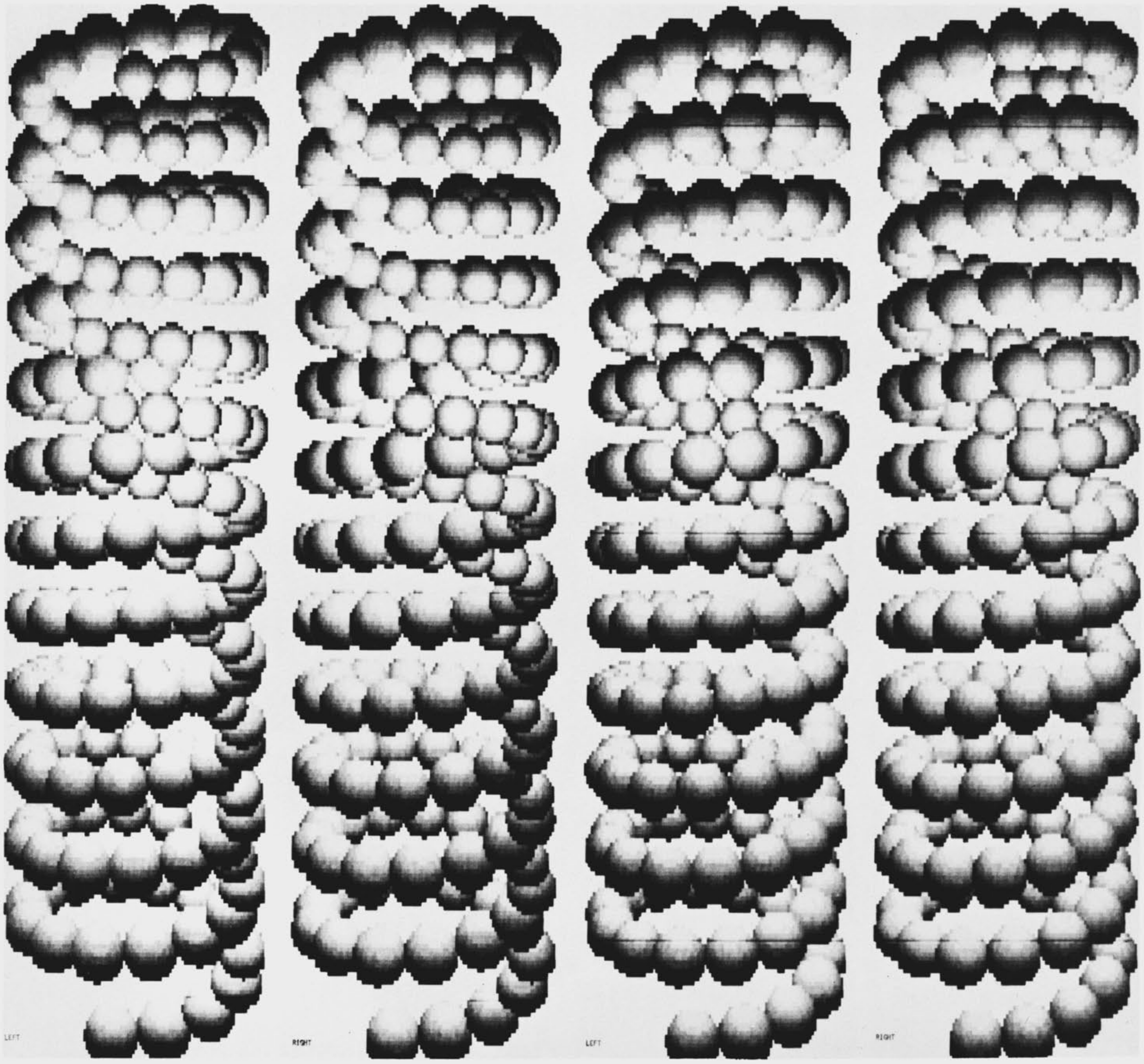
PAGE44

COMPUTER ARTS SOCIETY QUARTERLY APRIL 1980



CHRIS FRENCH: COMPUTER ART – A LOAD OF QUASI-SPHERICAL OBJECTS?

COMPUTER ART – A LOAD OF QUASI-SPHERICAL OBJECTS?

(Piss-artistry – the computer as a tool, or Just more screwball research?)

CHRIS FRENCH
Abysmal Sciences Department
Northern University of Technology and Science

Address for correspondence:
Dr Chris French
Optics Department
UMIST
PO Box 88 Sackville Street
MANCHESTER
England M60 1QD

In recent years in Britain it has been quite common to hear the cry go up "What a load of balls!" This popular ejaculation appears to have its roots in the sad malaise which has recently afflicted the British Isles and England in particular. Our continuing financial crisis and loss of self-confidence seems to me to be traceable to one source – the decline and collapse of the British national sports of soccer and cricket. The games were of course invented by the English so that there would be at least two fields of endeavour in which they were supreme and victorious. To some extent this acted as a psychological bulwark against losses such as the erosion of the British Empire and even the corruption of the rules of soccer and cricket into American football and baseball (games which are played virtually exclusively in a small region of the Western Hemisphere – if you cannot win a game then change the rules so that you can). So, despite the losses of Empire and other adversities, the British morale remained high until an insidious change of fortune crept into these fields of sport. The culmination was when England failed to even qualify for the 1974 World Cup Soccer Finals at a time when its cricket was totally lacking in distinction. Recent history has seen England fail to qualify for the 1978 World Cup, Scotland exit ignominiously from these Soccer Finals, and the spectre of big-money professionalism (American-style) hover over our cricket. Naturally a lack of prowess in such important sports led to other failures – London stopped swinging, mini-skirts became extinct, Rod Stewart joined the brain-drain to America, the value of the pound plummeted and thousands of American tourists flooded across the Atlantic. The whole syndrome, emanating as it did from ball sports, led to the application of that one phrase to characterise anything which is lacking in quality, disappointing, worthless or pseudo – even though it may not itself relate to sport or the loss of British self-confidence. Indeed nowadays people other than the British also use the phrase. Frequently it is shortened to one word – "Balls!"

