# Not only computing—also art

JOHN LANSDOWN

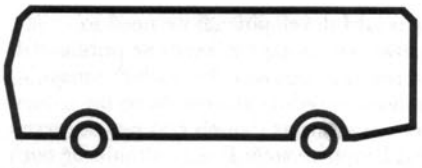


*Figure 1*

### Through thick and thin

In connection with some computer animation work for public information films, I have been much taxed lately by the need to draw thick (that is, about 5mm wide) lines on a plotter around fairly complex pictures (Figure 1). This isn't such a simple task as at first appears. Alan Sutcliffe in a note *Thick and Thin: Plotting for Art* (copies available from me), points out that there do not seem to be any plotters that do this automatically and suggests that there are at least five ways of tackling the problem: pressure, angle to the paper, angle to the direction of drawing, multiple lines and using different pens. In 1970, former editor of PAGE, Gustav Metzger described his ideas for a plotter which, by use of fibre optics and photosensitive paper, could produce lines not only of varying thickness but also of varying sharpness. This latter effect would be achieved by the simple expedient of moving the lightpen further away from the paper and relying on a certain amount of light scattering to fuzz the outline.

To get a really dense line the method I used initially was to draw the line at right angles to its length—that is in short (5mm) strokes along the length of the line. This approach considerably reduces computation time over the method of lines drawn parallel to the length in that only the angle of the line and its length need be calculated but plotting time is substantially increased. However the great advantage of this method is that the line can, if needed, be 'feathered' to go from thin to thick and vice versa. When this feature is not required, the best method I have come across is that outlined in the March 1978 issue of *Computer Graphics: A Quarterly Report of SIGGRAPH-ACM*. At page 67, in their article, Font Variations in Vector Plotting Lettering, Kurt E. Brassel and Jack J. Utano of the Geographical Information Systems Laboratory, State University of New York describe a way of thickening up graph plotter lettering which is both ingenious and attractive (Figure 2). Essentially the idea consists of doing no more than plotting the lettering (or drawing) a number of times with each new plot starting at a different point around the circumference of a circle. The thickness of the line is determined by the radius of the circle, and the number of repeats of the plot by the pen thickness. Brassel and Utano give a formula (incidentally wrongly printed) for deciding the number of plots. An added advantage of this method for some applications— though a considerable disadvantage for others— is that the lines forming the figure end in a circular profile. The biggest advantage though is that no extra computation is needed however complex the figure to be plotted and, if only one thickness of line is needed, this seems to be the method to adopt.

Has anyone else any bright ideas? How about if you want to thicken a line in perspective?

### I'll swear her colour is natural

The issue of *Computer Graphics* referred to above contains a microfiche of 59 examples of computer colour graphics from University of Utah, Los Alamos Scientific Laboratory, Information International Inc, Atlas Computing Laboratory, University of Illinois, Case Western Reserve University, New York Institute of Technology, Mathematical Applicators Group Inc and Lawrence Livermore Laboratory. Some of these graphics, especially those by Information International Inc, are truly remarkable and anyone interested in this form of output should see the issue. The production of such microfiches is to be a regular feature and, to have your work included in the next one, you should submit slides to the Colour Editor (or rather, Color Editor) by 1 November 1978.


*Figure 2*

My colleagues in System Simulation Limited and I have just bought an Intecolor 8051 colour graphics system and, although we have not yet had time to do much on it, look forward to submitting our graphics for future issues. In comparison with US, not much colour graphics is going on in this country although work by the Cambridge CAD Centre and Atlas Laboratory is comparable with anything going on there. I particularly like the CAD Centre's developments on brickwork colours using their Bugstore—unfortunately it cannot be reproduced here (perhaps our Editor should also consider a microfiche edition).

