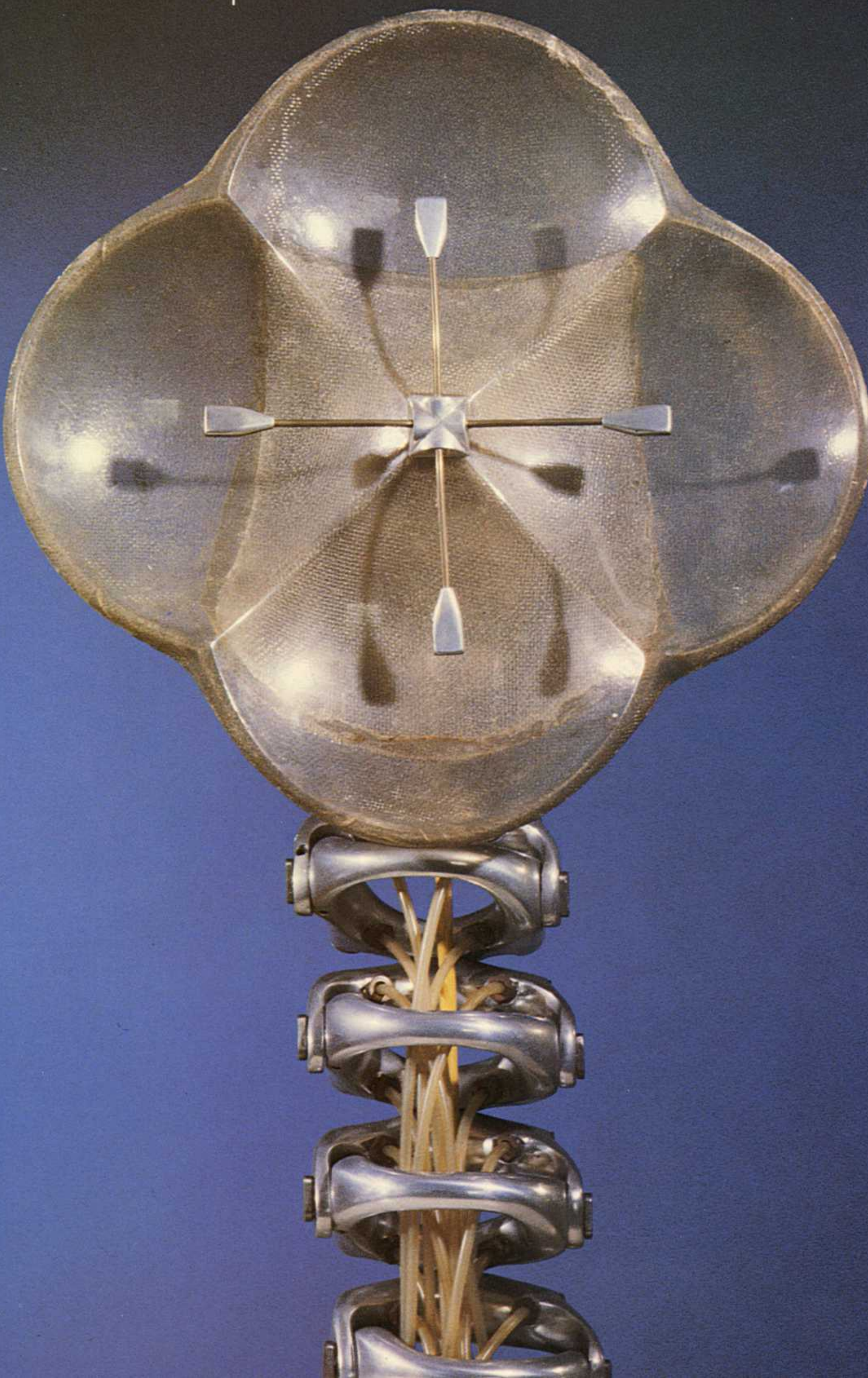
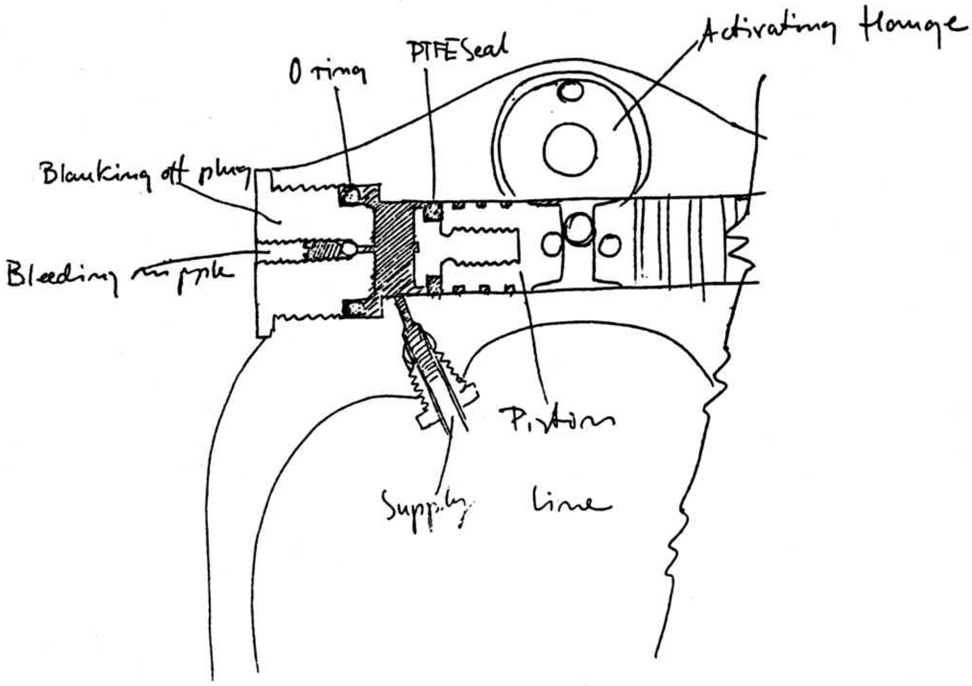
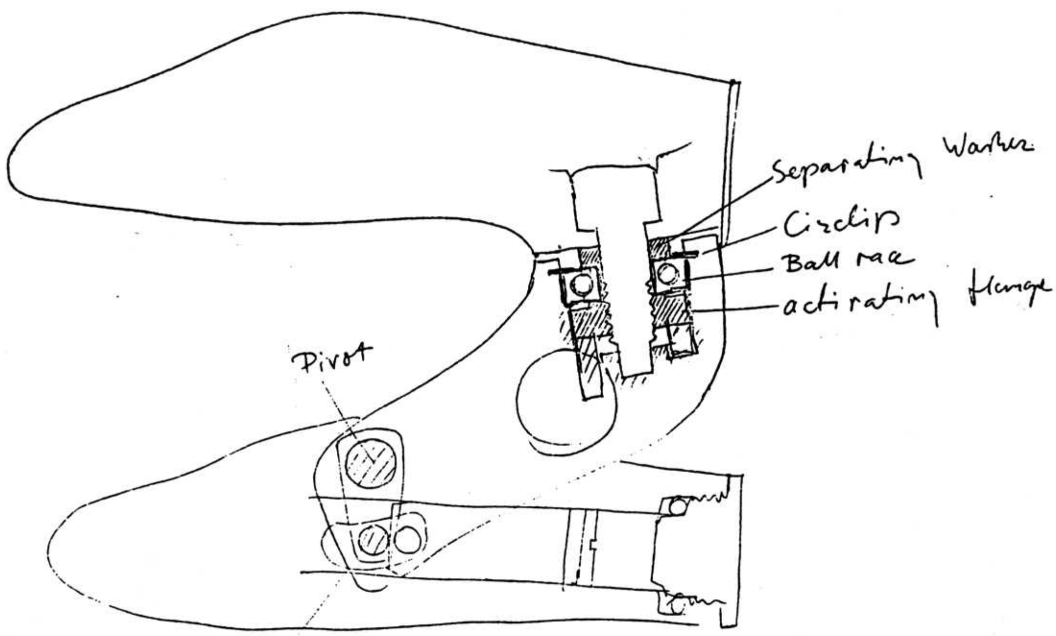
Edward Ihnatowicz