Recently we have seen the phrase applied to psychology and computer art. As a psychologist with a strong interest in the computer-for-art movement, I was naturally concerned at this denigration of two areas of activity which are close to my heart and which I consider important and fine. I therefore decided to initiate my own investigation. Could computer art really be "a load of quasi-spherical objects" as had been alleged? And could that excellent young science of experimental psychology be implicated? My starting point was a short article by Alan Parkin in 1968 on how to draw a ball using a plotter. My intuition told me that here might lie the key to the whole problem. Alan Parkin's routine enables a computer to plot a picture of an illuminated ball after its size, its position relative to the observer, and the direction of the illumination have all been specified. My first step was to rewrite the routine in Fortran IV modifying it at the same time. The changes mean that the ball produced is illuminated by a point source instead of a parallel beam of light. This provides for more varied and attractive specular effects. Another simple modification enables one to use a lineprinter or typewriter as an output device. Printers are quicker and more available than pen plotters although the illustrations to this article were in the main performed on a microfilm plotter as this helped the photography. The final change means that the routine can plot more than one ball ... in fact a *load* of balls. This last change *is* deceptive. It has subtle implications which are easy to overlook and which this article hopes to make clear. The major implication is that it enables us to produce "Oddball" pictures – pictures which are illusory or ambiguous – pictures which are "impossiball" (sic).

