serendipity

Not only computing – also art

JOHN LANSDOWN

I'm strangely attracted to you

Dr Barry Martin of the Department of Mathematics and Physics at Aston University in Birmingham has sent me some intriguing drawings based on what has become something of a current vogue in mathematical research: chaos theory and 'strange attractors' (Figures 1 to 4).

It is odd how, over the years, we are subjected to 'weak signals' coming from all around which, if we could only interpret and put together, would lead us to new discoveries and ideas. I first came into contact with strange attractors (though they were not then known by that name) during the late '50s when I took an evening course in a branch of topology called 'Theory of Knots'. I had become interested in knot theory for two reasons. Firstly, because I was trained in a nautical school where the practicalities of knot making were taught and secondly, because I had read an article by Alan Turing in the Penguin Science News in about 1955 which discussed aspects of knots as unsolved problems. The excellent lecturer in knot theory (whose name, I'm ashamed to say, I've now forgotten), was researching attractors in the complex plane. Attractors are the values to which solutions of iterative equations tend as one systematically introduces numbers into them. Thus, given that:

$X(N+1) = X(N) * X(N) - 1$

we see that, if we start with $X(0) = 1$, we have the sequence

$1,0,-1,0,-1, \ldots .$

so that the attractors are 0 and -1. If we start with $X(O) = 2$, on the other hand, the sequence grows

2,3,8,63,3968, . . .without bound.

Hence, the attractor in this case is infinity. Sometimes, for some equations and values, the solutions jump about in what are known as 'chaotic orbits' and plots of these are of some visual interest. For instance, when

$X(N+1) = X(N) * X(N) - 2$

and $X(0) = 0.5$, we have the sequence:

$0.5,-1.75,1.063,0.871,-1.241 \ldots .$

My next aquaintance with these concepts came when I chaired a session in the Stockholm 1974 IFIP Congress in which a paper on '*Point Sequences generated by two-dimensional recurr-*

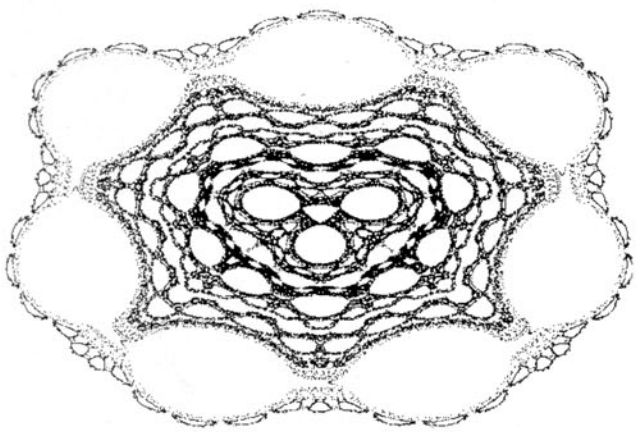

Figure 1

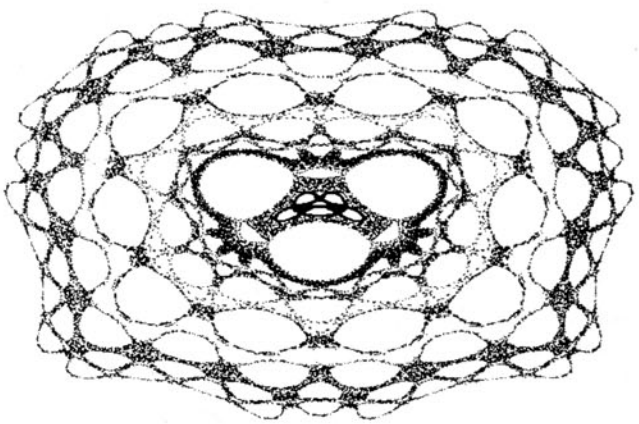

Figure 2

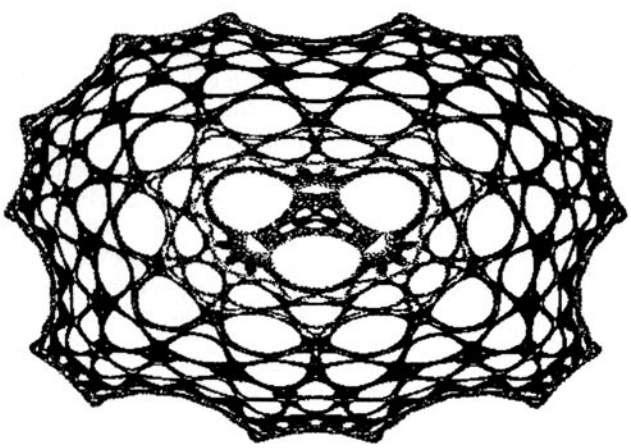

Figure 3

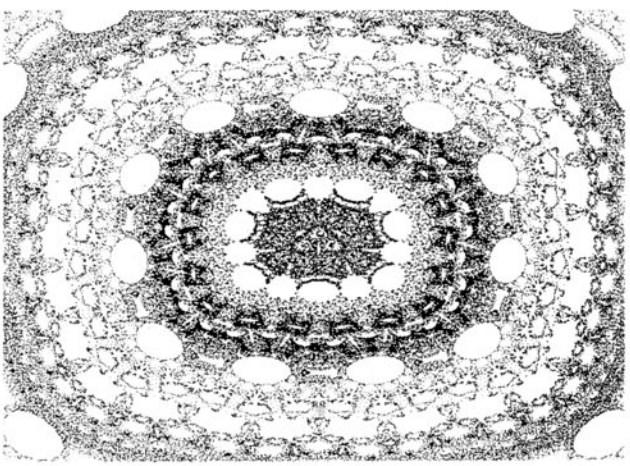

Figure 4

ences' was given by Gumowski and Mira. (Incidentally, this paper was the subject of one of the first articles I wrote for *Computer Bulletin* over ten years ago). Gumowski's paper didn't discuss attractors and I didn't immediately connect the complex plane work with it. As I have never seen another reference to it, the paper seems to have had little impact although I showed how to use its technique to produce interesting and complex graphics in an issue of *Creative Computing* in the late 1970's. (A reader wrote in to say he had also used this technique to make drawings although the output he produced in evidence showed he did no such thing. He was using standard Lissajous methods).

