was absent due to ill health, numerous well known lecturers participated in this workshop. The first was Robert A. Moog, (U.S.A.) the inventor of the Moog Synthesizer. He talked about the perceptual and physiological preconditions for the construction of musical instruments. Wendy Carlos, well known for the record "Switched-On Bach", reported on the history of the synthesizer and the vocoder, which registers the human voice. Klaus Netzle, (Munich) presented probably the most complicated computer composition system, "Fairlight CMI". With this system any multi-instrumental music can be composed and played in real time. A highlight of this day was Thomas Piggott with his "Crumar Computer". He demonstrated the idea of his system, which is based on contact-sensitive keys. Not only loudness but any tonal dimension can be controlled by the touch. In the course of his explanations, Piggott composed some sequences – a demonstration that amazed even the experts.

Unfortunately, the workshop of the second day, "Literature to Hear and See / Literature in Image and Sound", did not fulfil the title theme. Gerhard Rühm, (Cologne/Vienna), Alain Robbe-Grillet, (Paris) and Bazon Brock, (Vienna/Bonn) introduced by Klaus Ramm, presented auditory poetry, reflections on film aesthetics and conventional interpretations of pictures. Only Heidulf Gerngross, (Vienna) used some electronic means for the production of his "Folk Literature", a collection of quotations from newspapers, paragraphs from detective and science-fiction stories, folk songs, mythological texts and his own works. These sources were fused into a composition with the aid of a computer, and put together as a book with 1280 pages. As might be expected, the result was nonsense – but together with the recitation it was great fun, anyway. In relation to this symposium, it was possible to hear by telephone some experiemental radio plays which featured electronic sound.

The third workshop/symposium: "Electronic Media for Visual Creation" was led by Herbert W. Franke, who had already contributed to the successful conception of Ars Electronica 79. The first lecture was given by Paul K. Hönich, (Haifa) who explained his "Sunpainting", a method of producing coloured and moving pictures, which utilises the sun as a light source. The latest of his developments is a "Light Robot" that is independent of day-light. The inventor demonstrated the function of this robot with some experiments.

The next lecturer was Otto Frühling, (Berlin) with "Rotography – Light Kinetics with Luminous Diodes". These are rotating discs studded with softly illuminated diodes, which can be programmed in various sequences. The discs produce various coloured figures, thus illustrating by example the moderator's thesis that electronics can help to realise the idea of a moving image. Hans-Martin Ihme, who is engaged in light kinetics has passed the experimental phase. His recent "Lightmachines" are controlled by microprocessors, enabling him to produce very beautiful and innovatory light effects running over surfaces and across the room.

The couple Ulrike and Dieter Trüstedt, she being an artist, and he a physicist, presented "Laser-Light-Drawings", accompanied by a performance on a new string instrument, which in addition to being bowed and plucked can also be blown. Their performance proved a drastic contrast to the "Laser Concert" of David Tudor, (U.S.A.), where the capabilities of laser technology were demonstrated as flashily and variously coloured as possible. Ulrike and Dieter Trüstedt showed that the same medium can also produce gentle sounds. In their performance, the circle-modulations on the screen were accompanied by the modulating sounds of Ulrike's instrument, and they produced a rather meditative atmosphere.

In the afternoon, Otto Piene, Director of the Centre of Advanced Visual Studies, Massachusetts Institute of Technology, reported on "Technology as a New Basic Element of Art". Using a great number of slides and video tapes he touched on many themes which had to remain unconsidered this year, such as video art, computer animation, and attempts to include water, fire, steam etc. in the artistic creation. According to Otto Piene's explanations concerning the co-operation between artists and technicians at M.I.T., the ideal of such a co-operation seems to be almost a reality there. So the general reflections at the beginning of his lecture were very important; observing the necessity for co-operation and the mutual stimulation which arises in apparently separated fields. In comparison with this, conditions had not been so ideal for the members of the K & K Experimental Studio, Vienna, who had developed their "Moviophon" without any subsidies. They included it in a socio-critical multi-media presentation. The "Moviophon" produces synthetic sounds which are controlled by light sensitive cells attached to the body.

This year Ars Electronica was well organised and has won a rather encouraging recognition and enjoyed the participation of numerous prominent persons. It is to be hoped that the experimental and progressive character will be preserved in future years.

A WORK IN 36 MOVEMENTS
by William Simons

CHANGES IN 6 PARTS
by Marcus West

A Work in Two Parts is the title of a performance which combines music by Marcus West with a sequence of slides by myself. The "Two Parts" of the title refer to Marcus West's composition *Changes in 6 Parts* on the one hand, and my sequence of visual images entitled *A Work in 36 Movements* on the other, both of which were conceived and produced as self-sufficient works in their own right. In their conception, therefore, neither work makes any reference to the other, and to this extent they remain heterogenius.

The following article is accordingly presented in two sections. The first consists of a brief introduction to the work as a whole, together with a selection of images from *36 Movements*. In the second part, the music and its method of composition is discussed by Marcus West.

The manner in which these two works are combined is very similar to an intuitive, aleatoric approach used by Merce Cunningham (the American choreographer and dancer) in association with other artists, the most notable of whom is probably John Cage. Cunningham's association with Cage rests to a large extent upon a very simple, mutually held aesthetic that dance is dance and music is music. 'Both men' writes James Klosty, an American photographer and writer, 'shared the belief that neither dance nor music need function as dependant of the other, that the two have nothing arbitrarily in common but custom, that their combination is less necessity than reflex, and that they can be advantageously freed of one another's syntax'. Certainly between themselves, as well as in association with artists like Robert Rauschenburg and Jasper John, there exists an unusually consistent, and sometimes baffling preoccupation with the separateness of the different disciplines, for most of which, apart from their respective contributions, no one has an overall responsibility. This can be seen at its most expressive during the actual moment of performance — when the rhythms and phrasings of the dance, unaccompanied by the music, assume a significance of separate importance in relation to those of the music or the lighting or the decor.