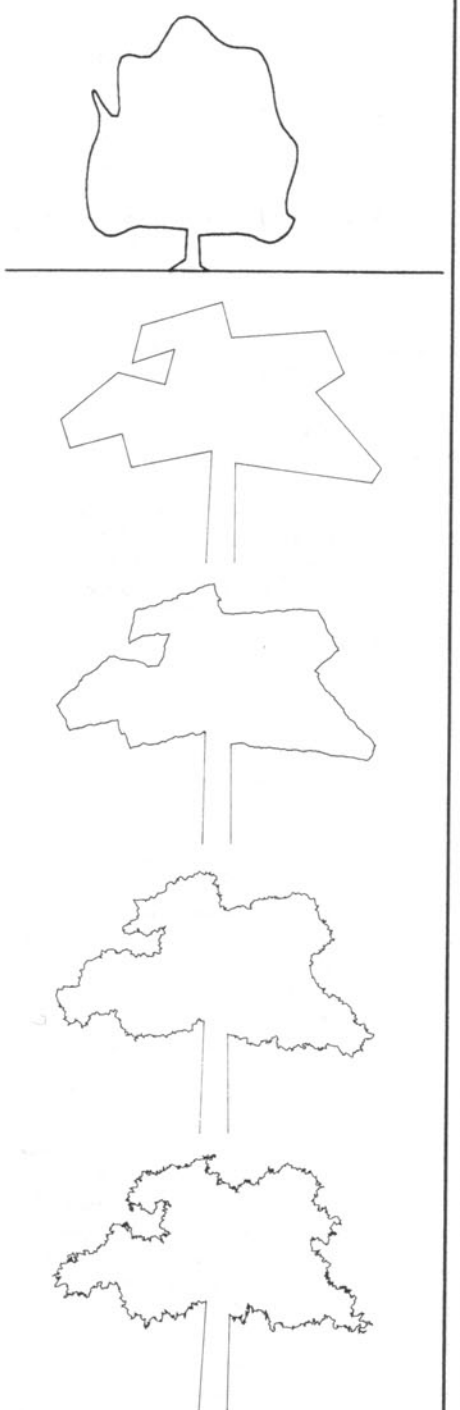
A little known (to me at least) British work in colour graphics was drawn to my attention by Professor John Oldfield of University of Wales, Swansea. This is by T. W. Rowley of Marconi Radar Systems Limited, Leicester who is working on flight and ship simulators. Using raster graphics on an ordinary domestic TV connected to a Marconi LOCUS 16 computer he can produce fairly complex full colour pictures at the rate of 4 or 5 a second—which, of course, is too slow for smooth movement—although he and his team are developing a system to produce pictures at a rate of 50 a second, which will result in flicker free continuous movement. I was particularly interested to note that one of the members of the team is an artist—*and is employed as such.* Other groups please copy.

### Only God can make a tree

A program used fairly frequently in my office is one which allows an architect to choose suitable trees for a given set of conditions: for example, alkaline soils, autumn foliage, size and so on. Having gone interactively through a set of questions to which he gives either definite answers or indicates his indifference, he is given a list of trees which meet the requirements (if indeed any do). One of the things I would like to do is to accompany the list with a set of drawings of the trees showing them in three stages of growth: new, semimature and mature, as well as in their summer and winter configurations. As there are more than 200 trees in the data bank, it will be readily appreciated that the storage and manipulation of $200 \times 3 \times 2 = 1200$ different sets of digitised data, each containing say 500

*Figures 3 to 7 (below)*

*Variations from Paul Brown's foliage drawing program*



points presents a problem for a microcomputer based system—as well as one of sheer physical effort in digitisation. For this reason, I have been experimenting with a parametric approach to storage and preliminary results suggest that it is possible to represent a tree in its summer configuration by about a dozen points provided a suitable means of regenerating the outline can be achieved. The problem is two-fold: one, to recapture the general outline in order to distinguish say, an ash from an elm or an oak; and two, to add sufficient local variation to the outline to give realism to the shape.

To tackle the first problem I used Akima's method of drawing curves as outlined in the *Journal of the ACM*, October 1970. Unlike Bezier's method or other spline-like procedures where you have to specify tensions and stiffnesses and where the points only help to define the curve, Akima's method allows you to draw the curve directly through the set of points without further ado (Figure 3). The second problem is essentially that of introducing 'wiggles' onto the smooth curve. An enormous amount of research seems to have gone on into drawing smooth curves—I don't know of any that deal with the business of drawing ragged ones although the fascinating book *Fractals: Form, Chance and Dimension* by Mandelbrot gives some generalised clues on this. I mentioned this problem to Paul Brown of the Slade school (see *Computer Bulletin*, March 1978) and he produced a foliage drawing program which goes some way towards fitting the bill. Figure 4 shows just the data points connected by straight lines; Figure 5, a first approximation with control variables set at 0.2 and 2; Figure 6, a second approximation with variables 1 and 2; and Figure 7, with variables 1 and 10.

The control variables are, in fact, the standard deviation and the area under the curve of a normal distribution of line lengths and directions and of course, the tree trunk is untreated in all the pictures. The problem of drawing complex (but nonfunctional in the mathematical sense) pictures from simple data is a fairly central one in computer art and it is surprising that more work hasn't been done on it.

This really is the opposite problem to that dealt with by D. H. McLain of Sheffield University in the algorithms supplement of the May 1978 issue of *The Computer Journal*. There McLain shows how to approximate a more complex drawing of 264 lines with a simpler one of 83 lines—what I am looking for is one which reproduces the more complicated one from the simpler.

