Not only computing—also art

JOHN LANSDOWN

Micros and the public

In the last issue, the editor published a letter from me indicating my unhappiness with the way microprocessors were being introduced to the public and, in particular, that the 'jaggies' were not drawn to the potential purchaser's attention. T. M. Spence, the managing director of Scotbyte Computers Limited of Edinburgh agrees to a certain extent with my comments on the 'jaggies' but thinks I overstate the case and has written as follows.

'We can't all afford £30,000 super high speed super definition graphics devices. I, and a lot of other people, have had a lot of fun with the likes of the Nascom – let's not throw the baby out with the bath water. In talking to a customer recently about one of the more popular microcomputers and its graphics facilities I was at pains to point out some of the shortcomings. His reaction, after using the device was 'far from there being disadvantages, it is producing some most interesting graphics effects'. Certainly not the response I was expecting!

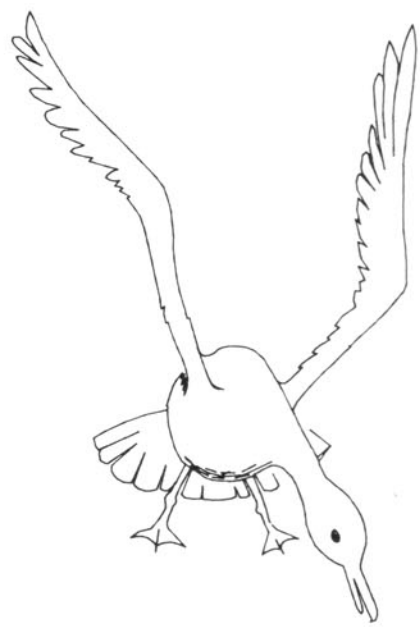
'May I point out that some members of the Society do sell microcomputers and are aware of the pitfalls but do believe that with care such machines can fulfil a very valuable and cost effective role. I think it is very easy to adopt the attitude that because it is not as powerful as a mainframe, a micro is useless. In my view, that is certainly not the case and it would be a pity if the Society adopted that general view.'

Mr Spence is, of course, right. I would not like to give the impression that I am against micros – on the contrary, virtually the only computers I ever use are micro based. I simply think we should take care to show that micros are *appropriate* for some forms of computing and not so appropriate for others. That distinction has not yet, I think, dawned on the public consciousness.

Pictures

Most of the computer graphic art works I show in these columns are of an abstract nature and this, of course, reflects the general situation in computer art. Dr Eric Hope, who works in the CAD Centre, Ottawa, Canada, is interested in more impressionistic drawings and has sent me a computer assisted sketch of a harbour scene

Figure 1 (above)
Figure 2 (right)



(Figure 1). The picture was sketched on a graphics tablet using a stylus which acted both as a pen and the input device to the CAI LSI-2 computer, so that the picture being drawn appeared both on the tablet paper and a Tektronix 4015 video display unit taking about 90 minutes to be created. The input was *via* software written by Dr Hope in the Grapple language, part of which he helped to create. On completion, the initial sketch was plotted on a Zeta 3600 and then used as a guide for redigitisation when corrections, additions and deletions were made. The seagulls in the foreground were separately sketched to a much greater size (Figure 2) and then edited into the picture files using a 3D picture editing system Dr Hope has devised for producing structures such as building designs, frameworks and chip substrate layouts. This idea of building up the picture piece by piece conforms to the way many artists work and I look forward to seeing how other artists and architects might employ such a useful tool.

With the growing availability of new equipment and software such as Dr Hope has created, more and more artists are seeing the computer as a device for assisting in the production of what my colleague, George Mallen, and I call 'evocative graphics'; that is drawings which *evoke* a scene by using the techniques of art (line quality, colour, chiaroscuro, pointillism and so on) rather than the techniques of physics (laws of lighting and shadowing, 3D mathematics and so on). The combination of these two techniques promises much.

Expert systems

The indefatigable Professor Donald Michie has taken the initiative in forming a new BCS specialist group on Expert Systems and the inaugural meeting in June 1980 was attended by over 150 people, more than half of whom (rather surprisingly I thought) were from industry. An Expert

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(772–846AD) was at different times Governor of Hangchow, of Soochow and of Ho-nan. One of his last poems, translated by Arthur Waley, is about the philosopher Lao-tzŭ, according to tradition the founder of Taoism in the 8th century BC.

'Those who speak know nothing;
Those who know are silent'
These words, I am told,
were spoken by Lao-tzŭ.

How is it then, the poem ends, that one who knew, wrote so much?

