Not only computing – also art

JOHN LANSDOWN

Researching design

One of the too many things I do is act as part-time Senior Research Fellow and Tutor in Design Computing in the Department of Design Research at the Royal College of Art. In this role I supervise a number of talented students working at Master's and Doctorate levels - the RCA being an entirely post-graduate university. All the subjects of study in the Department relate to aspects of art and design and my students concentrate on areas which particularly interest me: computer graphics, CAD, participative design and intelligent systems for designers. Students of other tutors deal more directly with Design Methodology that is, the methods and techniques of design and innovation management. This is an important area of study for the activity and process of design and is by no means clearly understood. Elsewhere I've said that:

> ... design is a multi-faceted occupation which, for its successful performance, requires a mixture of intuition, craft skills and detailed knowledge of a wide range of practical and theoretical matters. It is a cyclical process in which groups of people work towards a somewhat ill-defined goal in a series of successive approximations. There is no 'correct' method of designing and, although it is recognised that the process can be divided into separate phases, there is no generally accepted sequence of work that might guide design teams in the direction of achieving a satisfactory solution. Indeed, there are no solutions to design problems in the way that there are solutions to mathematical problems: the best that can be hoped for is an outcome which satisfies the maximum number of constraints which bound the area of concern. Furthermore, design is not an algorithmic process in which the desired conclusion can be reached by the application of step-by-step procedures - first finalising this aspect, then that. It is a fluid, holistic process wherein at any stage all the major parts have to be manipulated at once. In this sense, it is less like solving a logical puzzle and more like riding a bicycle whilst juggling.

The purpose of Design Methodology is to set up a structure in which this somewhat amorphous subject can be more clearly understood.

It is extremely important to realise that this is not something of purely academic interest: good design is vital to our national well-being. In a study of US-West German trade, published in the early 1970s, the relative importance of such things as after-sales service, price structure, and quality were evaluated. It was shown that relative price advantage accounted for only 28 per cent of trade success, whereas 47 per cent was attributed to product superiority and uniqueness - which are essentially design-related factors. In a more recent study, *The effect of price and non-price factors on UK export performance and import penetration* by Kerry Schott and Kathryn Pick (University College London, 1983), it was shown that these design factors account for about 45 per cent of the reasons for purchasing British exports and, astonishingly, up to 80 per cent of the reasons for importing foreign goods.

Thus, while it is important to create products which are as cheap as those of our competitors, it is even more important to create things which are better than theirs. A recent Design Centre exhibition called '*Design and the Economy*', showed the possibilities and how UK firms manufacturing well-designed artifacts were frequently more successful than others. The exhibition booklet of the same name and written by Roy Rothwell, Kerry Schott and Paul Gardiner, is full of enlightening information on the importance and relevance of design (including the facts I outlined above). It is essential reading for anyone concerned with creating any products - and that includes (it especially includes!) computer products. Under the heading of '*Does Design Matter*', the authors say:

> ... the message of the booklet is optimistic in that it concludes that our economic decline is far from inevitable. But this reversal of fortunes depends on a major change in attitude within a great many manufacturing companies to ensure that their products beat their opposition in quality and performance within their price range. For all the evidence points to poor design and a failure to innovate as one of the major causes of Britain's loss of both export and home markets.

Many of you will have read in the press of the difficulties the RCA is experiencing. Despite these, we in the Design Research Department are doing our best to understand design and innovation, and to improve its quality.

The aesthetics of mathematics

Although it is probably invidious to pick out the work of one of my students in preference to that of others, Robert Dixon's studies are perhaps the most immediately relevant to the interests of those of you who read these pages. I'll deal with the work of some of the others at a later date.

Robert, who is a PhD candidate and artist/mathematician, is researching the ways in which computer graphics can help in the understanding of mathematical concepts. He has taken as his starting point a belief similar to that expressed by author, Ian Stewart, in his book *Concepts of Modern Mathematics* (Pelican, 1975), which is that mathematics has tended to become more and more abstract but that most mathematicians:

> ... think in pictures; their intuition is geometrical. Pictures carry so much more information than words. For many years schoolchildren were discouraged from drawing pictures because 'they aren't rigorous'. This is a bad mistake ... (pictures) are an essential aid to thought.

Robert's work at the RCA is aimed at explaining and expanding this belief.

The study is at an early stage and, as yet, Robert has only begun to look at examples of specific geometrical productions such as symmetry, space-filling curves and snowflakes, phyllotaxis (leaf arrangement in plants) and so on, all with the aim of mastering the Department's computer graphics system, before going on to the subject proper. Some examples of this work which stand as drawings in their own