cybernetic art

A personal statement

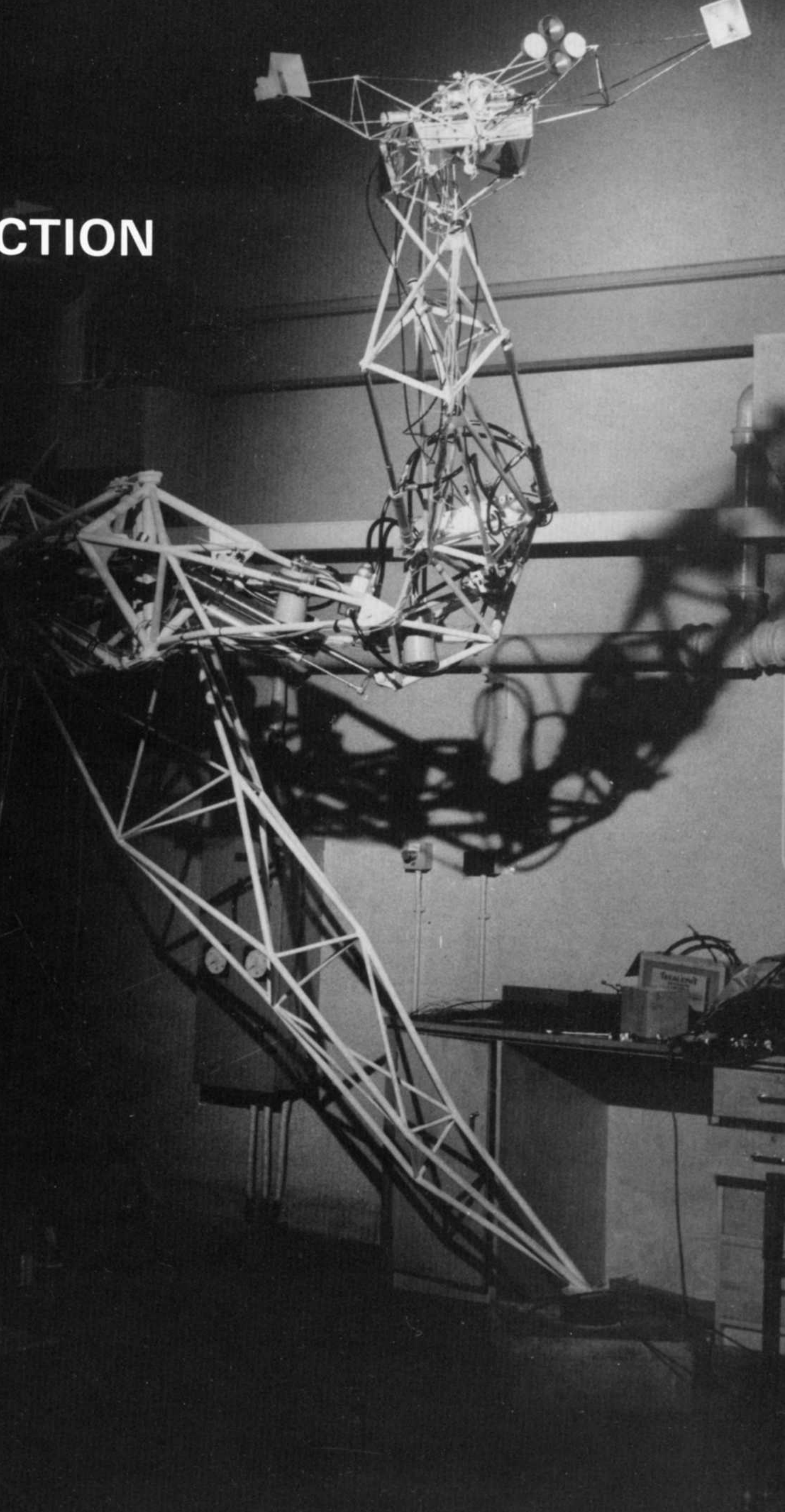






Original explanatory drawings of SAM showing the construction of hydraulic pistons.

INTRODUCTION



Cybernetic art is, by its very nature, immediately accessible, so much so that children are its most appreciative spectators. It is, however, very difficult to convey its effect in print. I felt that some explanation was necessary.

In 1968 the Institute of Contemporary Art in London mounted an exhibition called Cybernetic Serendipity dedicated to the proposition that technology and computing in particular were legitimate fields for experimentation by serious artists. By that time I had started making moving sculpture using some of the more advanced technology becoming available through the government surplus stores and the exhibition included the first one of these, SAM (Sound Activated Mobile). The exhibition, organised by Jasia Reichardt, had generated a good deal of interest and discussion and now, 17 years on, the central argument appears to have been won. The man in the street now readily accepts that anything can be art. The trouble is, he no longer cares whether anything is.

In the meantime serious artists have largely abandoned the field leaving it to the toy-robot manufacturers, Disneyland animators and Science-Fiction-Films special-effects departments. The early promise has not been fulfilled and the currency has been debased.

There are two reasons for this situation. The first one is the high cost and difficulty of access to the latest technology for the average artist and is chiefly financial. The other one is the general lack of appreciation of the importance of such art and of the benefits that would result from its wider acceptance and is the reason for producing this brochure.

ART AND TECHNOLOGY

Today they should be on better terms.

Most of the greatest works of art were produced without a great deal of expense – paint and canvas are relatively cheap – so that it is reasonable to ask whether it is not an extravagance for present-day artists to involve themselves with expensive new technology.