BELL FEEDBACK

In spite of some creative typesetting and ineffective corrections, at least one reader was able to follow my last article about the Bell numbers, 1, 2, 5, 15, 52, . . . Richard Pinch of the Mathematical Institute at Oxford (again) has been able to reconstruct the argument leading to my formula for the Bells. He writes:

'The inner term in the summation,

$$\sum_{s=1}^{N-a} \frac{(-1)^s}{s!}$$

represents the proportion of 'derangements' on $(N-a)$ objects, that is the proportion of permutations which leave no object fixed. I wonder whether there is an alternative derivation in which this term plays an explicit role? In mine it appears simply as an artifact of the simplification of the expression.

'Consider an N-tuple on exactly b letters. It will constitute an alphametic form iff, when listing the letters in order of their first appearance, they occur in alphabetical order. Clearly, for any such tuple there is just one permutation of the letters which, when applied to all the letters in the tuple, makes it an alphametic form. So the number of alphametic forms with just b letters, is $(1/b!)$ of the number of tuples with b letters. Call this latter number x_b. (It also depends on N, which we are assuming fixed for the moment.)

'The tuples with just b letters are what is left from the b^N possible words of length N on b letters, after excluding the tuples with less than b letters. For any number c less than b, there are $\binom{b}{c}$ ways of choosing the c letters from the b, and any choice gives rise to a complete set of exact c-tuples. Hence we get the recurrence relation

$$b = \sum_{c=1}^{b} \binom{b}{c} \; x_c$$

and it is easy to check that the solution is

$$x_b = \sum_{a=0}^{b} \binom{b}{a} \; (-1)^{b-a} \, a^N$$

which can be verified by induction, or written down directly from the exclusion-inclusion principle.

'So the number of alphametics on any number of letters up to N is

$$B_N = \sum_{b=1}^{N} \frac{1}{b!} \sum_{a=1}^{b} \frac{b!}{a!\,(b-a)!}$$

and we can reverse the order of summation to get

$$\sum_{a=1}^{N} \frac{a^N}{a!} \sum_{b=a}^{N} \frac{(-1)^{b-a}}{(b-a)!}$$

and on substituting $s = b - a$ we get the formula

$$B_N = \sum_{a=1}^{N} \frac{a^{N-1}}{(a-1)!} \sum_{s=0}^{N-a} \frac{(-1)^s}{s!}$$

$$\sum_{s=1}^{N-a} \frac{(-1)^s}{s!}$$

Q.E.D.'

M. A. Singer has also supplied a proof of this formula.

Meanwhile my own research has turned up an even more remarkable formula for the Bell numbers.

$$e\,B_{n+1} = \sum_{a=0}^{\infty} \frac{(a+1)^n}{a!}$$

This is 100 years old, and I will return to it in my next article, together with details of the alphametic computations of a team in Japan.

The algorithm I gave last time for the Cell arrangements needs only a simple change to list the alphametic forms. The value in each location can vary from 1 up to 1 more than the highest value in all the preceding positions, not just in the one immediately before it.

```
I=1
FOR J=1 TO 2
FOR K=1 TO J+1
R=MAX(J, K)+1
FOR L=1 TO R
PRINT I, J, K, L
NEXT L
NEXT K
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COMPUTER ART *continued*

System encapsulates knowledge gained from experts and makes this available to less experienced users in such a way that it can explain and justify any advice it proffers, so there is plenty of scope for such systems. Britain has not done too much in this field (although ICL's two good diagnostic Expert Systems and Edinburgh's AX/L for oilrigs are important contributions) so I am sure we all welcome the forming of the group.

I am pleased to tell you that the Royal Institute of British Architects has awarded a Fellowship for a short research study on the impact of Expert Systems on the construction industry. I am even more pleased to say that they have awarded it to me.

What Next?

On the way to Seattle (yes, grandma, it's SIGGRAPH Conference time again – but more about that in the next issue) I stopped off in Vancouver and a note in the *Vancouver Sun* of Tuesday 8 July 1980 caught my eye.

'On 5 July 1980 we reported in an article concerned with Scrabble that Mr Hal Ober was addicted to a narcotic. This statement was incorrect, misleading and grossly offensive in content. It creates a wrong impression of Mr Ober'.

After some apologetic lines, it went *'The Sun has explained to Mr Ober that the error occurred as a result of a problem within the Sun's computer system'.*

No further explanation ensued so that I am unable to let you know what sort of libellous bug it was that so maligned Mr Ober – and in an article on Scrabble, that most innocent of games. You will note that the drug spoken about was a narcotic – not an anabolic steroid which might have been more understandable.

We are all used to seeing computers used as excuses for errors of all sorts.

CELL FEEDBACK

Your Cell numbers C_n are better known as Catalan numbers (at least you won't have to change your symbol). See *Basic Techniques of Combinatorial Theory,* by D. A. Cohen, 1978, published by Wiley. Chapter 4 on Advanced Counting Numbers gives all the basic information.

I enjoy your contributions.

BARRY MARTIN *Birmingham*