A part of the slide sequence has been reproduced in the form of a series of contact prints. These show 20 frames of a section from the work, while the larger illustrations show a further division of this section into a series of phrases. Certain of these phrases recur throughout the sequence, there being no limit to the number of times a phrase or a sequence of slides can be repeated.

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Changes in 6 Parts

In this article I shall make a few comments on the uses of computers in music, describe a computer system (called "Sequemuse") I have implemented, and outline the structure of the piece "Changes in 6 Parts", in whose realisation "Sequemuse" played a vital part. The piece evolved from April to August 1980, and was used to accompany a slide-sequence as described in the companion article by William Simons, but it was conceived as 'absolute music' and I shall treat it as such. "Changes in 6 Parts" embodies features typical of the compositional procedures I am currently exploring, which owe much to my admiration for the music of Steve Reich.

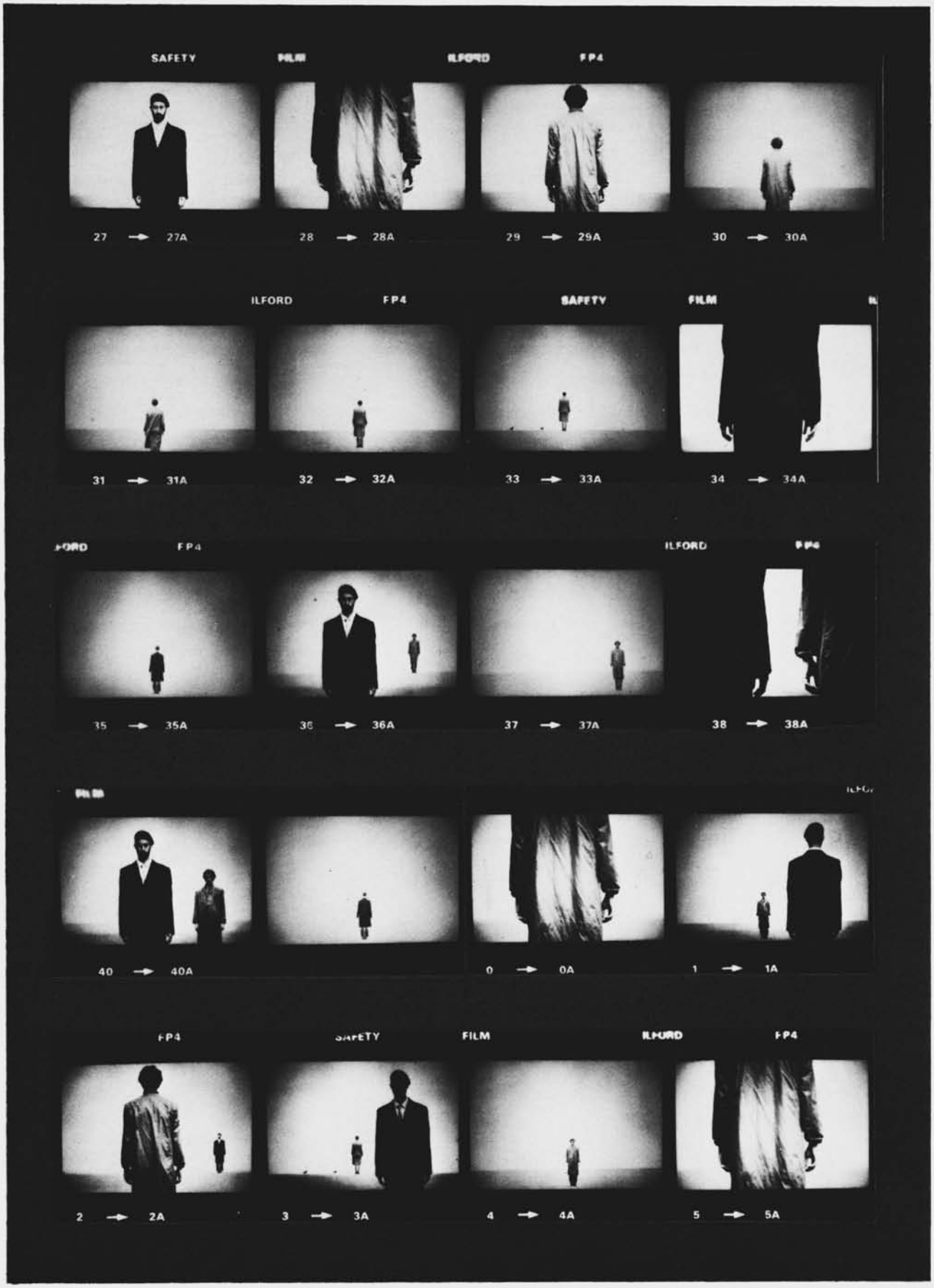
Computers have been used in music in 3 conceptually-distinct ways:

(1) in composition, from the mid-1950's onwards;
(2) in the digital synthesis of sound, from the late-1950's onwards, and
(3) in the control of voltage-controlled synthesizers and other voltage-controlled devices, following their invention in the mid-1960's. In such configurations, which are known as 'hybrid' systems, the computer generates no sound itself, but controls the operation of the synthesizer, which is the source of the sound.

Composition

The main approach to computer-aided composition is exemplified by such workers as Hiller and Isaacson, who used 'monte-carlo' methods to specify melodies and other aspects of music in the 1950's. The technique here is to generate a sequence of random numbers which represents a parameter in the work being produced, and select from these numbers only those which conform to some set of rules which govern the musical attribute one is attempting to impart to the piece. This set of rules (which might be derived from the rules of four-part harmony, for instance) acts as a kind of 'filter', removes from the stream of random numbers any that fail to follow the rules, and allows through only those that abide by them. Other composers, such as Xenakis, extended the application of these techniques, using statistical methods to determine such things as the order in which sections of a piece should be played, and even using them to produce unpredictable and dynamically-changing waveforms.