Experimental psychologists concerned with understanding how people see a three-dimensional world when confronted with a two-dimensional stimulus to the retina have anal-

```
C
C BALLIT BY CHRIS FRENCH
C           ABYSMAL SCIENCES DEPARTMENT
C           NØRTHERN UNIVERSITY ØF TECHNØLØGY AND SCIENCE
C           ENGLAND
C
C BALLIT IS AN EXTENSIØN ØF ALAN PARKIN S ALGØL PRØGRAM WHICH WAS
C WRITTEN TØ DRAW A BALL ØN AN INCREMENTAL PLØTTER USING A PEN. THIS
C PRØGRAM DIFFERS IN A NUMBER ØF WAYS: IT USES A LINEPRINTER ØR TELETYPE
C AS AN ØUTPUT DEVICE, IT DRAWS A CØLLECTIØN ØF BALLS - NØT JUST ØNE,
C IT IS WRITTEN IN FØRTRAN IV,  AND PØINT SØURCE ILLUMINATIØN IS USED
C AS ØPPØSED TØ A PARALLEL BEAM ØF LIGHT.
C
C THE USER SPECIFIES THE SIZE AND PØSITIØNS ØF THE BALLS ALØNG WITH THE
C PØSITIØN ØF THE ILLUMINATIØN SØURCE. WITH A CAREFUL CHØICE ØF DATA
C VERY PLEASING EFFECTS CAN BE PRØDUCED.
C
C THE MATHEMATICS BEHIND THE PRØGRAM ARE NØT VERY DIFFICULT AND ARE
C EXPLAINED IN PARKIN S ARTICLE.
C
C THE ØNLY NØN-ANSI FEATURE IS THE INCLUSIØN ØF A RANDØM NUMBER
C GENERATØR. THIS IS INITIALISED BY THE SUBRØUTINE RANSET AND CALLED
C USING THE FUNCTIØN RANF WHICH RETURNS A VALUE BETWEEN ZERØ AND ØNE.
C THE R.N.G. IN CØNJUNCTIØN WITH THE CØNTENTS ØF THE ARRAY KEY WILL
C PRØDUCE A VARIETY ØF WAYS FØR PRINTING THE BALLS.
C
C REFERENCE - PAGES 84-85 ØF
C               CYBERNETIC SERENDIPITY    EDITED BY JASIA REICHARDT
C               LØNDØN - STUDIØ INTERNATIØNAL - 1968
C               HØW TØ DRAW A BALL  BY  ALAN PARKIN
C
C
C BRIEF EXPLANATIØN ØF VARIABLES
C
C BALLS                  - NUMBER ØF BALLS IN PICTURE /CURRENT DECLARATIØN
C                          GIVES A MAXIMUM ØF TEN
C AZ                     - DISTANCE ØF EYE FRØM LINEPRINTER PRINT PLANE
C DIXT, DIYT, DIZT       - CØØRDINATES ØF ILLUMINATIØN SØURCE
C R(I)                   - RADIUS ØF I-TH BALL
C CX(I),CY(I),CZ(I)      - CØØRDINATES ØF CENTRE ØF I-TH BALL
C BACK                   - BRIGHTNESS ØF BACK-GRØUND  /HERE SET TØ ØNE
C 0.0,  0.0,  0.0        - CØØRDINATES ØF VIEWING EYE /VIEWPØINT IS ØRIGIN
C KEY                    - THREE-DIMENSIØNAL PRINT KEY ARRAY WHICH CØNTAINS
C                          EIGHT DIFFERENT PRINT KEYS WHICH ARE SELECTED AT
C                          RANDØM BY THE SUBSCRIPT J(RANGE 1 TØ 8). THREE
C                          LEVELS ØF PRINTING ARE USED (K TAKES VALUES 1 TØ 3
C                          AS SUBSCRIPT). THE FIRST SUBSCRIPT, I, ALLØWS FØR
C                          TEN LEVELS ØF BRIGHTNESS.
C
C NØTE CAREFULLY THAT WHETHER ØR NØT A BALL IS ØBSCURED FRØM VIEW BY
C ANØTHER BALL DEPENDS IN THIS PRØGRAMME ØN THE ØRDER IN WHICH IT IS
C READ IN AND NØT ITS PØSITIØN IN THREE-DIMENSIØNAL SPACE. MØDIFICATIØNS
C TØ REMEDY THIS ARE TRIVIAL. THE UNITS USED ARE THØSE ØF PRINT
C PØSITIØNS - TYPICALLY 0.1 INCH.
C
      REAL AX,AY,AZ, DIXT,DIYT,DIZT, NØX,NØY,NØZ, T,U,V, LAM, MISS, BRI,
     1CX(10),CY(10),CZ(10), DIX(10),DIY(10),DIZ(10), R(10), D(10), DUD
      INTEGER BALL,BALLS, LINE,LINES, CØLUMN,CØLS, I,J,K,L, IBRI, BACK,
     1IN,ØUT, BUFF(136,3), KEY(10,8,3)
      DATA BACK/1/, DUD/0.5/, CØLS/136/, IN/1/,ØUT/2/
C
C INITIALISE R.N.G.
      CALL RANSET(DUD)
C
C READ PRINT KEY TØ BE USED
      READ(IN,10)(((KEY(I,J,K),I=1,10),J=1,8),K=1,3)
   10 FØRMAT(80A1)
C
C READ IN NØ. ØF LINES ØF ØUTPUT, NØ. ØF BALLS, DISTANCE ØF EYE FRØM
```

```
C PRINT PLAIN, AND ILLUMINATIØN SØURCE CØØRDINATES
    5 READ(IN,11)LINES,BALLS,AZ,DIXT,DIYT,DIZT
      IF(LINES.EQ.0.ØR.BALLS.EQ.0.ØR.BALLS.GT.10)STØP 0000
   11 FØRMAT(2I3,F6.0,2X,3(F6.0,1X))
C
C READ IN THE CØØRDINATES ØF EACH BALLS CENTRE AND ITS RADIUS
      READ(IN,12)(CX(BALL),CY(BALL),CZ(BALL),R(BALL),BALL=1,BALLS)
C ELIMINATE PRØBLEM ØF NEGATIVE Z BALLS
C     IF(CZ(BALL).LE.0.0)STØP 1111
   12 FØRMAT(3(F6.0,1X),1X,F6.0)
C
C
C SAMPLE DATA FØLLØWS
C-------------------
C (NB DATA HERE FILLS CØLUMNS 3-80 WITH ØRIGINAL CØLUMNS 79 & 80 BEING LØST)
C
C HHHHHHHHHHHW$H*+:.   HW$H*+:.   HW$H*+:.   HW$H*+:.   HW$H*+:.   HW$H*+:.   HW$H*+:.
C $$$$$$$$$$$M         $M         $M         $M         $M         $M         $M
C XXXXXXXXXXX          X          X          X          X          X          X
C 66 05  100.      10.      10.    -50.
C   0.      0.   300.     100.
C  -20.   -30.   250.      40.
C  +10.   +15.   200.      30.
C  -10.   +20.   150.      20.
C  +15.   - 5.   110.      10.
C
C
C
C CALCULATE ILLUMINATIØN VECTØR (DIX(BALL),DIY(BALL),DIZ(BALL))FØR EACH
C BALL. D(BALL)  CAN BE USEFUL FØR SUPERPØSITIØN DECISIØNS.
      DØ 3 BALL=1,BALLS
      DIX(BALL)=DIXT-CX(BALL)
      DIY(BALL)=DIYT-CY(BALL)
      DIZ(BALL)=DIZT-CZ(BALL)
      D(BALL)=DIX(BALL)**2+DIY(BALL)**2+DIZ(BALL)**2
      D(BALL)=SQRT(D(BALL))
      DIX(BALL)=DIX(BALL)/D(BALL)
      DIY(BALL)=DIY(BALL)/D(BALL)
      DIZ(BALL)=DIZ(BALL)/D(BALL)
    3 D(BALL)=CX(BALL)**2+CY(BALL)**2+CZ(BALL)**2
C
C
      DØ 41 LINE=1,LINES
      AY=(LINES/2-LINE)*5/3
      DØ 42 CØLUMN=1,CØLS
      AX=CØLUMN-CØLS/2
      IBRI=BACK
      DØ 43 BALL=1,BALLS
      T=-2.*(AX*CX(BALL)+AY*CY(BALL)+AZ*CZ(BALL))
      U=AX*AX+AY*AY+AZ*AZ
      V=CX(BALL)**2+CY(BALL)**2+CZ(BALL)**2
      MISS=T*T-4.*U*(V-R(BALL)**2)
      IF(MISS.LT.0.0)GØTØ 43
      LAM=(-T-SQRT(MISS))/(2.*U)
      NØX=(LAM*AX-CX(BALL))/R(BALL)
      NØY=(LAM*AY-CY(BALL))/R(BALL)
      NØZ=(LAM*AZ-CZ(BALL))/R(BALL)
      BRI=NØX*DIX(BALL)+NØY*DIY(BALL)+NØZ*DIZ(BALL)
      IBRI=BRI*8.999999+2.0
      IF(IBRI.LT.2)IBRI=1
   43 CØNTINUE
      J=7.999999*RANF(DUD)+1.0
      DØ 42 K=1,3
   42 BUFF(CØLUMN,K)=KEY(IBRI,J,K)
   41 WRITE(ØUT,20)((BUFF(CØLUMN,K),CØLUMN=1,CØLS),K=1,3)
   20 FØRMAT(1H ,136A1/1H+,136A1/1H+,135A1)
C
C
      GØTØ 5
      END
```

Figure 2

Figure 1

ysed the effect of "depth cues". These cues provide information which enable us to see the third dimension with some objects nearer than others, and enable us to assess relative size and distance. One of these important cues is interposition or covering. If one object partially covers another then it is seen as being closer to the observer. Normally this information is accurate but on occasions it may be misleading and lead to illusory perception. A well known and elegant demonstration of this effect involves the use of two playing cards. In figure 1 the Queen of Clubs appears much bigger than the Eight. This is in fact an illusion. Both women are actually equally well endowed and the Queen of Clubs is closer. The effect has been achieved by cutting off a little of the Queen's bottom which would otherwise partially cover the Eight. This is made clearer by the hearts in figure 2 where the Queen of Hearts has been snipped as before but the two cards have been placed side by side. When the brain sees the image of figure 1 it assumes that the Queen is intact and that she is therefore behind the Eight and bigger. An illusion of size and depth has been created and three-dimensional space has been distorted.

