Extract from

Soft Computing: art and design

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pp. 147-155, Addison-Wesley, 1984

… Another hero of the creative use of computers is Edward Ihnatowicz whose Senster is probably the single most famous piece of such work in the world. A mixture of artist, sculptor, engineer, artificial intelligence worker and teacher, his ideas have provided food for thought for many workers in the area.

EDWARD IHNATOWICZ INTERVIEWED AT UNIVERSITY COLLEGE, LONDON

B. When I rang you to fix up the meeting, you said 'any time after 7.30 am', and I remember you've said before that you want to do a job where you wake up each morning and look forward to work is that still true?

E. I wish it were. I still feel I'm extremely lucky, but there are problems with money and time; and at my age I'm thinking of rounding things off and completing them rather than starting on new areas and investigations. I've done too much thinking and not enough doing, which is what I've always complained about other artists.

B. Well are you in fact an artist? Here you are in the Mechanical Engineering Lab, doing artificial intelligence, research, art and design of various kinds, designing equipment, theories... do you wear all those labels equally easily?

E. I've stopped worrying about labels, but I do appreciate now the difference between an artist and a scientist. I am definitely not an scientist, therefore I'm an artist. And there's a more positive side to it there is a common goal or preoccupation between artists and scientists: both of them are interested in discovering what reality, life, truth are but they have different criteria by which they satisfy themselves. Scientists look for an absolute solution or description, a formula which, completely dehumanised and abstract, will still stand when they're dead. Artists accept the fact that they are their own vehicles, means, of information transport, in and out. Anything that comes in to them is modified by their own sensitivity, prejudices and so forth, and they accept that as the standard, they say 'It seems to me like that' in other words their own bodies and equipment produce a frame of reference within which they're quite happy to operate. That's what's exciting in art you have to communicate with the person but scientists would like you to communicate with the idea, without regarding the person. (They fail in this respect, I think. There is no absolute truth to be found.)

B. So are you saying that art is making a virtue out of a necessity, that it's including the very obviously subjective?

E. The artists don't necessarily know that's what they are doing. They have no necessity to do anything at all.

B. But can a mode of enquiry be said to be going on if even the participants don't know that that is what is happening?

E. Well, you're putting the question in a scientific way... I don't know that I accept the original premise. Artists are people who look at various processes that people are

capable of controlling, and use them so that they communicate their involvement in some aspect of reality, which is not expressible in any other way.

Certain things preoccupy people certain things are in the air which have not yet been described. To somehow reinforce their existence, you can't use language unless you're a poet; generally you try to enhance your own experience of this subject, through doing something. It's no use simply looking at the beautiful sunset and saying it's lovely. Many people do that, but the artist tries to paint it, photograph it, do something with it.

In our present period, appearances of things are no longer particularly vital, important or exciting. I am interested in the behaviour of things. And it will always be a close run thing between technology and art, because technology is what artists use to play with their ideas.

I can be very precise about when I discovered technology it was when I discovered what servo systems were about. I realised that when I was doing sculpture I was intrigued or frustrated, because I was much more interested in motion, I was trying to make my figures look as if they were about to take off and start doing something. We respond to people's movements to a much greater extent than we are aware of.

Now the movements prior to 20th century technology were only achieved by very crude means, or extremely complex and inflexible automata which the Chinese and others used very subtly, but they were `once and for all'. Servo systems let you produce subtle motions and then modify them at will.

Most motions are expressions of something, so the person producing that motion must be aware of what it is a response to. Now we have the technology for all that we can make robots... devices having both sensory input and mechanical output, and a control box for co-ordinating the brain like functions. In theory, we could imitate life if we understood what it is about. But now, we can start investigating what it is.

I'm interested in birds for instance. If I'd been born in the last century, I'd have tried to capture their appearance as accurately as possible. Now, of course, I'm much more interested - I think most people are - in the fact that birds are self contained little cognitive systems. People see the birds, and the birds see them. There is an interaction going on. The spectator's behaviour affects the behaviour of the bird.

When a bird comes in my garden, I'm much more interested in whether it will fly away if I come near it, whether it will come if I offer it some bread, how close can I approach, will it be startled by anything, will other birds come down...