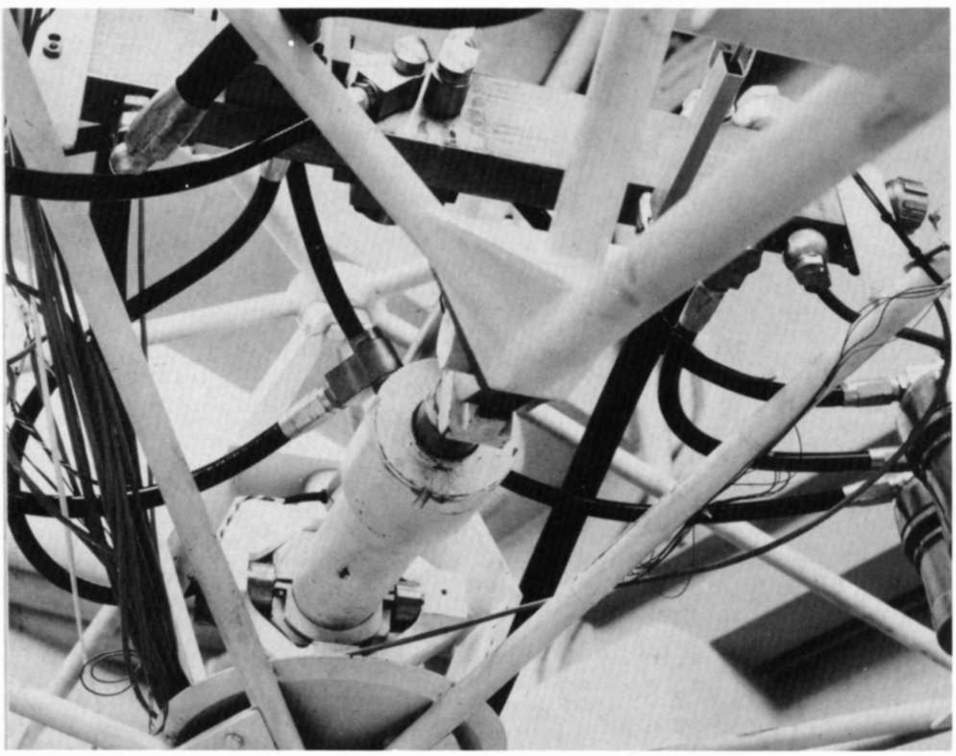
The answer is that the principal value of art is its ability to open our eyes to some aspect of reality, some view of life hitherto unappreciated. It is reflected in the fact that the highest compliment an artist can be paid is when his work is said to be life-like or full of life. This is in spite of the fact that no one knows what life actually is. At certain times different aspects of reality gain predominance in the general consciousness and are invariably reflected in some way in the contemporary art. Over the centuries art has echoed and sometimes stimulated our interest in human anatomy, perspective, colour perception and even relativity.

Currently our view of life and, indeed, our own part in it is being severely tested as the result of discoveries in the fields of computing, genetics, space exploration and robotics. On one hand machines have become extraordinarily clever and, some would say, intelligent, and on the other our own brains are suspected of being no more than organic computers. We seem to be in imminent danger of losing our souls.

In such circumstances an artist can do one of three things. He can ignore the present scene altogether and retreat to paint still life; he can give vent to his feeling of apprehension at the dehumanisation of our existence and the likelihood of our total destruction; or he can embrace the new revolution and use the new discoveries to enhance his understanding of the world.

It would be futile to argue the merits and demerits of the three attitudes and the choice is most often not a conscious one anyway. My own work puts me squarely into the third category and the best that I can hope to achieve with this brochure is to present the record and the philosophy of one person who has adopted a particular attitude towards science and technology to demonstrate both the problems and the potentialities attendant upon such a choice.

Inner workings of the Senster. Details of the main lifting jack.

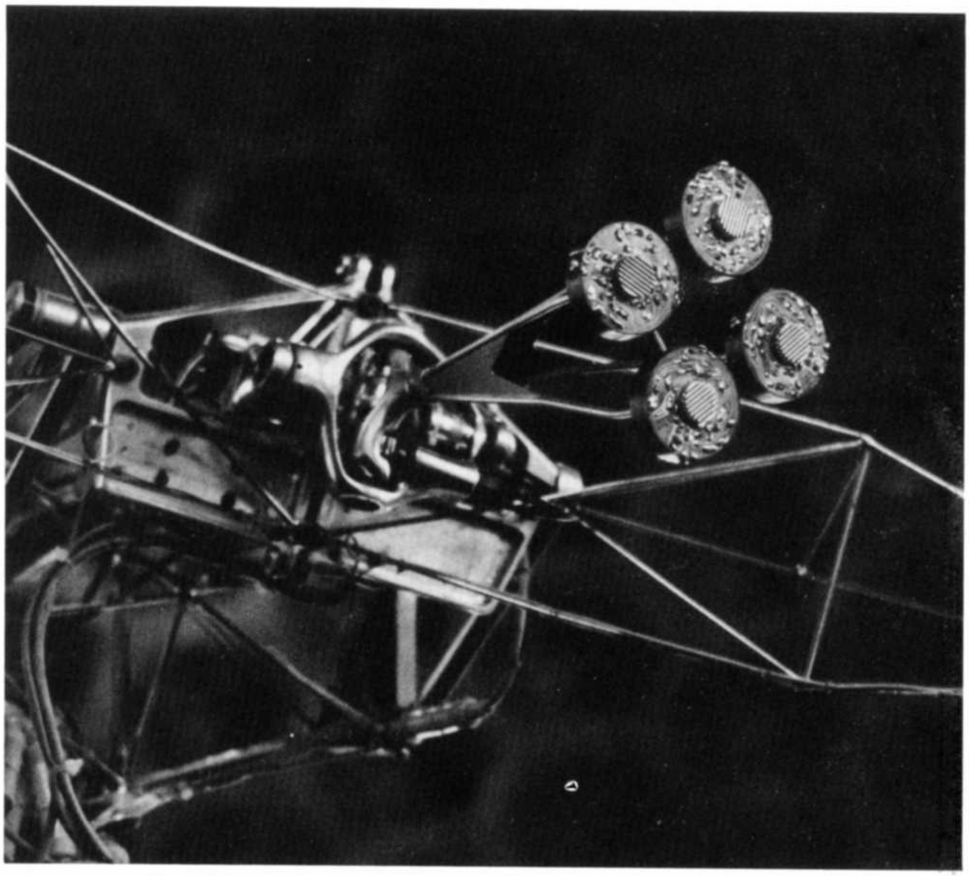


Aero-space technology has provided us with an excellent mechanism for generating physical motion in the form of the electro-hydraulic servo which is capable of moving a physical object with the greatest precision and at any speed in virtual silence. We are capable of duplicating, for instance, the subtlest gesture or the most complex dance step. But this is only a part of the story. In our daily life we are surrounded by movement and indeed move ourselves. Most of our waking life is spent in interpreting motion and responding to various things moving about us. We have to deal with mechanical motion of trains, cars, lifts, etc., the random motions of, for instance, things blown by the wind or borne by flowing water, and the purposeful motions of people and animals. It is this last type of motion which we are used to observing most acutely and which we have been accustomed to believe characterises life. The popular robotic dancers satirise man's attempts at fooling us into thinking that machines could move like people. And yet some automata can mimic human movements very accurately and the reason why we are not fooled by them is more subtle than any peculiarity of their motion. It is that most animal motion is in response to some condition in the environment, that is, it has purpose which we can generally divine and interpet.

The particular area where I have found technological innovation opening a completely new way of investigating our view of reality is in the control of physical motion. It is my considered belief that most of our appreciation of the world around us comes to us through our interpretation of observed or sensed physical motion. This is not the place to present the general argument that all perception is dependent in some way on an interpretation of physical movement but all the pieces I have made so far and all that I am planning to make aim ultimately at making the spectator aware of just how refined our appreciation of motion is and how precisely we are capable of interpreting the intention behind even the simplest motion.

For an artificial system to display a similar sense of purpose it is necessary for it to have a means of observing and interpreting the state of its environment. In this respect also, modern technology has provided us with a variety of sensing systems which, in theory at least, should enable us to equip our artificial animals with the ability to do just that, but in fact the problem has turned out to be a good deal more complicated than anyone had ever expected. The essential difficulty lies in the fact that computers are merely glorified calculating machines and have only memories while what we really need are machines that have understanding. Computers can deal only with numbers and we are very far from knowing how we could represent numerically not only values but such concepts as colour, mass, speed or indeed such basic ideas as what and where.

Here is a vital and quite intangible problem of equal fascination to an artist and a scientist which, I suspect, will not be solved by either scientific methodology or artistic intuition alone. If through my work I succeed in making someone aware of the complexity and the depth of understanding of the nature of perception required to solve this problem I shall be more than satisfied.