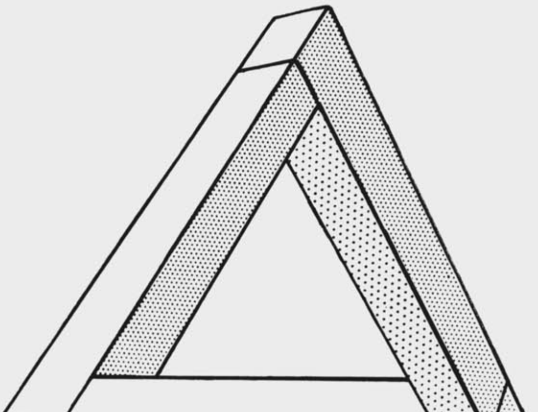


Figure 3

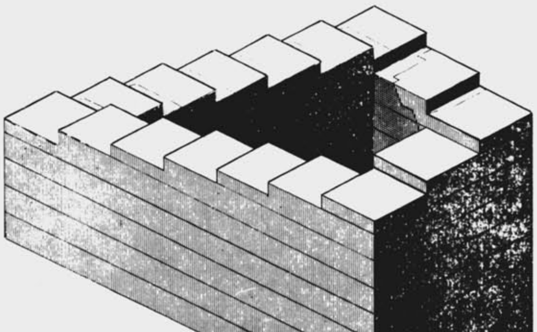


Figure 4

Over the last twenty years interest has focussed on a particular form of this type of illusion. In this a two-dimensional figure is presented which the eye interprets as a representation of a three-dimensional object. The problem with these is that in a sense of the word the objects are "impossible" (Penrose and Penrose). Each part of the figure is a correct two-dimensional representation of part of an object, but when put together the parts make a whole which is incongruous. Figure 3 is the first that Penrose and Penrose presented. It is possible to view one or two apices of the "triangle"(?) without any problem but if we view the whole then we find we have an object we cannot entirely comprehend. Another example is their ascending staircase (figure 4) which goes up and up but cannot get any higher because it goes round in a circle coming back to its starting point. Although the objects represented are called "impossible" it is in fact *possible* to construct them. However, when viewed from different angles these objects appear quite unlike the two-dimensional figures which initiated them. These impossible figures have been brilliantly exploited by the artist, Escher, who has presented them at their most fascinating (see Teuber, 1974). Figure 5 shows his "Belvedere". Note how sections of the building are "in front" in the middle area of the picture but "behind" in the upper part. It should perhaps be emphasized that Escher was not the first artist to tamper with depth cues and perspective, and contemporary experimental psychology did not invent impossible pictures. The general principles at work have been known for centuries. A rather good early example is the picture shown in figure 6, which is an 18th century drawing by Hogarth: "Whoever makes a DESIGN without the Knowledge of PERSPECTIVE will be liable to such Absurdities as are shewn in this Frontispiece." In all the examples presented in this article – from Hogarth's fisherman to the playing cards – the viewer carries with him or her non-conscious "expectations" as to the form of the real world. We expect playing cards to be rectangular and not have bits cut out of them and we expect buildings to be vertical. When perspective cues and interposition cues in particular are carefully manipulated we may end up with impossible pictures.

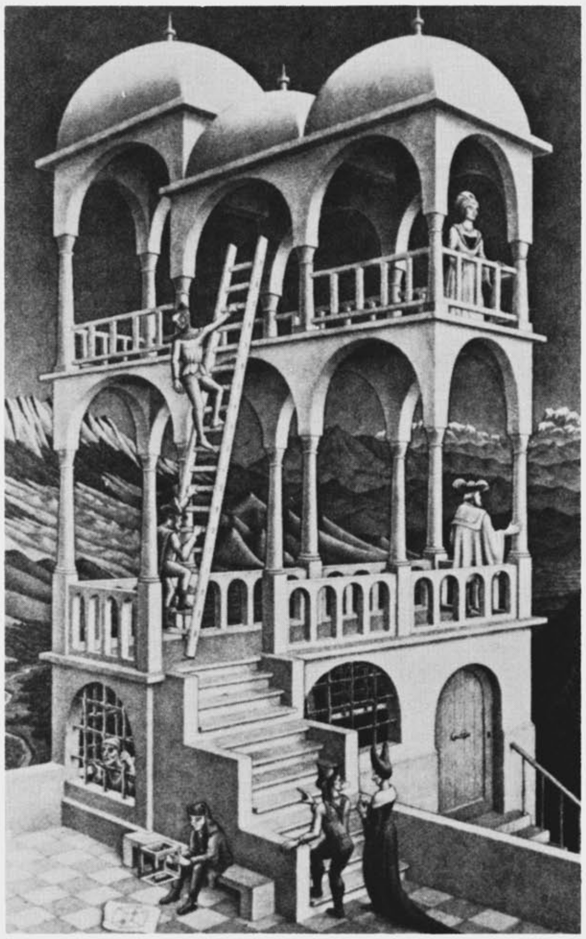


Figure 5

Figure 6

Now we can return to our ball program and see how we can produce "impossiball" pictures. Very simply, the program will on request take a ball which is "behind" and print it "in front". And if we do this in a context where the observer has an "expectation" about what he is viewing then we can produce an impossiball type of illusion.