I find computer-aided composition unsatisfactory for several reasons. Firstly, composition with the 'monte-carlo' type of technique tends to lead the user towards a linear view of music, in which music is seen as being 'extruded' into the present through a kind of statistical nozzle: musical events at any point in the piece are thought of as being highly related to events just past, less related to those of a few seconds ago, even less related to those of longer ago, and so on. This linear view neglects the hierarchical aspect of music, its construction from hierarchies of elements. For example, the musical sequence, a simple phrase played once and then re-stated at a different pitch in the musical scale, is a ubiquitous



William Simons: 20 frames from "A work in 36 Movements"

William Simons: phrases from "A Work in 36 Movements"

feature of classical, serial and popular music, but because it is conceived 'hierarchically' (as a group of elements which is later transformed, as a group, and repeated) rather than 'linearly' (as a series of notes, which just happen to be related in the way sequence-figures are), it is difficult to use statistical procedures to achieve this elementary musical device.

A second difficulty I have with computer composition is that when I approach a new piece, I wish to explore new structures and elements. If I were to formalise a compositional procedure sufficiently for it to be embodied in a computer programme, then subsequent pieces realised using that programme would essentially be mere variations on the first piece it had produced; and this would be so however much I tampered with the variables it permitted me to alter.

Sound Synthesis

The first programme for digital sound-synthesis, which set the pattern for subsequent developments in that field, was developed by Max Mathews at the Bell Telephone Laboratories in the United States. The programme, known as Music 4, offers the composer a formidable degree of precision in specifying the sounds he wishes to work with: the sound is entirely generated by the computer, which builds it up harmonic by harmonic, or component by component, as instructed by the composer. In principle this gives him an unlimited palette of sound with which to compose, but this does not mean that it is a simple matter to use Music 4 effectively. Even though there may be an unlimited number of tone-colours available, the vast majority of these will be undesirable ones: the composer, if he wishes to exploit Music 4 thoroughly, will have to work hard to build up an intuitive grasp of the relationship between the physical characteristics of the waveforms he is defining and the timbres which will result when these waveforms are converted into perceived sound. Music 4 addresses itself to the 'surface events' in music, to the timbral or 'micro-structural' level, rather than with events at a hierarchically-higher, 'macro-structural' level. I think there are several reasons for this. Firstly, it was developed at Bell Labs, where thinking was concerned with the digital encoding of speech, very much a 'surface event'. Secondly, it came towards the end of a decade of (musical) pointillism, in which the surface features and isolated-ness of musical events were more apparent than any deeper structural connections linking them. Thirdly, Music 4 was written with small-scale works in mind, perhaps as much because of the expense and limited availability of computer-time as because of current musical thinking. Any impulse to include the means of easily creating extended pieces would have been suppressed, because of the expense it would have involved.

Later versions of Music 4 incorporated the means of operating at a higher level. It seems to me that using Music 4, without such means, to write a large-scale work is analogous to trying to write a novel while perpetually thinking at the level of the phonemes being used. My compositions are more concerned with the structure of the pieces than with the timbre of their voices, and it is for this reason that I find my hybrid system so valuable. "Changes in 6 Parts" consists of about 4,300 carefully-placed notes: to define that amount of data using Music 4-type programme would take perhaps 2 or 3 weeks of eight-hour days. Using "Sequemuse" it can be comfortably done in an hour or two.

Hybrid Systems

Hybrid systems have been rather neglected in comparison with all-digital systems, but some work on them has been done by Max Mathews, and some interesting and important, indeed pioneering, work in the field has been carried out by EMS in the U.K. I am interested in the hybrid approach because it offers control at what is for me the right level for my compositional methods: I don't want to have to explicitly define every aspect of every note, and I don't want to entrust compositional decisions to the computer. "Sequemuse" allows me to operate on groups of elements in the 'hierarchical' manner mentioned earlier, making the realisation of my compositions relatively easy.

"Sequemuse" offers the following main facilities.

Firstly, it enables the user to express certain kinds of long and complex pieces in a simple, highly compressed manner; this it achieves by permitting him to define his musical information at two conceptual levels.

(a) At one level, he specifies the musical 'raw material' of the piece (in terms of the conventional elements of bars containing notes, each having pitch and duration),

and:

(b) At the second, hierarchically higher, level, he specifies repetition and transformation schemes which he wishes to be applied to this material. The transformations he may apply include transposition (tonal, in a user-defineable key or mode, or chromatic), inversion, rhythmic augmentation and diminution, rhythmic inversion, retrogression, sharpening or flattening of selected scale-members, and so on; these transformations may be applied to the bar data singly or in any combination.

An example of data governing part of one of the voices in "Changes in 6 Parts" is:

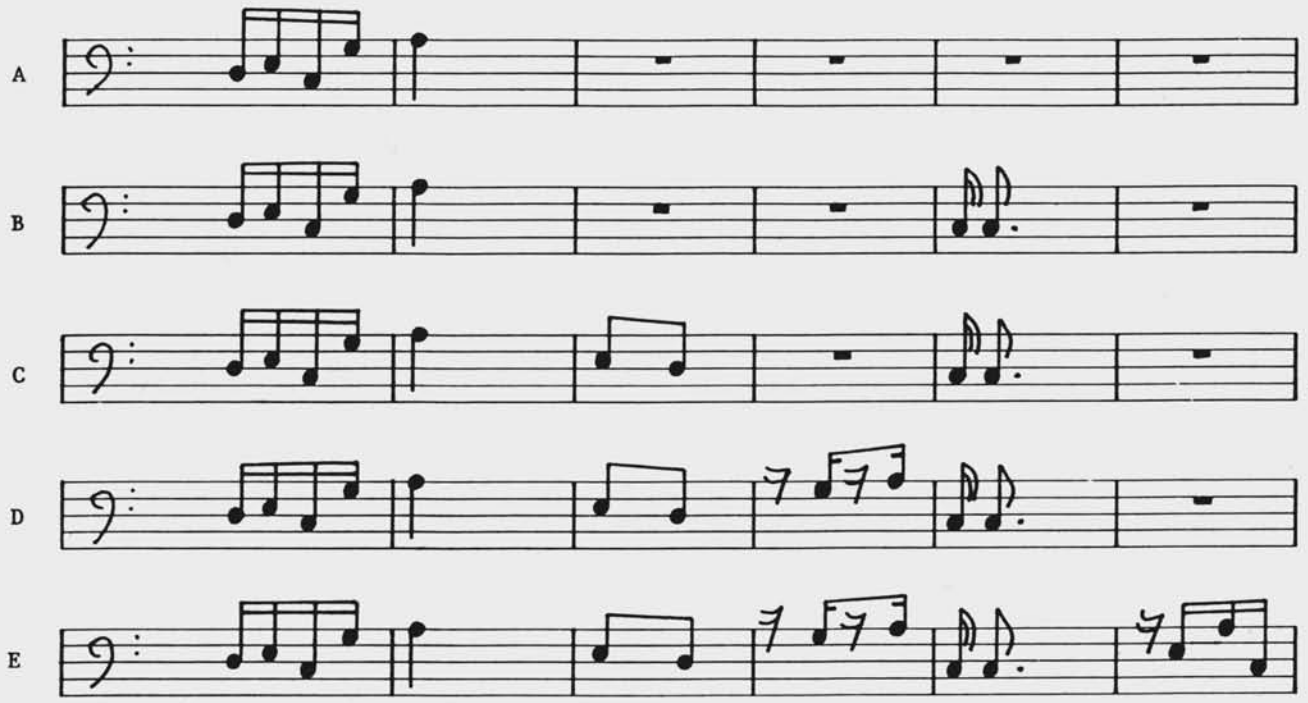
. . . TH10 FD1 FD4 3(1 2 13-16) 7(14 15 6 1 2 13) . . .

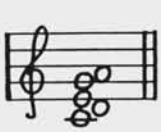
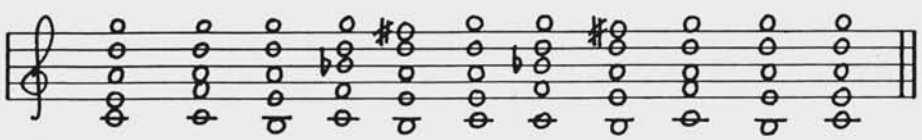
which causes bars 1, 2, 13, 14, 15 and 16 to be played 3 times through, followed by 7 repetitions of bars 14, 15, 6, 1, 2 and 13, with a tonal transposition by an interval of a tenth having been first applied, followed by the flattening of all first and fourth degrees of the currently-defined scale which are present in the bars being played. "Sequemuse" also offers the facility of controlling up to 12 other variables in the synthesizer (e.g. degree of reverberation, loudness of different voices) using programmed control voltages.

"Sequemuse" is an interpreted programme, rather than a compiled one; that is to say, there is no stage at which the final, expanded version of the music exists explicity inside the computer: instead, the computer expands ('interprets') the compressed data as it plays through it. This approach permits long pieces to be defined and stored within a fairly small amount of computer memory.

For a more detailed account of "Sequemuse", see a forthcoming issue of "Interface".