The bird is not there to be observed, it is there to be interacted with. This is the exciting thing about life. I am surrounded by cognitive systems like yourself whose every action is an interaction with me, and me with them.

B. Do you use computers because they're the best device or `fabric' to explore this?

E. The only one. The only one.

B. You're saying it's not pretend interaction, it's actual interaction that's important...

E. Precisely.

B. Between you and it, or the world and it?

E. I am part of the world: What makes me interesting to the animal, is what makes it interesting to me. In the case of my Senster for instance, it made people feel that it spotted them. The game was always to try and attract its attention. There was no pretence it was anything other than a piece of machinery. Nevertheless it endeared itself to them. The way it moved, which I went to a great deal of trouble to make lifelike in the sense that I tried to make its movements efficient. In the process of doing that, I discovered that animals, when they perform competent movements, are extremely efficient, and my machine looked animal like, even though I didn't try to copy animal movement.

B. Have you always worked on things that exemplify this sort of interaction?

E. Yes, except that the Senster had motion only in its output. But the second piece I made, the Bandit - people could move a lever and interact with the computer through motion; the lever moved back at them too.

Now I'm thinking about perception in terms of physical motion being its underlying basis on which all else is mapped; we move first, and all our thinking is about how, why, when and where to move. The reason for storing anything in your head at all is to know what to do at some point.

You've got to be very sure about what you are, what you need to do, what are the boundaries of your existence, what do you have to have in order to survive, and what would make it better, before you can start looking around and saying `Isn't that pretty'. That's a luxury.

There's no justification or reason for any of the actions in the brain unless it's controlling something. Having receptors and no effectors doesn't produce anything sensible.

If you try to understand how learning has developed, or perception, you cannot do it in a system that is incapable of physical movements, because you'd never see the process of improvement. (Chess is just a dead end.)

B. Is this where you tend to diverge from conventional artificial intelligence work?

E. I think so, yes. I am firmly convinced that thinking can never be demonstrated in a computer unless that computer is a controller for some physical device. The complete cycle of perception, response and observations on the effect of the response on the thing perceived must be included. If we are receiving sensory data, it must be some aspect of reality. To check out that it's not random, or something irrelevant, you must be in a position to affect, modify, push it, and see that the data consistently changes as a function of your activity. If you can't do that, maybe you've got a headache - maybe something is happening completely unconnected with the information to your sensory system.

B. What was the Senster actually doing? Was it behaving `intelligently' at all?

E. It wasn't doing anything! This is why I was disconcerted about it. I could see the response that it produced, and people kept referring to it as an intelligent thing, but there wasn't an iota of intelligence in it: it was a completely pre-programmed responding system.

I came across the problem, then, of deciding at what point intelligence can be thought of as existing. The evolution of animals is an absolute continuum. Deciding whether an

animal has intelligence, or perception, is an arbitrary thing - you say `those animals above that line have intelligence, and those below don't. But the situation where the animal just does things, `before' intelligence, is almost as interesting, you can see the potential.

I'm trying to arrive at a description or definition of what is required, what is the method that nature used to produce us that is so sure-fire that in an extraordinarily short time we have developed out of amino acids. Something fairly simple must be in operation, something straightforward and easy to appreciate. And very tolerant of faults otherwise these things would not have happened.

I am convinced that all the component parts of it are already known to us, and once we've discovered the formula it can be applied at any level. Applying it to the most intelligent computer we have would tell us how to make a better one, and applying it to a thermostat would tell us how to make a more intelligent switch.

B. You talked earlier about things imitating life, but surely you mean `the appearance of life' not imitating the psychological and social things ... unless you get very reductionist about those things. Yet what you seem to say now is that those sorts of things can actually emerge out of the ability to get right the program in your thing that is initially behaving `below the intelligence line'. You said `you can see the potential'.

Are you saying that you can make a system `below the line' that could become or at least demonstrate the possibility, back into the world, of transcending its limitations?

E. If I could do that, I would have succeeded... if a proof were required of my theory, this would be it. I could apply it at any level, including below the level of intelligence, and show that through the process, this mechanism could acquire learning or perceptual abilities which would make it more intelligent, and still leaving the next step available. I don't know that I'd do it...

B. One of the problems at the moment is that artists and others get computers, but quickly say `yes but what can we do with them?' Have you got any advice as to what art, or experiments or whatever, what approach, they could adopt...