## The tree of life

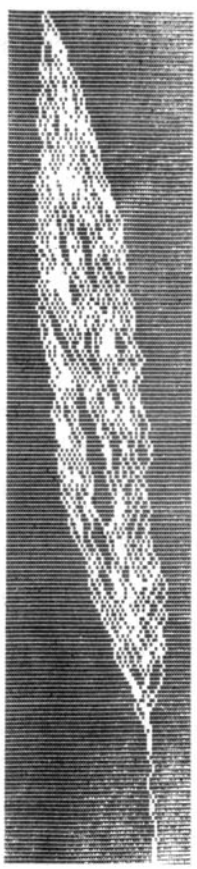
Related both to the foregoing and the Game of Life is a program by Rik Gammack of Hull College of Higher Education which produces tree-like drawings on a teleprinter. Growing downwards from top to bottom on a line-by-line basis, one such drawing (Figure 8) is derived from a growth pattern related to a series of changing values which determine whether or not an element will grow.

Apart from the first, each line is derived from the previous one which is composed of points which either belong to the growth or do not. For each of these points the program decides whether: *a)* it will continue in the same position; *b)* it will move one position right or left; or *c)* it will split both right and left. Which of these possibilities is decided by random selection from an empirical distribution input at the outset and which makes the probabilities different for each line? This is an ingenious use of cellular automata techniques and is easy to implement. Try it!

## Getting it all together

It is surprising how quickly one accumulates hardware. This fact came home to me when, last month, in various rooms in my offices were the following items, all more or less in use at the same time in connection with various graphic works
a 16K Tektronix 4051 graphics system with hard copy unit and digitiser/plotter;
an 8K Intecolor 8051 colour terminal microcomputer with floppy disc drive;
a 32K Altair 8800b microcomputer with dual floppy disc drives;
a 1K Kim 1 microprocessor;
a Diablo 1620 printer;
a Centronics 701 printer;

*Figure 8*



*Continued on page 31*

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## NOT ONLY COMPUTING *continued*

a Tektronix 4010 terminal;
a Teletype terminal connected by modems to a timesharing service;
and a random access slide projector and interface (connected to the 4051). On another floor, but not in use, was a 563 Calcomp 30 inch plotter and controller.

It seemed to me that we really should have connected all this equipment together if only to be able to share printers and hard copy units, and there is no doubt that a local inhouse network is required. We have already begun the first stages of this by connecting the 4051 to the 8051 thus enabling one machine to be a terminal to the other and allowing time sharing of the Diablo printer (which in itself is quite a sizable proportion of the total cost) but, because we have unusual requirements for peripherals such as synthesisers, cameras, projectors, TVs and so on, what we really need is something more on the lines of *a simple data bus for low data rates* described by Chris Moller in *Electronic Engineering*. In this article Moller shows schematics for the six types likely to need interconnection.

I am not much good at hardware but I think that even I could put together some of the circuits described in the article. What is disturbing however, and must be extremely frustrating to the large number of first time users around the world, is the extraordinary difficulty of connecting one piece of computer equipment to another. Apart from the multiplicity of plugs and connectors (which are often not easy to come by) the differences in parity, baud rates and other technicalities which I do not pretend to understand make it unlikely that one item will work with another. Something should be done about this.

Whilst in a complaining mood—why is it that the switches for so many computers and terminals are in such funny and, sometimes, inaccessible places? Tektronix seem to delight in hiding their switches in different places for different machines, presumably on the logic that only those intelligent enough to find the switch should use the device anyway. On the Intecolor 8051 the switch is at the back! As the device measures 500mm wide × 600mm deep × 450mm high, only those with arms of simian proportions can actually get at it. Do they mean you not to switch it off at all?

Manuals, too, seem to vary in quality enormously. Those for the 4051 and the Kim 1 are excellent and could hardly be bettered but others just aren't good enough. The experienced user would be able to find his way around without too much trouble, but the first time user would find that he could not make the best use of his machine because of the inadequacy of the manual. Often the problem is not that the information is not given (although this sometimes happens) but that the manual is so illogically and idiosyncratically arranged as to defy all but the most intense efforts at discovery. In one case, a colleague and I were going through some step-by-step instructions given on disc marking. I was operating the steps while he read them out. The process went something like this:

1 Do the following
2 Do something else
3 Now do this

At the end of this third item, which was about six or seven lines long was a note which said 'Don't do the preceding steps if you haven't done such-and-such'. This was the first mention of such-and-such we could find and, of course, we hadn't done it! The effect was to lose work we already had done. Perhaps we were stupid not to read the whole set of instructions first, but a simple rewording would have prevented misunderstanding.