After reading Mandelbrot's seminal work, '*Fractals: Form, Chance and Dimension*', I thought I saw a slight resemblance to Gumowski's idea in some of the examples but it was not until the Online CG83 computer graphics conference when Pietgen and Saupe gave a paper on 'Julia Sets' that the penny finally dropped. Now Pietgen and Richter of the University of Bremen have set up a fascinating exhibition called '*Frontiers of Chaos*' which is presently touring the UK before being shown in the USA and Canada. This presents some extraordinary manifestations of the apparently disparate elements of non-linear iterative equations, attractors and fractals.

Barry Martin's work is in this area too, although he is investigating rather different iterative equations. His are of the form:

$$X(N+1) = Y(N) - \text{function of } X(N)$$
$$Y(N+1) = C - X(N)$$

which are related to Gumowski's.

Vastly different designs can be generated from very simple equations and minor changes in the parameters make substantial and often unpredictable changes in the output. The colour versions of Barry's drawings are even more impressive – perhaps we'll return to these in a future issue.

I have frequently thought that everything we know can be connected to everything else in the form of some gigantic semantic network. True genius involves being able to recognise the connectivity before anyone else. We lesser mortals need computer systems to help us navigate these immense networks. Nowadays one of my main concerns is to devise methods of doing this.

Another glittering prize

In the seventeen years that the Computer Arts Society has been in existence we have had much support from the BCS and the computer industry. Because of this we have been able to produce 52 issues of *Page* and many of these are now highly-prized documents. The cost of production has gone up greatly over the years – both because of inflation and because we've improved the quality of production. Theoretically we should be able to cover our costs by means of subscriptions but that would not leave anything for our other activities in advising, lecturing, helping with exhibitions and so on. *Page* and the activities of the CAS need further sponsorship. A start in this direction has been made by the investment fund managers, Baillie Gifford Technology who have proposed a yearly award of £1000 for a computer art graphic for the cover of its company accounts. Details of the competition to produce this are circulated with *Page* 52. Why not submit your ideas?

Dear Sir...

The Fortran X3J3 Committee (an American committee) paid Britain the compliment of holding its first ever meeting outside N. America in Oxford in July. It was a very successful working meeting, attended by 17 European observers who welcomed the opportunity of active participation in all the discussions particularly in subgroups. It was followed by a very lively one-day Forum organised by the BCS, marred only by the room being barely large enough for the audience.

The Fortran community in Britain demonstrated its support, but *Computer Bulletin* was churlish enough to publish a totally negative guest editorial by David Barron on the committee's work and aims. It is fashionable to knock Fortran in academic circles, and the committee will turn its other cheek, but frankly this was rudeness. There was a nicely written article in the same issue (June 1985) by John Wilson, explaining the committee's aims, but the editorial made no reference to it.

For ammunition, David Barron used (without acknowledgement) one of the notes that I have written after each of the meetings since I joined the committee in 1983. These notes are intended for 'friends of Fortran' who wish to follow the work and make constructive suggestions. He took my note following the May 1984 meeting and ignored those following the meetings in August 1984, November 1984, February 1985 and May 1985. He concentrated on our problems with brackets. I mentioned that [and] are not available everywhere and he describes such places as 'the computing equivalent of the Galapagos Islands'. Well I have on my desk a standard modern terminal supplied by the world's largest and most successful computer vendor and it does not have keys for [or]. I was criticised for suggesting that < and > might be used as brackets. Although mathematicians use those symbols pretty universally to mean 'less than' and 'greater than', it is standard in quantum physics to use them also for a special pair of brackets. Fortran (and physics) needs more kinds of brackets. In fact the committee has now come off the fence. It decided in August 1984 not to use < and > as brackets, following which it was able in November 1984 to approve them as alternatives to .LT. and .GT. .

On David Barron's more serious points:

a) The committee is not designing a new language. It is taking an existing (very widely used) language and revising it in the light of experience both in Fortran itself and in other languages.
b) The committee does not vote on individual ideas without considering the overall context, as is apparent from the full minutes. As for the voting, well often there is a conflict between two desirable aims, such as safety or efficiency, and committee members have to decide which is more important to the Fortran community. I record the votes because I believe them to be of interest to friends of Fortran. It appears as a 'Dutch auction' only to readers who do not consider the pros and cons of particular issues.
c) Compatibility with Fortran 77 is vital. There is an enormous investment in working programs with lives of ten, twenty, or more years. Some features are currently marked as 'deprecated', which means that they might be removed in Fortran 9x and therefore unavailable in about twenty years time. I am getting more comment about this 'threat' than any other feature of Fortran 8x. The principal reason for PL/I's failure to catch on, despite all of IBM's efforts, was its incompatibility with Fortran.
d) Yes, we need a revision of Fortran. Pascal, Ada, Modula 2, *etc* are all incompatible with Fortran, so do not provide an alternative to Fortran 8x.

Revising the Fortran Standard means a lot of hard work for the committee members. The Fortran community needs the revision and is beginning to show signs of impatience with the time it is taking. The committee's deliberations are open. Please use this openness as a means of providing constructive rather than destructive criticism.

JOHN REID *Harwell*