Perhaps this can be made more clear by the example given in figure 7.* Two helices on the right are constructed of chains of balls. If you examine them closely you will see they differ slightly. The left one is the view seen by the left eye and the right one is the view for the right eye. Together they form a stereo pair and if suitably presented to the observer he or she will see a normal helix composed of balls in three dimensions. To enhance the stereo-effect a close point source of illumination has been used in this instance. Two helices on the left, however, are quite different. A first glance may give the same impression but closer inspection, even with only one eye, will reveal differences. Generally, the first thing noticed is a "break" in the pattern of balls near the middle. The bottom halves of the chains seem to go round and round as in the thread of a screw but the top halves do not. Closer inspection reveals that even the bottom halves are more screwball than you first thought. Only the lower left quadrants of each of these two left helices are normal. In the other quadrants the balls have the correct size, shape, position and illumination you would expect for the helix. The problem is that you would not expect to see some of the balls shown and others which you would expect are missing. Some balls have been printed in front when they should be behind. The effect is to give the observer the impression of a paradoxical object. It looks like a helix but it isn't! The balls appear to weave continuously towards the eye but they can't! The object portrayed is "impossiball". As with other impossible objects it should be possible to physically construct this one, but for a non-dextrous programmer it is easier to produce a pair of stereo images which is what these two left pictures are. When the left eye is shown one image, the right the other and the two are fused into one, the object is seen in three dimensions although the precise percept will depend on how good the observer's binocular vision is. In the lower left quadrant, part of a normal helix is seen, while in the upper left half the interposition depth cues are suppressed and the tendency is to see part of the helix, but with the front balls transparent or cut away so as to show the ones behind – much as you sometimes have in engineering drawings designed to show hidden parts. One might expect to find the same effect with the right half of the helix but here one tends to find that the interposition depth cues are dominant and the impression is given of quasi-spherical objects coming towards the viewer and getting smaller. This is despite the fact those balls which are seen in front are actually behind as far as the computations and the information supplied by the binocular depth cues are concerned. It is as well to mention one limitation of the balls portrayed here. They have a somewhat ethereal quality. They are on a "higher" plane than your "everyday" ball as they cast no shadows. This useful feature is simply a limitation of this programmer.

The next stage is to turn from questions of perception to aesthetics and ask how figures such as these can be made more interesting to the viewer. If we make the angle our helix subtends at the eye larger than an eye's normal field of view we obtain a distorted helix and balls as in the middle upper section of figure 8. We have also done two other things in this figure to generate interest – (i) the horizontal and vertical scales have been made different so that our balls are now ellipsoids, and (ii) the negative image has been presented with the highlights now appearing as dark spots. The lower half of this figure is in fact simply the illumination levels – the numerical data for the print in the upper half. The banded effect results from the varying densities of the digits 0 to 9, of which the picture is comprised. There is no distortion in the outer helices as the angle subtended at the eye is within normal limits.

Just considering interposition or covering, there are four main ways of printing chains of balls. One may use the normal convention and print those which are closest to the observer on top or one may reverse this and print the most distant ones on top. Alternatively we can see where each ball comes in the chain of generation and print the first on top, or do the reverse and print the last on top. All four of these possibilities are shown in the four columns of figure 9. An added dimension of change to those already mentioned has also been incorporated by varying the position of the point source of illumination.

The reader may consider by now that we have been going round in circles long enough, but in fact we have hardly begun to exploit the potential of balls. If we turn our helix around and look down into the tunnel so formed we obtain the pictures in figure 10. These are again wide-angle views with the balls distorted near the edges of the pictures; the vertical and horizontal scales are unequal; and positive and negative pictures are presented. Also by presenting the ground to