The ears of the Senster. The microphone array and the electro-hydraulic actuating mechanism.

THREE EXAMPLES

SAM, the Senster and the Bandit.

My involvement with technology dates from 1968 when SAM was constructed in an attempt to provide a piece of kinetic sculpture with some purposefulness and positive control of its movement. Until then kinetic sculpture had tended either to exhibit completely random movements produced, for example, by currents of air (Calder) or had their motion produced by electric motors in a completely predetermined fashion (Tinguely). SAM was the first moving sculpture which moved directly and recognisably in response to what was going on around it.

It was exhibited at the 'Cybernetic Serendipity' exhibition which was held initially at the Institute of Contemporary Art in London and later toured Canada and the U.S. ending at the Exploratorium in San Francisco.

SAM consists of an assembly of aluminium castings somewhat reminiscent of vertebrae, surmounted by a flower-like fibreglass reflector with an array of four small microphones mounted immediately in front of it. The 'vertebrae' contain miniature hydraulic pistons which enable them to move in relation to each other so that the whole column can twist from side to side and lean forwards and backwards. A simple electronic circuit uses the signals from the four microphones to determine the direction which any sound in the vicinity is coming from and two electro-hydraulic servo-valves move the column in the direction of the sound until the microphones face it.

The original idea behind SAM had nothing to do with responding to sound and only indirectly with movement. At the time I was disappointed with the abstract sculpture I was producing, feeling that the shapes I was making were too arbitrary and the aesthetic criteria by which I was judging them unreliable. I envied the engineers their ability actually to prove the correctness and appropriateness of the shapes they were producing. I felt that I would produce more convincing shapes if I were to design them as some imaginary, idealised pieces of machinery and refined to the point where the shapes would show nothing of the process of manufacture by which they were produced but clearly indicate the function they were to perform. Such a method would absolve me from the responsibility for the actual appearance of the shape since, I would claim, that was dictated

by its function. What it still left me responsible for was the choice of the function which, if chosen too capriciously, would still render the whole exercise absurd. I stumbled on the idea of a neck of an ultra-sophisticated robot which took care of the problem of function but still left me with the arbitrary choice as to where and how such a neck should turn. I wanted to avoid having to choreograph the movements of the neck, feeling that this would be simply shifting the same problem into another area. Instead of an arbitrary shape I would end up with an arbitrary motion. The idea of turning towards sound seemed to resolve this difficulty since both the appearance and the behaviour of the sculpture would be determined by external factors.

The resultant shapes fell some way short of my ideal but were, nevertheless, a good deal more interesting than any I had produced before. I was intrigued therefore to discover that one of the shapes I had developed for SAM had a very close equivalent in nature in the claw of a lobster. It appears that lobsters are some of the very few animals that have very simple, hinge-like joints between the sections of their exoskeletons. Most animals, even insects, have much more complex swivel joints, which we, as engineers, would have great difficulty in constructing and powering. A lobster's claw was, therefore, inevitably, the inspiration for the next piece, the Senster.

The Senster, commissioned by the electronics giant, Philips, for their permanent showplace, the Evoluon, in Eindhoven, was a much bigger and more ambitious piece of work. In addition to responding to people's voices, the Senster also responded to their movements, which it detected by means of radar, and was the first sculpture to be controlled by a computer. It was unveiled in 1970 and remained on permanent show until 1974 when it was dismantled.

An example of current work. Details of a robotic actuator.

Its size – it was over 15 feet long and could reach as high into the air – made the use of aluminium castings inappropriate so it was welded out of steel tubing, with the castings employed only in the more intricate microphone positioning mechanism. Its behaviour, controlled by a computer, was much more subtle than SAM's but still fairly simple. The microphones would locate the direction of any predominant sound and home in on it, rather like SAM but much more efficiently, and the rest of the structure would follow them in stages if the sound persisted. Sudden movements or loud noises would make it shy away. The complicated acoustics of the hall and the completely unpredictable behaviour of the public made the Senster's movements seem a lot more complex and intriguing than they actually were. It soon became obvious that it was that behaviour and not anything in its appearance which was responsible for the impact which the Senster undoubtedly had on the audience.

I only learned about computing and programming while already constructing the Senster but by the time it was completed I was convinced that computing could be a valid and important artistic medium.

In the following years, whilst employed in the Department of Mechanical Engineering of University College, London, and doing research in robotics, I built several devices which, although sculptural in their original concept, all ended up as pieces of departmental research equipment. One, however, during an early stage of its development, was exhibited as a piece of cybernetic art. It was called the Bandit and was a simple lever, rather like the ones on Las Vegas slot machines (hence the name). Under computer control it could both move and sense motion if it was itself moved by someone. It was exhibited at the Computer Art Society exhibition at the Edinburgh Festival in 1973 where a fairly simple program enabled it to interact in an apparently purposeful way with anyone who moved the lever and by statistically analysing the resulting motion succeeded, in the large majority of cases, in classifying the person in terms of sex and temperament.

PROSPECTS

Technological Art in Limited Editions.

Although I have continued to work on the problems of motion and perception, I have not built or exhibited any more pieces, chiefly through lack of money. I have watched others quit the field and found promising youngsters reluctant to enter it, deterred by the high cost of equipment and materials. For a newcomer there is also the problem of technical expertise which, if the work is to be serious, has to be considerable. Various co-operative ventures bringing artists and engineers together have been tried in the past but without too much success.

Although disappointing, the situation is not, I think, irredeemable, but it will require a considerable shift in some of our attitudes towards art. We live in an industrialised, technological and commercial world and if art is to have any relevance it cannot hide in the romantic, artist-in-the-garret cocoon but must be prepared to come out and join the fray.

In the industrial sphere, high technology, although expensive almost by definition, manages to keep its cost within reasonable bounds through mass production. Only space shots and esoteric weapons systems have budgets large enough to enable construction on a one-off basis. The same constraints must apply to technological art and it is reasonable, therefore, to consider what would be the effect of applying to it the same mass-production methods.

The essential element of a piece like the Senster is not any particular part of its construction but its general design which is contained in the original engineering drawings, and its final behaviour which is determined by the computer programme. There is no reason why replicas of such a piece should not be as interesting or valid works of art as the original piece, which, as it happens, no longer exists. In fact copies of a piece like this would not, by their very nature, be the same. Their chief characteristic being a response to the environment, they would behave differently and, therefore, be different in different locations and on different occasions.