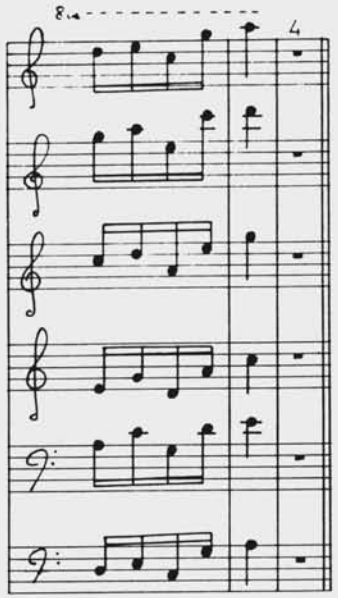
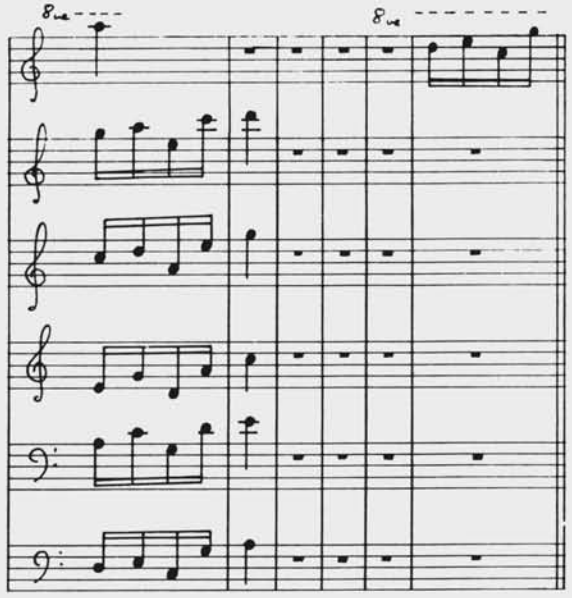
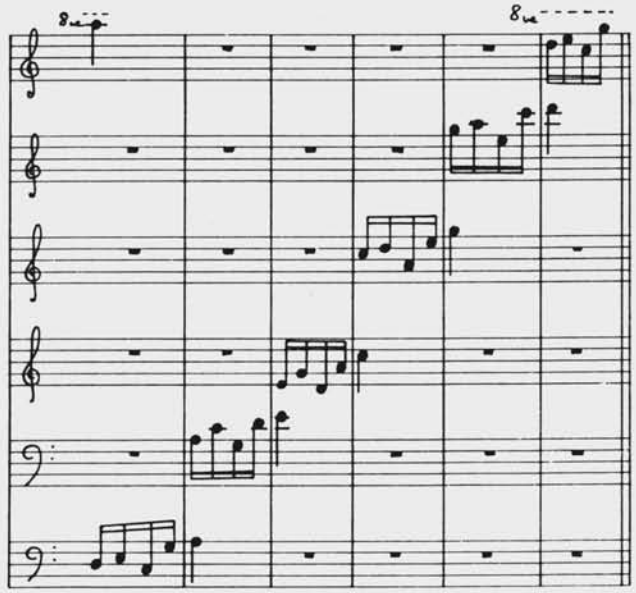
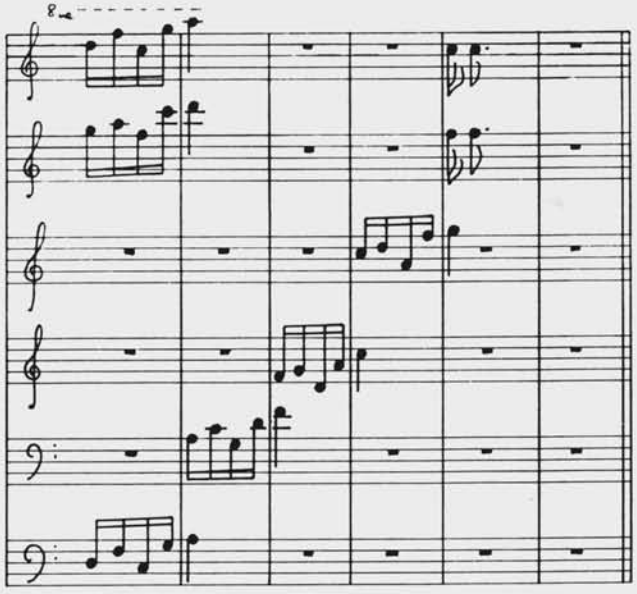
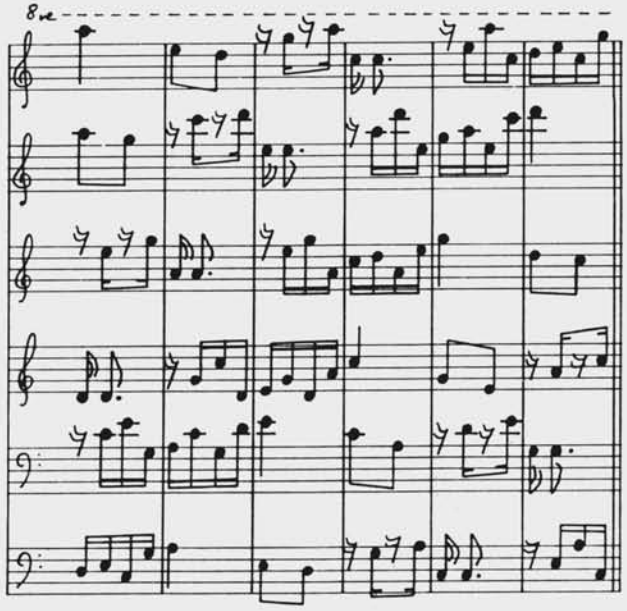
The second main function of the computer is to send the appropriate voltages, correctly timed, to the associated voltage-controlled synthesizer to cause it to accurately perform the music as defined by the user.

ex 1

ex 2

"Changes in 6 Parts" utilises a 6-bar phrase (ex 1) which is used, unsurprisingly, in 6 voices. This 6-voice texture undergoes several simultaneous processes during the unfolding of the piece. Firstly, the phase relationships between the voices change systematically throughout the piece. Secondly, the bars in the main phrase which initially contain rests (bars 3-6) are subjected, one by one, to a process of substitution by single-bar (non-rest) fragments during the first half of the piece, and to the reverse substitution (rests for non-rests) during its second half (ex 2 shows each stage (a — e) in the progression from the initial phrase containing rests to the phrase in which all rest-bars have been replaced by non-rest bars). Thus textural density is at a maximum towards the centre of the piece. Thirdly, there is the slower process of modulation to related modes, which occurs 12 times.

ex 3

ex 4

root of mode = C root of mode = F root of mode = G

ex 5

The harmony is pentatonic throughout, (that is to say, it uses a scale of 5 notes with a given interval structure, that of the 'black notes' of a keyboard instrument, rather than simply a scale consisting of any arbitrary 5 notes); this provides a static harmonic background against which the rhythmic interplay of the voices can be heard. The piece begins and ends in the familiar pentatonic mode C, D, E, G and A (ex 3); during its unfolding, it shifts to neighbouring modes through the simultaneous mutation, in all voices, of certain scale members. For instance, if all E's are sharpened to become F's, the pentatonic mode on F, (F, G, A, C and D) is produced; if all C's are flattened to B's, the mode on G, (G, A, B, D and E) is obtained, and so on. Sharpening or flattening more than one scale-member will effect a modulation to a more remote tonal region. The cycle of modes through which the piece travels is illustrated in ex 4. (The constituent notes are

ex 6

ex 7

ex 8

ex 9

ex 10

presented widely-spaced for ease of reading). Because the phrases are not radically changed when the piece modulates, but only alter by the mutation of one, two or occasionally three or four notes, the contours of all the voices are similar, whatever mode they may be playing in; ex 5 illustrates the opening phrase in the mode based on C, and the phrase it becomes when shifted to the modes on roots G and F. Thus although the sense of tonal centre alters significantly during the piece, the outlines of the melodies alter only slightly, and the sense of their kinship is not obscured.