* Cover

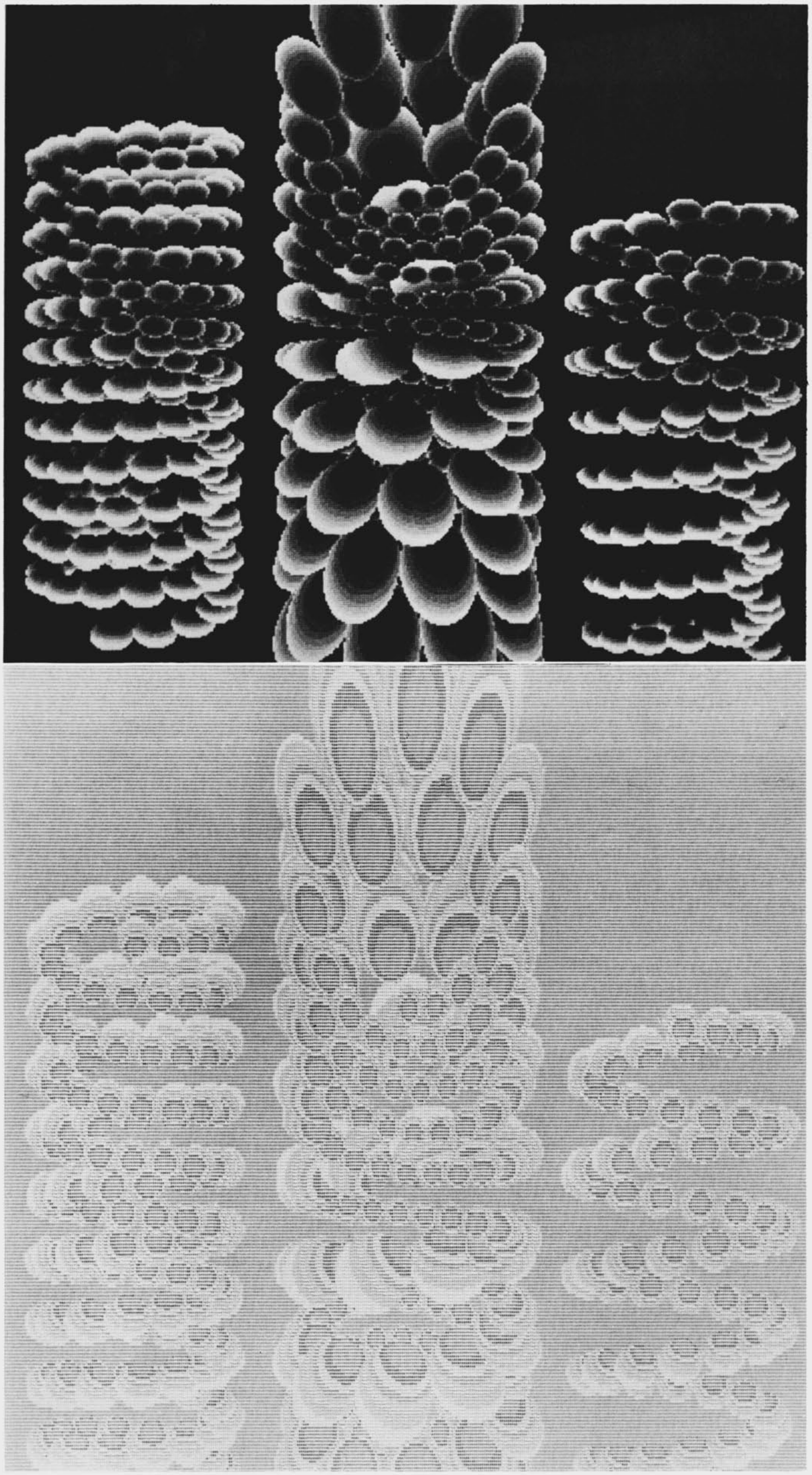


Figure 8

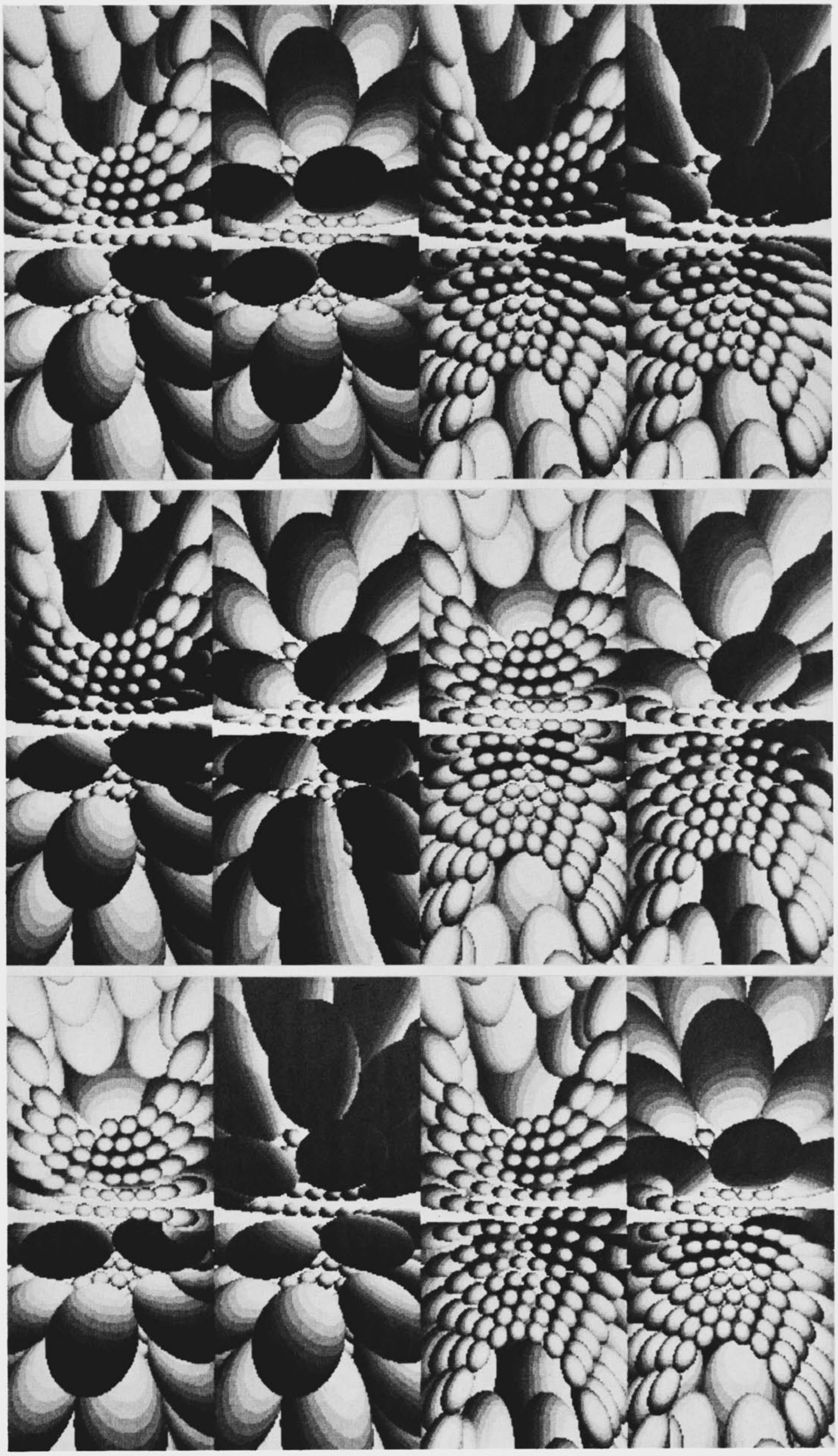


Figure 9

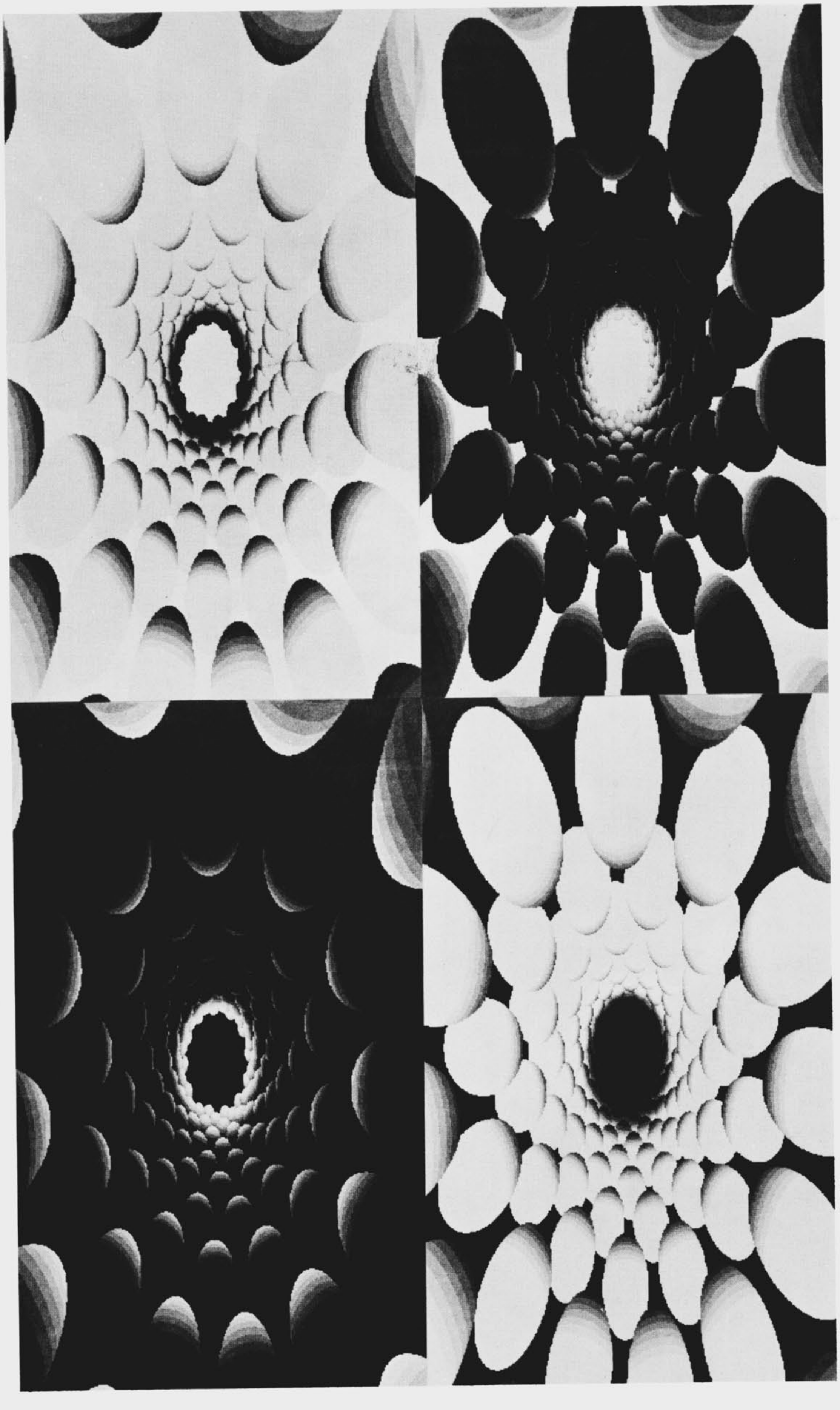


Figure 10

Figure 11

each figure (the "sky" if we consider our balls as celestial in nature – "the music of the balls"?) as either dark or light we obtain quite different effects. Perhaps if we consider this art we could begin venturing titles – "Sperm's eye view"?

Serendipity as a factor cannot and should not be ruled out. Indeed program errors should be encouraged in moderation as they frequently act as a catalyst to the creative process. They were responsible for figure 11.

There is one last interesting possibility to mention. What happens if we try to print balls which overlap each other's position in space? Plotting such concatenations of balls can lead to tube-like effects which are quite intestinal (sic). In some cases the effect becomes rather removed from what one might expect. Figure 12 is part of a double helix of balls much like you would find with some electric light filaments, except that the balls have been placed so close to each other that they overlap.

Figure 12

Of course, in the end we have to ask the perennial question – "But is it art?" My answer is "Yes". To my mind, in the future personal computers will enable even the most ham-fisted individual to express his ideas graphically and artistically. Piss-artistry need not restrict itself to the spray-can and factory wall. The computer can provide a more socially acceptable tool and medium and provide "art" within the pocket of everyone. It seems to me that computer art can indeed be a "load of quasi-spherical objects", and this article attempts to illustrate a few of the ways in which this may be achieved. "Achieved?" Yes – "achieved" because being a load of balls doesn't appear to be such a bad thing really. Does it? As Shaw has argued so persuasively, Art could do with a little less pomp and ceremony.