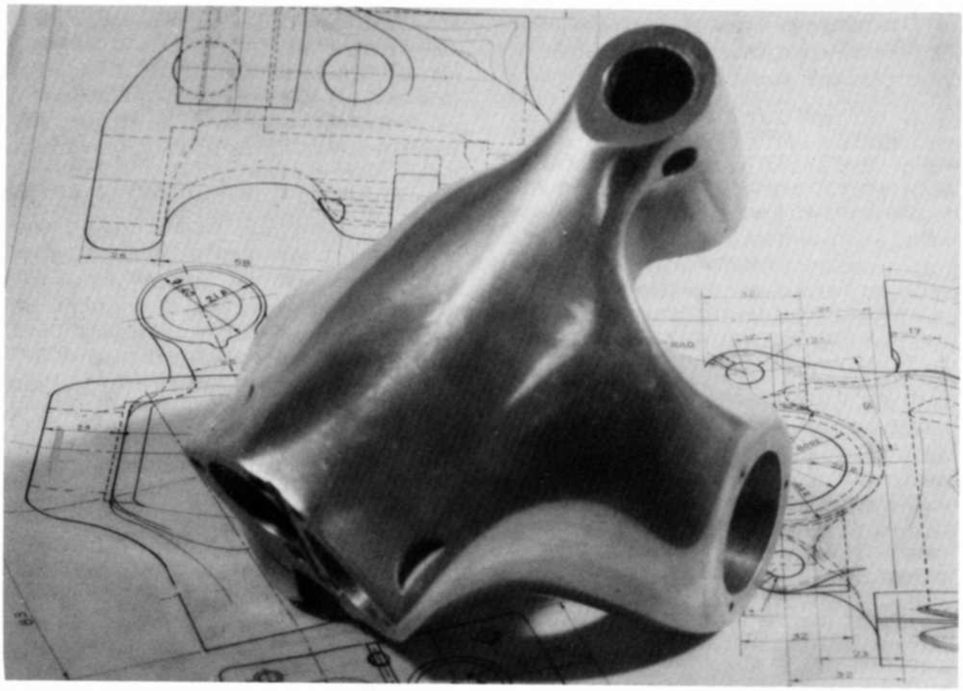
The Senster no longer exists and would not be my property if it did but SAM is still in my possession and could be resurrected and brought to its original condition. I may well do it one day as an exercise in historical reconstruction, but artistically I should consider it a retrograde step. It would make much better sense to re-engineer it so as to incorporate some of the recent advances in technology and making a number simultaneously to make use of the advantages offered by mass-production.

The numbers produced would not need to be very great to show important advantages over production of single pieces. Any piece of moving machinery is prone to mechanical failure and the adoption of production rather than prototype technology would, inevitably, result in sound engineering methods being adopted which would improve the reliability. In addition, and this would be an important selling point, the adoption of standard manufacturing techniques would enable service guarantees to be offered to potential buyers and professional maintenance manuals to be written.

There is no reason either to suspect that the aesthetic quality of the mass-produced shapes would be in any way affected. Over the last few years I have been working in a university research environment developing a number of mechanical manipulators. Most of the components were cast in aluminium (my preferred way of working) and at no time did I feel compelled to make any compromises with what I felt was the correct shape to accommodate some manufacturing requirement. Admittedly, most manufacturing engineers would consider my shapes to be over-designed but apart from the increase in the time required to produce the original patterns, this in no way affects the manufacturing cost. As a matter of fact there are some marginal advantages in that the casters like the smooth shapes which allow the metal to flow freely into the moulds and the patterns to come out easily from the sand boxes.

All of this, of course, will only make sense if there is a prospect of selling a sufficient number of such pieces and if their price can be maintained high enough to make the exercise profitable to all those involved. To accomplish this yet another area of expertise will need to be tapped – that of promotion, advertising and salesmanship – and there is no doubt that, initially at least, the promotion of such an idea would require a greater effort than the actual production of the pieces. Certain deeply seated prejudices will need to be overcome and, perhaps, novel ways of selling devised but as we approach a new century it may not be unreasonable to hope that people might be prepared to revise their attitudes.

A typical cast aluminium component.



WHAT THE PAPERS SAID . . .

. . . about SAM

The ultimate triumph of the side-issue – the kind of triumph that involves transfiguration into something else – is Edward Ihnatowicz's sound-activated mobile (shown at the top of this page). Sam, let's call it, is basically a large electronic ear which can 'attend' to sounds by turning and elevating/depressing until it is zeroed-in on them. The visible ear is just a moderately pretty plastic flower-shaped affair, but that's not the point of the machine; the point is the mounting that enables the ear to attend. In doing this it performs analogously to a radio telescope tracking a satellite on automatic, and a mounting like that used at Jodrell Bank or Goonhilly, in miniature, would have enabled it to do this smoothly and with little consumption of power.

But only smoothly – whereas what is so startling about Sam is that it can snap round to attend to a noise as suddenly as a human being, can peer up or down as quickly as a cat hearing a mouse or a bird. It can do so because of a mounting that superficially resembles a human neck, but works rather differently – a superimposed set of highly polished articulated yokes in metal mounted one on top of another. The forms of these yokes are – to quote Paul Valéry, talking about something different – *nets comme des ossements,* and the blood-and-bone analogy is reinforced by the plastic tubes that rise in pairs through the central void of this 'spinal column' to bring hydraulic power to its articulations. It's about the most beautiful fragment of sculpture I have seen in a decade – and the most disturbing. Beautiful because of the forms of the yokes, their finish, their articulation, their congruence in motion. Disturbing because the old atavism still shies at the sight of any patently man-made creation moving and responding in a manner that millenial tradition insists is the prerogative of the creations of the Almighty.

Reyner Banham, New Society, August 1968.

. . . about THE SENSTER

At a time when most art-produce, including that using new technologies, is particularly footling, and buffered from public indifference by the support of art administrators with no more belief in what they are doing than has the most frightened commissar – at such a time I am glad to report on a really pioneering development, though the support for it does not come from this country.

Edward Ihnatowicz's 'Senster' was officially set in motion some weeks ago at the Evoluon, Philips's permanent industrial exhibition at Eindhoven in Holland. It is probably the most technically ambitious computer-based artefact yet made anywhere. The physical context is distracting, for the Evoluon is a paean to technology in the form of a flying saucer on legs, opened in 1966 and already something of a period piece. But Philips are to be congratulated for their intelligence and enterprise in commissioning the Senster.

Ihnatowicz, a wartime refugee to Britain from Poland, and now a British subject, studied at the Ruskin School of Drawing and Fine Arts at Oxford, and has worked as a sculptor, photographer, designer and furniture manufacturer. He exhibited SAM (Sound Activated Mobile) at the ICA's Cybernetic Serendipity in 1968, and was commissioned by Philips at the suggestion of the designer James Gardner. Realisation of the Senster took more than two years. Ihnatowicz was helped by engineers from Mullard and Philips, and by the mechanical engineering department at University College, London, but his own self-taught command of scientific and technical detail is equalled by very few other artists.

About 15 feet long by 8 feet high, the Senster consists of six independent electro-hydraulic servo-systems based on the articulation of a lobster's claw, allowing six degrees of freedom. Crustaceans move by means of hinges whereas most animals move by pivots, which are more difficult to reproduce in engineering. The Senster has a 'head' with four sensitive microphones which enable the direction of a sound to be computed, and also a close-range radar device which detects movement. The whole is controlled in real-time by an on-line digital computer, which tells the servo-systems how to move in response to various combinations of sound and movement from visitors to the Evoluon. The acoustic 'head' is so designed as to give a vivid impression of an animal's eyes flicking from one object to another. The servo-systems can position the head within a second or two anywhere in a total space of more than 1,000 cubic feet.

No attempt is made to conceal any of the mechanical or electronic components, or to give the surface of the machine a biomorphic appearance.

Ihnatowicz decided that the most economic way of moving the 'claw' would be by effecting constant acceleration and deceleration. Halfway through any movement, an instantaneous reversal is made from a constant rate of acceleration to a constant rate of deceleration. An electronic predictor was designed to achieve this. Only after beginning to implement his idea did Ihnatowicz discover that measurements made on human beings, for the purpose of designing artificial limbs, had proved that human movement follows a similar principle.

The computer programme is not fixed but can be varied so as to generate different responses. At present, the 'head' moves swiftly towards any source of quiet motion, as though hunting for food. But if the motion becomes violent – say, a spectator tries to strike out at the claw – or if the amplitude of the sound rises – one person is monopolising attention by shouting at it – the 'head' will shy away as though frightened. Ihnatowicz hopes that new computer programmes will be developed so that the Senster will 'learn' new behaviours.