The 6 voices do not play at the same pitch; each plays at an interval of a fourth from neighbouring voices. This is not the fourth of the diatonic scale (i.e. an interval of four scale-steps in a Major scale), but an interval of four scale-steps within the pentatonic scale mentioned. Ex 6 shows the 6-part opening of the work. Each of the upper phrases is derived from the lowest one by applying to it a tonal transposition, within the principal pentatonic mode, of 4, 8, or 12 etc. scale-steps; "Sequemuse" can be easily instructed to perform such transpositions. When all the voices are moving in parallel in this fashion, the sound tends to be perceived as a complex timbre, rather than as several voices playing simultaneously; as each voice adopts a new phase relationship relative to the several remaining voices playing in parallel, thereby ceasing to be in parallel with them, its contribution to this composite timbre is stripped away, leaving a subtly altered composite timbre, and a newly-heard voice perceived as entirely distinct from this timbre.

The phrase given in ex 6 is repeated 3 times at the beginning of the work, to establish a sense of tonality and tempo. For the next repetition of the phrase, the topmost voice is shifted by exactly one bar-length, producing the arrangement shown in ex 7. The subsequent phrases each introduce an increasing amount of phase shift in the next-lower voice, (except in the lowest, whose phase is never changed throughout the piece, thereby providing a constant rhythmic reference 'point' amid the changing phase relationships) until the arrangement is as given in ex 8. At this point the first mode-change occurs, from the mode rooted on C to the one on F. During the next few phrases, the phase-shifts between the voices are removed, starting with the topmost one, continuing with the next one down, and so on. However, the phrases that are introduced in perfect phase with the lowest one are not the original phrases, but those in which a substitution of a rest-bar by a non-rest bar has occurred. An intermediate stage during this process of restoring perfect phase between the voices is shown in ex 9. After a few phrase-lengths, the 6 voices are again in perfect phase with each other, as they were at the opening of the piece; however, the phrase they are now all playing is different, by one bar, from the opening phrase. The process of introducing a phase-shift, starting in the top voice, begins once more, and again, at the place of maximum phase-displacement between the voices, a mode-change occurs. This process of changing phase until voices are maximally out of phase, modulating, and changing back into phase accompanied by an alteration in the density of the phrases, continues throughout the piece, with the maximum density, illustrated in ex 10, occurring at the centre of the piece. This section, along with the opening and closing of the work, are in the mode C, D, E, G, A: other parts of the piece are all in other modes. After the central point of maximum density, the gradual process of substitution of rests for non-rests starts, and the final three bars of the piece are an exact re-statement of the first three.

"Changes in 6 Parts" as described here is the fifth and final version of the piece; earlier versions had a similar overall structure but differed in significant details. The piece, which lasts approximately 9 minutes, is scheduled to be broadcast by BBC Radio 3 on the 20th February, 1981.

Marcus West
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NEWS

CASS — COMPUTER ARTS SOCIETY SWITZERLAND

The Society is pleased to announce the inauguration of a new Branch in Switzerland. The Secretary of CASS is Herbert Bruderer of the Institut für Nichtnumerische Informationsverarbeitung. Herbert Bruderer has been involved with computer-assisted art for some time, and past activities include a television film on computer art, several publications on all branches of computer art, a Swiss Radio production of computer poetry, and three books on non-numerical computing including all forms of computer-assisted art. He is also a representative of the Association for Literary and Linguistic Computing in Switzerland, and of the machine Translation Swiss Specialist Group of the British Computer Society.

Herbert Bruderer is interested in organising further events, such as a computer art exhibition, and a television broadcast, and would be pleased to hear from interested CAS members and especially Swiss members.

He can be contacted at:
I.N.I.V.,
Thaler Strasse 8,
Postfach 409,
CH — 9400 Rorschach SG,
Switzerland.

BOOKS

PERMUTATIONS DE LIGNES/LINJE PERMUTATIONER

by Torsten Ridell. Wedgepress & Cheese, Sweden, 1979. First edition: 300.
30 pp loose-leaf book, 21 x 15 cm. US $ 6.00 plus $ 1.00 postage.

An "artist's book" immaculately printed in velvety black ink on pure white paper. The paper is thick, and each of the 26 drawings is printed on a separate sheet. This is the first edition of computer-assisted drawings that Leif Eriksson published, and the first (i.e. the earliest) publication of Torsten Ridell's series "Permutations de Lignes". The program was developed at A.R.T.A., Atelier de Recherches Techniques Avancées, Centre Georges Pompidou, Paris. The book contains 2 series, each of 13 drawings. Each drawing is composed of 12 lines, which are put through a series of permutations, first systematically, and then aleatorically.

Although Leif Eriksson's publications are not "limited edition prints" within the Fine Art definition, the quality of printing and small edition size (even allowing for future reprints) make them collectors' pieces. So here are 26 Torsten Ridell prints for $ 6.00 — what a bargain.

Order prepaid adding $ 1.00 postage for first title, 25 cents for additional titles, from: Wedgepress & Cheese, Leif Eriksson, Leifs väg 11, 237 00 Bjerred, Sweden.

Dominic Boreham

COLLOQUE REPRESENTATION DES CONNAISSANCES ET RAISONNEMENT DANS LES SCIENCES DE L'HOMME
PROCEEDINGS KNOWLEDGE REPRESENTATION AND REASONING IN THE HUMANITIES AND SOCIAL SCIENCES

17—19 September 1979, Saint Maximin, IRIA — LISH, 1980, 607 pp. I.S.B.N. 2 — 7261 — 0234 — 4 Edited by l'Institut National de Recherche en Informatique et en Automatique. INRIA — SEDIS — Diffusion, B.P. 105 — 78150 Le Chesnay, France.

IEEE COMPUTER GRAPHICS AND APPLICATIONS

IEEE Computer Society, 5855 Naples Plaza, Suite 301, Long Beach, California 90803

A new quarterly magazine, commencing publication in January 1981, aimed at computer graphics users, and designers of graphics hardware, software, and systems. Articles on technology and applications from conferences and computer scientists and engineers.