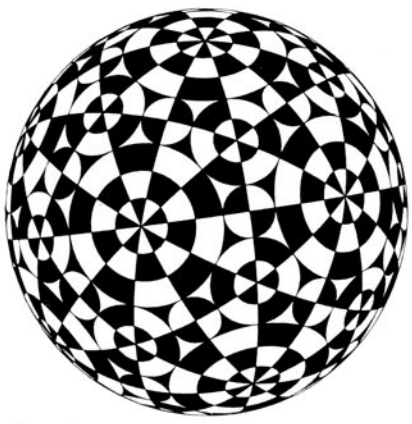

Figure 1

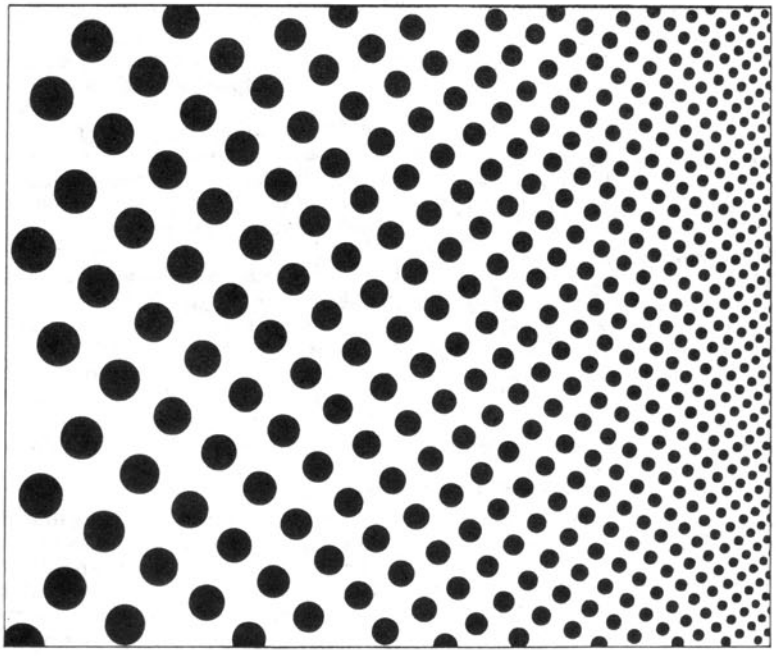

Figure 2

right are included here. Figure 1 shows one of the beautiful 14 spherical symmetries and, Figure 2, unrolled cylindrical phyllotaxis - a subject which has interested Robert for some years and is covered in articles he published in *Leonardo* (Vol 16 No 2 1983) and *New Scientist* (17 December 1981).

A geometrical transformation, called *inversion*, is the subject of Figure 3. Inversion is a non-linear transformation and, hence, is little-used in normal computer graphics. Given a circle of radius R, it maps a point P, lying at a distance D, from the centre of the circle to a point N, which is on the same ray OM, but at a distance $R*R/D$, away from the centre. The effect of this is to change straight lines into circles and, as Figure 3 shows, chessboards into rosettes.

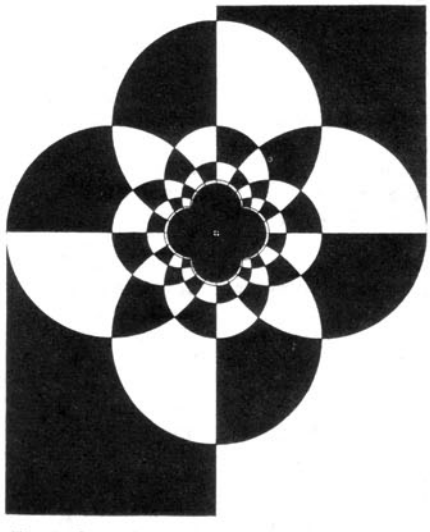

Figure 3

Is there anyone still out there?

One of the difficulties of writing this regular series of articles (which, to my amazement, I find I've been doing since 1974) is that I get little feedback from readers - if, that is, there are any. People who I meet in Branches round the country say that they read my contributions but I receive very few letters commenting on or arguing with anything I say. This is slightly frustrating as I don't know whether or not I'm saying anything of interest. Please let me know your reactions or news of what you're up to.

Book review

Design of Computer Data Files
By Owen Hanson, 1982; 358 pages.
Pitman, $16.00

Mr Hanson has written a lengthy book intended to fill a gap in the available literature, namely, the need for a teaching and reference text dealing with the physical aspects of data file design. However, like the proverbial square peg, an excess of material has been used to not-quite fill the round hole. It could also be argued that the increasing availability of data base systems and associated design aids have, of late, reduced the need to fill the 'hole'. That having been said, the book is a well structured and informative exposition of the subject, reflecting the author's extensive data processing and educational experience.

The initial chapters are a useful source of background information, reviewing file design, storage devices, record formats and blocking/buffering strategies. Subsequent chapters deal with file organisation (sequential, direct, indexed sequential and multi-indexed) and the final chapters deal with factors influencing the choice of file organisation and the security and integrity of files. There are a number of appendices containing reference data and additional illustrative examples. The work is profusely illustrated with tables and graphs, the latter not always well annotated. The instructional objectives of the book are well served by imaginative use of bold type for emphasis and term definition as well as by revision questions at the end of each chapter. The book would best suit a course containing a substantial element of commercial data processing systems analysis and design. Students on less specialised courses would benefit from a more selective reading of it.

In a book very much concerned with storage hardware and associated systems software, there is always the danger of obsolescence as well as bias towards specific machines. This has not been wholly avoided by the author. IBM and ICL systems predominate and, regrettably, there is no mention of techniques such as balanced tree indexing or more recent developments such as contents addressable file systems and order-preserving hashing mechanisms. Systems for storage and retrieval of free text also receive less attention than they deserve.

All in all, the author is to be congratulated for his effort in a neglected area, but not without some regret that he has chosen to sacrifice breadth of coverage for an excess of detail.

D. C. LINDSEY *Aberdeen*