It will be easier to say how fully successful the Senster is when it has settled down with the half a million visitors who come to the Evoluon annually, and with the scientists who wish to experiment with it. In any case, the Senster is no monument to an artist's genius but a step towards new forms of creative collaboration on the highest level between scientists and artists. Ihnatowicz likes to work on projects where everyone involved is intellectually stretched.

Jonathan Benthall, Studio International, November 1971.

. . . about THE BANDIT

Edward Ihnatowicz is a very respected worker in the field since he conceives of his work as art and yet is taken seriously by scientific researchers in robotics and 'artificial intelligence'. I described his Eindhoven work, *The Senster,* in the November 1971 *Studio International.* At Edinburgh he showed a new work, *The Bandit* – a concept which surely has a robust future in the fair-ground, yet he has an assistant in University College, London's, department of mechanical engineering who is working on the project for his PhD thesis.

The visitor is asked to move a cylindrical lever, rather like that of a fruit-machine, up and down, and the lever responds by offering resistance under computer control. The computer receives data about the way in which the visitor handles the lever and – referring to criteria stored in its memory – it decides and prints out the sex of the visitor and also (in one word) his or her temperament: 'crude', 'sensitive', 'timid', etc. Success in sex determination is at present about 70%; the computer is thrown by children, for instance.

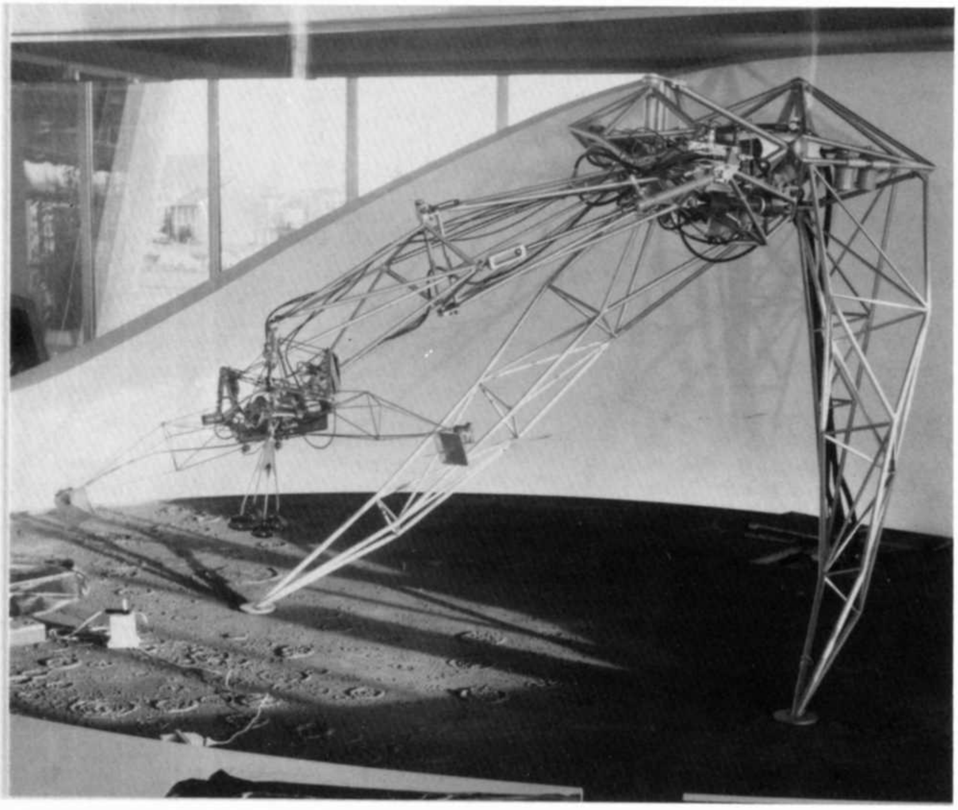
Obviously there is scope for refining the psychological criteria, but as art the concept seems to me brilliant. Ihnatowicz draws on the eroticism latent in all machinery: the lever becomes a phallus, partly responsive or resistant to the visitor and partly determined by strange forces outside the visitor's ken. Whether the computer guesses our sex rightly or wrongly (its on-line typewriter clacked out that I was classed as 'precise masculine'), the artwork can be seen as a beautiful and serious play on the theoretical riddles of the 'tool', or what it means to manipulate and be manipulated, and of what it means to distinguish an object from a presence. These philosophical enigmas are not set out in academic jargon but are captured at an intuitive, not wholly conscious level, accessible to everyone from the professor to the cleaning-lady. Isn't this what art is about?

Jonathan Benthall, Studio International, October 1973.

Reprinted from New Scientist May 4 1972.

Art at large

by Jasia Reichardt



The ultimate machine

The ultimate machine will have desires and needs, and its own machine Buddha nature. It will respond to the environment, move, participate in dialogue with others, and have means of restoring its energy. Finally, it will be a sculpture. It hasn't been made yet but it has two predecessors. These two penultimate machines are the works of an expatriate Pole, sculpture and inventor, Edward Ihnatowicz, who is working currently in the engineering department at University College.

SAM

Having made conventional sculptures —mostly figures in bronze, Ihnatowicz became increasingly interested in applying technological ideas to art and by 1968 produced an extremely sophisticated cybernetic sculpture called SAM (sound-activated mobile). The work consisted of a form constructed from four petals on top of a vertebrae-like neck. The sculpture was sensitive to sound and inclined towards any source of quiet but sustained noise. Shrieks failed to provoke a response, but quiet words did, and a great many people spent hours in front of SAM trying to produce the right level of sound to attract its attention.

Ihnatowicz himself described it as his first electro-hydraulic sculpture, articulated, sensitive to the environment and controlled by an electronic system. The appearance of the work was to reflect the idea behind the work and the technology necessary to realise it.

Senster

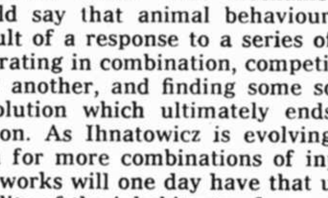
His next project was a large structure operated by a computer, designed to explore the possibility of a much more subtle and varied movement, as well as more complex reactions to the environment. It looks like a giant lobster claw, is called Senster, and is now in the Evoluon in Eindhoven. Senster responds to directional sound by moving in what could only be described as an organic way, indeed the same way as the real claw of a lobster. The mechanics of Senster are readily visible—the actuators, pipelines and wiring are undisguised. A hydraulic system supplies the power for the independent movement of the joints of the Senster. It was chosen because it is quiet and facilitates fast and accurate movement. Each of the activating mechanisms forms a closed electro-hydraulic servo-system which responds to the analogue signals from the control unit. The sculpture was intended to react to the environment in a more complex fashion than was actually feasible within the limitations of budget and time. The input of information is twofold. Microphones listen to the sounds made by the visitors and a radar watches their movements. This information in combination "motivates" the movement of the claw. Since the Senster responds to a number of stimuli simultaneously its reactions are more life-like and less obvious than if merely the volume of sound were to provoke a slow or fast movement. Senster is controlled by a computer which coordinates its activities, translates the input signals into instructions and modifies the behaviour of the sculpture according to past experience and the present contingencies. An important part of the interface are the so-called "predictors" which determine the accelerations and decelerations required for the most efficient movement of the claw.