INNER LIGHT (I)

by Jonathan Harvey. For seven players and tape (30 minutes). Study score £5.75
Novello & Co. Ltd., 38a Beak Street, London W1.

MUSIC

M.I.T. CONCERT: MUSIC FOR INSTRUMENTS AND COMPUTER-PROCESSED SOUND

On 17 November, 1980, the M.I.T. Experimental Music Studio presented a programme of works composed at the Studio, for instruments and computer-processed sound, in a free public concert in the Kresge Auditorium.

The programme represented new compositions that were written at M.I.T. during the past four years and were selected to demonstrate the broad spectrum of acoustic and musical techniques explored at the E.M.S. These pieces also served as a showcase for the variety of styles that have been brought to the E.M.S. by composers from around the world.

The earliest of the new works on the programme, *Synapse for Viola and Computer,* was written in 1976 by Barry Vercoe, Director of the E.M.S. and associate professor of music and technology at M.I.T. Available on CRI Records, the piece was performed by Marcus Thompson, violist and associate professor of music at M.I.T.

Three other works were written for performer and electronic tape. John Lunn, from Glasgow University, Scotland, performed his own *Echoes for Piano and Computer* (1980). Elliott Balaban, a jazz performer, arranger and composer of Cambridge, Mass., presented a musical theatre piece: *In My Future* (1980), which featured nine-year-old Nancy Anderson of Needham, Mass., in a singing and dancing role. *Nocturne III* (1979), a setting of a Robert Desnos text composed for soprano and tape by Geoffrey Wright, from the Peabody Conservatory, Baltimore, Md., was performed by Judith Hull.

The concert also included pieces for computer alone. U.C.S.D. composer Richard Boulanger's *Trapped in Convert* (1979), was described in a *Boston Globe* review as a "sonic spectacular that trafficked knowingly in extremities of volume and pitch, worked with a colourful pallette, and successfully evoked a labful of sci-fi tinglers and their ilk." On the other hand, Brandeis University composer Peter Child's *Impressions* (1979), contrasted unusual electronic timbres with a relatively conventional musical structure.

Other compositions on the programme were *Septenarius* (1978) by Alexander Brinkman, Eastman School of Music; *Microvariations* (1979) by Graham Hair, Latrobe University, Melbourne, Australia; and *Spinner Web* (1979) by Edith Piatt, Orange Coast College. Of the 1979 premiere of this last work, the *Boston Globe* said it "showed a vivid aural imagination

. . . would have worked equally well as a concise, shapely, orchestral tone poem."

This programme will be repeated in a concert at Alice Tully Hall, Lincoln Center, New York City, on May 19, 1981. Many of the pieces were composed during the summer Workshops in Computer Music Composition, offered annually at the EMS since 1978. With the assistance of technical staff and visiting composers, workshop participants are able to realize complete compositions during these sessions.

The M.I.T. facility has three computers, solely dedicated to the art of music making: a PDP-11/50 and a PDP-11/34, donated to the EMS by the Digital Equipment Corporation, and an IMLAC PDS-4 display computer.

A standard computer-based system can be artistically inhibiting. "However, our computers have been taught to understand the language of music," Dr. Vercoe explains, "so that composers may have the freedom to do exactly what they want."

This new situation is exceedingly attractive to the current generation of young composers. Eastman School of Music, for instance, is but the latest of a large number of institutions to have acquired a copy of the M.I.T. system for its own teaching and concert performances.

"Computer music," Dr. Vercoe says, "is coming out of the closet for composers and audiences alike."

TECHNIQUES OF COMPUTER SOUND SYNTHESIS
June 22 — July 3, 1981
WORKSHOP IN COMPUTER MUSIC COMPOSITION
July 6 — 31, 1981
Massachusetts Institute of Technology

Programme 1 explores current methods of digital sound synthesis in concept and in practice. Comprehensive lectures will cover topics such as sound analysis, additive and non-linear synthesis, digital filtering and reverberation, man-machine interaction, microprocessors, and real-time digital synthesizers. Participants will be able to construct and test these networks in high-quality sound using the Music-11 language and the interactive computers of the MIT Experimental Music Studio. All ideas will be developed from first principles. No prior experience is required.

Program 2 provides opportunity to synthesize a complete medium-scale composition in digital sound. Synthesis networks are created interactively by patching oscillators and filters diagrammatically on a screen. Scores are created when notes played on a musical keyboard appear on the screen in standard musical notation to be edited, printed out, or synthesized by the computer. Lecture demonstrations and private coaching by prominent composition faculty. Limited enrolment will ensure 4-6 hours/day/participant of computer time in the Experimental Music Studio. The workshop will culminate in a large public concert of completed participant works on Friday, July 31.

Both programs offered by MIT Studio Director, Professor Barry Vercoe.

For further information, please contact:
Director of the Summer Session
Room E19-356, M.I.T.
Cambridge, Massachusetts 02139

S P N M SOCIETY FOR THE PROMOTION OF NEW MUSIC COMPOSERS' WEEKEND 1981

The 1981 Composers' Weekend will take place on 10 - 13 September inclusive, at Morley College, with public concerts at St. John's Smith Square. The weekend focuses on three ensembles: the Michael Nyman Band, the Myrha Saxophone Quartet, and the Electro-Acoustic Music Association of Great Britain, (live performers with electronics: Harry Spaarnay bass clarinet, Peter Lawson piano and a 'cellist to be announced).

CALL FOR SUBMISSIONS TO THE SPNM

Composers are invited to submit original works or arrangements for the above ensembles. Works may involve tape and any live electronic manipulation. Full details from SPNM, please enclose a s.a.e. SUBMISSION DEADLINE: 30 June 1981. The Administrator, SPNM, 10 Stratford Place, London WIN 9AE

emas

EMAS PARTICIPATION IN SPNM COMPOSERS' WEEKEND 1981

Last April the first collaboration between SPNM and EMAS took place in a series of concerts and workshops over three days. This year EMAS will be fully integrated into the annual Composers' Weekend (see above). The EMAS Equipment Pool will provide a wide variety of the electronic gear needed for such a national event. The electro-acoustic installations and other concerts will be at St. Johns and the majority of the seminars, discussions etc., at Morley College.