ACKNOWLEDGEMENTS

Figures 3 and 4: Penrose and Penrose. Reproduced by courtesy of the British Psychological Society from: *"Impossible objects: A special type of visual illusion", British Journal of Psychology*, 49, 1958. pp.31-33.

Figure 5: Belvedere by Escher. Reproduced by courtesy of the Escher Foundation – Haags Gemeentemuseum – The Hague.

Figure 6: Hogarth. From a Meriden Gravure Company photograph of a print now in the W S Lewis Collection. Reproduced by courtesy of the publishers of a book in which it appears. Paulsen, R. *Hogarth: His Life and Times Volume II*, London: Yale University Press, 1971, 159, plate 245.

REFERENCES

Parkin, Alan. *How to draw a ball*; In: Jasia Reichardt (Ed.) *Cybernetic Serendipity*, Studio International, 1968, 84-86.

Hochberg, Julian. *Perception*; In: J. W. Kling and L. A. Riggs (Eds.) *Woodworth and Schlosberg's Experimental Psychology*, Methuen, London. 1971, 475-519.

Penrose, L. S. and Penrose, R. *Impossible objects: a special type of visual illusion.* In: *British Journal of Psychology*, 1958, 49, 31-33.

Shaw, T. L. *Hypocrisy about Art*, Stuart Publications, Boston, 1962.

Teuber, M. L. *Sources of ambiguity in the prints of Maurits C. Escher.* In: *Scientific American*, 1974, 231, 90-104.

FOOTNOTE

The computational aspects of this work were aided by an SSRC grant to the author for an investigation of the aesthetic reactions to value keys. Some of the illustrations were produced during the testing of programs written to produce output with equal-spaced grey scales.