E. This is like someone who has a nice set of paints, and is very knowledgeable about their chemistry, the range of colours and so forth, who says `now what shall I do with them?'

It should be the other way round. You should have a burning desire to reproduce something on canvas, you find charcoal or pencil doesn't take you far enough, you want colour, so you can make the pictures come to life, the same with computers.

Artists by now, the new generation of art students, are well aware of computers as tools, in various other demonstrations, and ought to appreciate what computers can do, and what aspects of life they can reveal, in other words things that are too complex, commonly, to appreciate can be made simple by allowing the computer to churn the stuff over. Then they ought to generate the ideas for it, rather than the other way round. But the interesting things that I expect to see are in control, having the computer as part of a larger set up, with sensors responding to things.

This is the most promising area as far as I am concerned, but as I say I'm just responding to an area of life

that has always been around, but we just didn't have the tools. Now computers help us to investigate it.

But of course the business of the artist is to show things that the rest of the world would never bother looking at. If he's any good, he will make these discoveries for himself. He now has a powerful tool at his command; but it would be fatal to try and advise anybody... I don't think art can be taught. Except by an atelier technique, with a Master who is really onto something, has real communication with some aspect of life, then that enthusiasm can be transmitted. But the techniques that can be learnt are not the crucial things.

The thing is to observe a person who is passionate about something; if you can see what he's trying to tell you, and observe how he's got there... you can see what psychological stages he went through, what were the tricks he played in order to get that idea across, what books he read, what connections he made between what he saw, and the things around out of which he could construct or represent.

Or there's the `doodle' syndrome a person may watch a mason chipping stone in order to make something for a gothic window, and say `well if I had a chisel I'd try to do something different' and so starts putting more decoration on, not knowing what he's trying to express, but through the activity of wanting to divert arbitrarily from the straight and narrow, he wanders into things that become, without him even knowing about it, expressions of his personality. The decisions he makes in trying to do something different are already determined by his sensitivities and life.

B. Formally, within the University here, you run an atelier, don't you? You have students who...

E. They're not artists. They've already been sorted out as engineers. They've got their vision very well blinkered. I hope I've opened their eyes a little bit, because I'm a very weird sort of person to have in a department like this. I enjoy the fact that they get quite enthusiastic about working here, and enjoy my weirdness and the fact that I don't know half the things they know from undergraduate maths or physics, yet I can open their eyes to other things they haven't thought of, that they don't get in their books.

B. When did you start in art? You did drawing and sculpture at the Ruskin, didn't you?

E. At my primary school, in Poland, I wasn't any good at art. I got better at secondary school, but it wasn't till just before the Ruskin that I carved a piece of chalk into a head, and the man who was teaching me painting said `You've got a natural gift for that, and drawing is a bit of hard work for you...'; that's why I decided to do sculpture at the Ruskin. Funny thing was, at the Ruskin, I was also very interested in electronics, I built myself an oscilloscope out of bits from an old radar set, things like this. But, at some point, feeling introspective and conscientious, I said `I've got to concentrate on my drawing and painting, throw away all my electronics, to dedicate myself to my art'. The stupidest thing I've ever done. I had to start again from scratch ten years later.

B. And now you've started up a new company producing control programs for small computers in engineering and so on.

E. This will help to make the money for some of the other things. I know there's a lot of such work about, but we're writing software that is easy

to use and apply in an industrial environment, that foremen and secretaries can use... special purpose menu driven stuff.

Eventually you find out that you can run complex operations very simply.

Generally speaking, in Britain at the moment, there's a greater need for improvement at the bottom level of automation rather than the top. People don't want to spend a hundred thousand pounds on some big system, and then have to go to school for three years to learn how to use it; so they get a little micro, and then say `what the hell do we do with it now?' this is where we come in. For a few thousand pounds we can automate something and make it easy to use.

B. Is it just as exciting as your other work? Will you still start work at 7.00?

E. I find it very satisfying if I can make someone's life easier by simply writing a program, and see the results down in the factory. I once went to a company, and saw that one of my machines was controlling maybe half the factory! One part was run by a large Digital machine, and the other was run by a PET microcomputer. I get a tremendous kick out of that.