ELECTRO-ACOUSTIC MUSIC FESTIVAL MARCH 18 - 19 1981

Concert 1 Wednesday 18 at 13.10
Nicky Holland : Kaba Caida @@@
June Schneider : The Assassination of Shaka @@
Tim Souster : Spectral

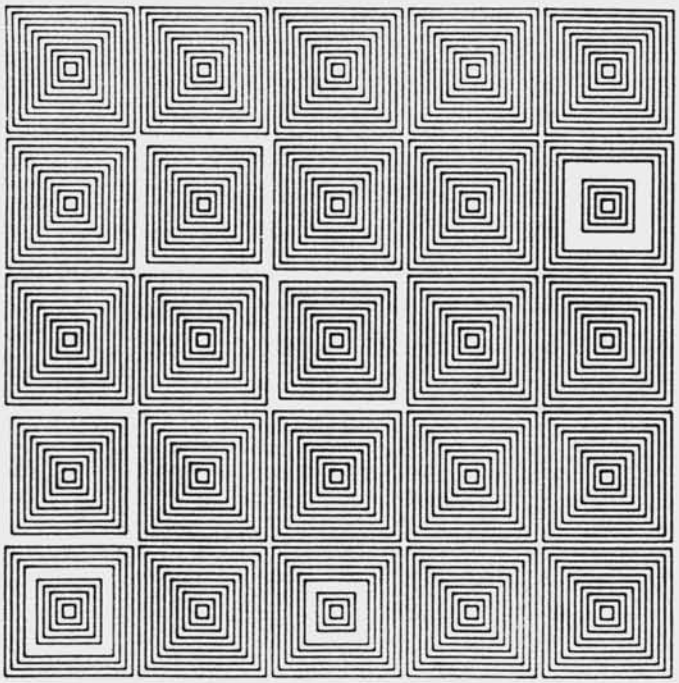
Concert 2 Thursday 19 at 13.10
Kevin Jones : Ice Breaker @@
Melvyn Poore : Playback IV @@
Jonty Harrison : EQ

Concert 3 Thursday 19 at 19.30
Alejandro Vinao : Other Fictions: GO @@@
Morton Subotnick : Liquid Strata @@
Jonathan Harvey : Mortuos Plango, Vivos Voco
Steve Stanton : Brighter Days Will Come @
Alan Belk : New York @@@

@@@ World premiere
@@ British premiere
@ London premiere

NEW HALL, THE CITY UNIVERSITY, NORTHAMPTON SQUARE, LONDON EC1

EXHIBITIONS



FREIE UNIVERSITÄT BERLIN
UNIVERSITÄTSKLINIKUM STEGLITZ

Projekt Kunst im Krankenhaus

Ausstellungsserie Computer-Grafik
in Zusammenarbeit mit Dr. Herbert W. Franke
im Mittelteil des Hauptganges im Erdgeschoß
vor den Räumen der Computer-Tomografie

VERA MOLNAR

4. März bis 28. April 1981

WAVES IN SPACE / NEW ART AND TECHNOLOGY

Downey Museum of Art 27 February - 2 April 1981

Computer-generated and computer-plotted graphics, interactive displays, video, & holography. Audio tapes from JPL.

DOWNEY MUSEUM OF ART, 10419 South Rives Avenue, Downey, California 90241, U.S.A.

COMPUTER ARTS SOCIETY

BRITISH COMPUTER SOCIETY SPECIALIST GROUP

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 everyone at £4 or $10 per year. Members receive PAGE four times a year, and reduced prices for the Society's public meetings events. The Society is a Specialist Group of the British Computer Society, but membership of the two societies is independent.

Libraries and institutions can subscribe to PAGE for £4 or $10 per year. No other membership rights are conferred and there is no form of membership for organisations or groups, though members of other organisations are welcome to join the Society as individuals. Membership and subscriptions run from January to December. For further information write to John Lansdown, Dominic Boreham, or Kurt Lauckner (U.S.A.)

COMPUTER ARTS SOCIETY ADDRESSES

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Treasurer: Dr. George Mallen, 50/51 Russell Square, London WC1B 4JX

PAGE Editor: Dominic Boreham, 42 Campion Walk, Beaumont Leys, Leicester LE4 OPD
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CASS — Swiss Branch: Herbert Bruderer, I.N.I.V., Thaler Strasse 8, Postfach 409, CH — 9400 Rorschach SG, Switzerland.

CASUS — US Branch and Editor of US editions of PAGE: Kurt Lauckner, Mathematics Department, Eastern Michigan University, Ypsilanti, Michigan, 48197, U.S.A.

LONDON MEETINGS

The Society holds regular meetings at 7.30pm on the 1st Monday of each month at John Lansdown's office, 1st floor, 50/51 Russell Square, London WC1. Members and guests are welcome; there is no charge.

PAGE

COMPUTER ARTS SOCIETY QUARTERLY

PAGE is published quarterly, and mailed to subscribers, (see under Membership). Articles, papers, news, reviews, pictures, announcements, should be submitted to the Editor at least eight weeks prior to the month of publication. Please submit manuscripts typewritten. Photographs should be of good quality, high contrast and definition, and either the actual size intended for publication, or larger. Pages are laid out with ¾ inch margins, leaving a maximum size for photographs of 6¾ x 10 inches. Please document photographs clearly on the reverse, with author, title etc., and indicate which way up they should be. It usually helps with layout if diagrams, flowcharts, etc., are presented in landscape format rather than portrait. Please enclose a pre-paid mailer if you wish your manuscript to be returned.

The Editor is pleased to receive articles from anyone with an active interest in the use of computers in the Arts, whether or not they are members of the Society.