One of the initial problems was how to pick out the sound to which the Senster should respond amidst the noisy background of a public hall. What in fact happens is that the sounds which reach the two channels are compared at frequent intervals through the use of the control computer, and reaction is motivated when the sounds from the two sources match as far as possible. What occurs visually is that the microphones point at the source of sound and within a fraction of a second the Senster turns towards it.

Towards the ultimate

Senster provoked the kind of reactions which one might expect from people who are trying to communicate with a person or an animal. It appeared more as an organic creature that is capable of evaluating the messages that are sent, and responding to them. This is somewhat reminiscent of the program DOCTOR developed in America, where patients had a conversation with a computer and were convinced that their partner in dialogue on the teletypewriter was a human doctor sitting in another room. This sort of confusion is merely at its beginning. As machines begin to simulate even more convincingly all aspects of human behaviour so the spectator will have to become more conscious of the processes involved. Indeed, the next work Ihnatowicz is planning will demonstrate even more accurately a pattern of behaviour which is organic in character rather than mechanical. One could say that animal behaviour is the result of a response to a series of inputs operating in combination, competing with one another, and finding some sort of a resolution which ultimately ends in an action. As Ihnatowicz is evolving a system for more combinations of inputs, so his works will one day have that uncanny quality of the inhabitants of a mechanical zoo, which to all intents and purposes demonstrates the behaviour associated with living creatures.

While what Senster does is more fundamental than what it is, the ultimate machine will be a more complete being with the hardware determined by software. The machine will express itself even to the point of getting extremely bored and manifesting this state by going to sleep. But how much of a spirit can a machine be endowed with? A machine which is essentially a sculpture and not the ultra-intelligent machine of Irving John Good which will eventually resolve our problems. The ultimate machine is a very extraordinary proposition since it will be modelled on nature and yet have that irrationality which is a part of every work of art.



Edward Ihnatowicz is fascinated by moving sculpture – an obsession dating from his servo-mechanism discovery, says Brian Reffin-Smith

EDWARD IHNATOWICZ makes sculptures that use computers, and attacks the problems of control and artificial intelligence (ai) with an artist's insight.

He works in the Mechanical Engineering Laboratory of University College, London – yet he is famous for producing what many consider one of the finest pieces of computer art ever made.

I went to see him at work, though not at the time he suggested: 'I'll be in any time after 7am.' He is super-keen and slightly defensive, as are many of those who flout the English cultural law that one should only be good at one thing at once.

He believes very strongly that scientific rigour and softer, artistic insight are both effective in solving problems in computing, control and artificial intelligence.

What separates Ihnatowicz from other such thinkers, however, is that he has consistently sought to apply his theories to a highly successful, if controversial, practice.

In Ihnatowicz's view, things must work – do something – to be valid.

This doesn't necessarily go down particularly well with those workers who concentrate on perception, pattern recognition and learning, and he is seen in the ai community as a bit of a maverick. His work has drawn more attention when seen as art rather than as science.

But Ihnatowicz is firmly convinced that thinking can never be demonstrated in a computer unless that computer is a controller for some physical device.

'To check that sensory data isn't random or irrelevant, you must affect, modify or push things, and see that the data changes as a function of your activity.'

He used to paint and draw, but now . . . 'Appearances of things are no longer particularly vital, important or even exciting. I'm interested in the behaviour of things. But it will always be a close-run thing between technology and art, because technology is what artists use to play with their ideas, to make them really work.'

Artists use technology to make their ideas work

When he was doing sculpture, he was always frustrated because it didn't move. It looked like it wanted to, but it didn't. Then he came across servo-mechanisms, presumably skipping over mere motors.

Ihnatowicz dates his interest in technology – and his obsession with ideas actually being put into practice, and moving – from his discovery of servo-mechanisms, about which he talks lyrically, but these things are best discussed between consenting mechanical engineers, in private.

He studied painting, drawing and sculpture at the Ruskin, and dabbled in electronics – to the extent of building an oscilloscope from an old radar set.

But then he threw away all his electronics to concentrate on the finer of the fine arts: 'Stupidest thing I've ever done – I had to start again from scratch 10 years later.'

But he did catch up again, and for proof there's his Senster. A kind of electro-mechanical giraffe, powered by a Philips minicomputer, the beast/artwork is probably one of the very few worthwhile things ever done in that field, and as far removed from the meretricious nonsense so often put forward as 'computer-art' as Escher from etch-a-sketch.

The Senster used doppler radar 'eyes' and quadrophonic microphone 'ears' to locate sound and movement. The piece had many degrees of freedom, and could move from the 'waist' up to follow these stimuli.

The sight of this big, swaying head coming down from 15 feet away to hover uncertainly in front of you was more moving than you'd suppose.

There was no attempt to conceal the hydraulics, cables and computer. I had seen it being made, and had observed the hole it made in Ihnatowicz's ceiling when it once ran amok. Yet it was impossible not to regard it as being alive.

It would remember the origin of a loud sound, or a violent motion, and not return there for some time. Only constant pleading and soft gestures would eventually bring it back down again, to give you a second chance.

The Senster was ET made from metal – a sheep in wolf's clothing.

And as with ET get out your Kleenex as the pathos mounts: people were thought to be taking too much interest in it, as it stood in the Evoluon, Philips' science and technology showcase in Eindhoven, Holland. Couples, it is said, had wedding photographs taken in front of it. Kids watched it for four, five hours at a time.

It began to be emasculated, its responses becoming more and more sluggish, though it could still turn its head to watch a flock of birds passing overhead, like a cat at a window.

Still the people came to see the lobotomised, ailing artwork, and stayed instead of looking at Philips' very wonderful lightbulbs. Now the Senster is 'dead', lying in pieces somewhere in a Dutch barn.

The Senster was like ET but made from metal

Ten years later, Ihnatowicz is quite critical of his work: 'People kept referring to it as intelligent, but there wasn't an iota of intelligence in the thing: it was a completely pre-programmed responding system.'

He began to look for new ways of expressing intelligence, and stopped worrying about labels. He called himself an artist, but did science and technology. He tutored students at the university.

'They're not artists – they're already sorted out as engineers. They've got their vision very well blinkered. But they enjoy my weirdness, and the fact that I can open their eyes to things they haven't thought of, that they don't get in their books.'

He insists that artistic insight is indispensable to his – and very nearly everybody else's – work. The scientist, he believes, ignores the subjective, and pretends to search for some absolute, whereas the artist makes a virtue of his frame of reference, filtering all the information that comes in.

He built the Bandit – a slot-machine-like lever that you could push and pull, and that would then begin to pull and push you back, and learn about this interaction, guessing your sex along the way.

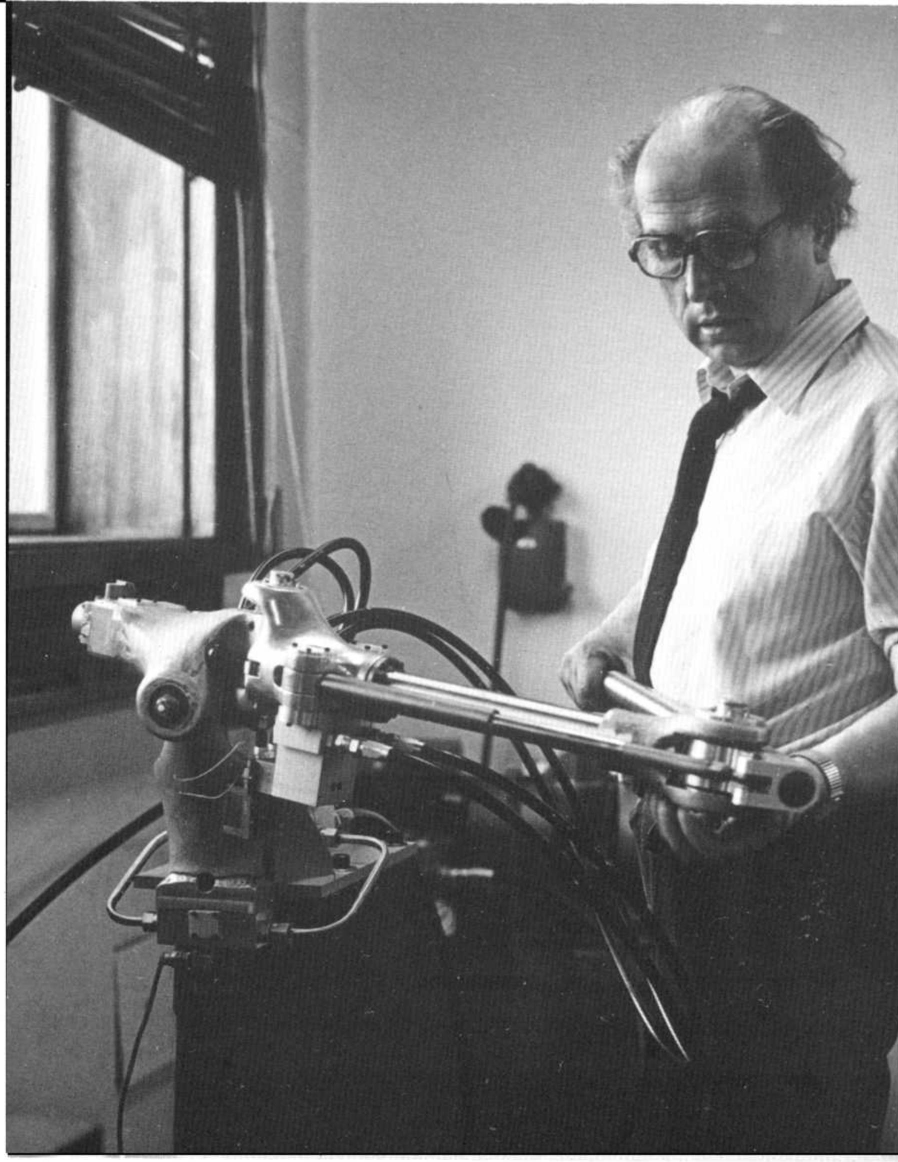
Then robotic artificial limbs. Now he has set up his own business, producing control software for industry, Industrial Microcomputer Applications at Twickenham.

His approach, part artist, part scientist, part cybernaut, seems to pay off. Again, he is only satisfied by actions, by his programs doing things.

'I went down to a factory, and there was a large mini controlling one half of the factory. My software, running in a Pet micro, ran the other half. Fantastic!'

It will be interesting to see how his work is regarded in years to come. The one-armed Bandit was shown at the Edinburgh Festival. Is Ihnatowicz's true home there, rather than in the ai department of the university up the road? He would say that question was missing the point.

Brian Reffin-Smith runs the computer studio at the Royal College of Art.



PERSONAL DATA

1926 Born in Poland.

1939–1943 War refugee in Romania and Algiers.

1943 Arrived in Britain.

1945–1949 Ruskin School of Art, Oxford.

1968 SAM

1971 The Senster

1973 The Bandit

1971 University College, London.

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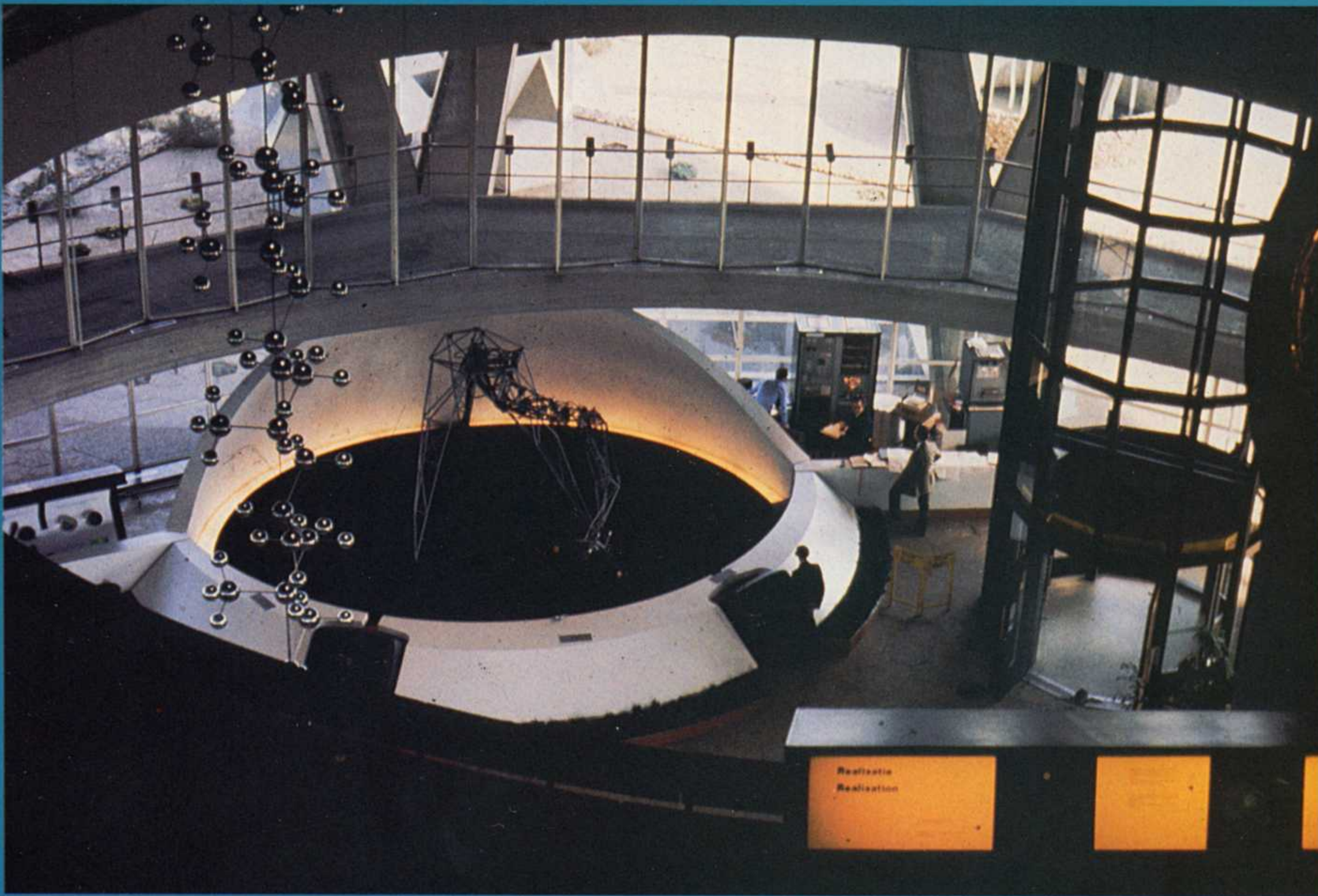

Front cover

SAM (Sound Activated Mobile)
Cybernetic Serendipity
Institute of Contemporary Art
London 1968

Above

The Senster
The Evoluon
Eindhoven
Holland 1971

Right

The Bandit
Computer Art Society
Edinburgh 1973