Every day, café, I wander through stardust.
I am a derailed artisan, the deregulator of logical machines,
Seeker of emotion in the metal memories,
I force and compute the space of their game.
Voyager in dust,
I follow them without respite to the bottom of their silent desert.
Plugged in to keyboard, I immolate like the Japanese
The infernal black hole of the Constellation of the Swan.
Tracer of a course in the shadows of random spaces,
I plunge without rest, luminous brush,
Into their intimate rituals.
Hired applause of the particles which vibrate in my body,
I sharpen the minuscule cancers which go astray,
To flash brutally on the magic screen.
Emotion – Despair – Immersion.
It moves, it lives, there under my eyes,
It develops, outside of me, it exists . . .
Fascination . . . Spaghetti contemplation . . .
I am a creator of dust,
Random medium, blacksmith of intimate expansions . . .
I bathe in space.

Bernard Demio 1979

ELECTRO-ACOUSTIC MUSIC ASSOCIATION OF GREAT BRITAIN

PREVIEW: "Computer Music in Britain"

COMPUTER MUSIC CONFERENCE

Department of Computer Science, University of Edinburgh 8 – 11 April 1980

A CONFERENCE ON "COMPUTER MUSIC IN BRITAIN" DIRECTED BY S.R. HOLTZMAN and hosted by the Department of Computer Science, University of Edinburgh, is to take place under EMAS sponsorhip in Spring 1980. Papers will be presented on research topics within the United Kingdom, and the Conference is also to include practical demonstrations and 'hands-on' sessions with different computer music systems in use in Britain, and a concert of computer music.

PAPERS

"Series Phi" – microprocessor-based control system for EM performance.
LAWRENCE CASSERLEY (RAM, London) – software for control of a digital synthesis system allowing for specification of any parameter as a 'constant' a 'function' or a 'variable', in the studio or with suitable accessories, as a live performance instrument.

The Musician-Machine Interface in Digital Sound Synthesis
STANLEY HAYNES (IRCAM) – *Stanley Haynes* examines weaknesses in the design of existing languages at the interface between the musician and the system, discusses how they are being tackled and how improvements might be made in future.

Computer Composition with Grammars
S.R. HOLTZMAN (Univerity of Edinburgh) – discusses the application of 'context-free' and 'context-sensitive' grammars in composition, with examples in Generative Grammar Definition Language (GGDL).

Computer assisted application of stochastic structuring techniques in musical composition and control of digital sound synthesis systems
KEVIN JONES (The City University, London) – examines a range of techniques of pattern formation based on stochastic generative schemes. Both computer output for transcription for performance by conventional musical forces and for direct control of digital sound synthesis programs and equipment are considered.

An Heuristic Approach to Computer Composition
RICHARD ATTREE (The City University, London) – expresses composition in terms of memory, prediction and feedback.

SHORT REPORTS

A Computer Program for Melodic Improvisation
MICHAEL GREENHOUGH (University College, Cardiff)

An Interactive Hybrid Computer Music System enabling Musical Information to be organised and transformed in a variety of musically-useful ways.
MARCUS WEST (University College, Cardiff)

Durham University Studio Report
PETER MANNING (Durham University)

Keele University Studio Report
TIM SOUSTER (Keele University)

SYSTEM DEMONSTRATIONS

Demonstration of sound generating techniques on the ITT2020 (Apple II) microcomputer
KEVIN JONES (The City University, London)

A Digital Synthesis Module for live performances
LAWRENCE CASSERLEY (RAM, London)

The Edinburgh GGDL composition/synthesis system
S.R. HOLTZMAN (University of Edinburgh)

A microprocessor synthesis system
D. FINLEY (The City University, London)

EXHIBITIONS AND ANNOUNCEMENTS

CAS CO-ORDINATOR

The organization of CAS activities, including exhibitions and the publication of PAGE, depends entirely on the voluntary help of a few members. At present the exchange of information, both through members' correspondence and through the publication (and circulation) of PAGE, is far less efficient than it might be. PAGE in particular would benefit enormously from someone with enthusiasm and a little time, who would be interested in co-ordinating information and increasing sales. Is there anyone who lives within reach of Russell Square or West Kensington, who would like to take a more active interest in the Society by helping out one afternoon or evening a week? Please contact Dominic Boreham (address on back page).

There will be an exhibition of computer-assisted art, with performances, in The Hague in May 1980. Further information may be obtained from the organizers: "De Haagse Kunstkring", Denneweg 64, Den Haag, Holland.

DEUXIEME CONFERENCE INTERNATIONALE SUR

BASES DE DONNEES DANS LES HUMANITES ET LES SCIENCES SOCIALES

MADRID-FACULTAD DE INFORMATICA

16-19 JUIN 1980

Humanités
* Archéologie
* Anthropologie
* Beaux-Arts
* Géographie
* Histoire
* Lexicographie
* Linguistique
* Littérature
* Musique

Sciences Sociales
* Démographie
* Economie
* Electologie
* Planification
* Politique
* Psychologie
* Sociologie

Renseignements

Prof. E. García Camarero
2ª Conferencia Internacional
sobre Bases de Datos en Humanidades
y Ciencias Sociales.
Facultad de Informática
Carretera de Valencia, Km. 7
Madrid–31

The Institution of Electrical Engineers publishes a new series of bibliographies on a wide range of microprocessor applications:

Microprocessor applications in engineering 1977–1978
S. Deighton and K. D. Mayne (Eds.), 1979, 150 references, £6.50

Microprocessor applications in home and office 1977–1978
S. Deighton (Ed.), 1979, 150 references, £6.50

Microprocessor applications in science and medicine 1977–1978
S. Deighton (Ed.), 1979, 200 references, £7.50

Microprocessor applications in electrical engineering 1977–1978
P. J. Dayasena and S. Deighton (Eds.), April 1980, £10.00

For further information please contact The Marketing Department, The Institution of Electrical Engineers, Station House, Nightingale Road, Hitchin, Herts. SG5 1RJ, England. Telephone: Hitchin (s.t.d. 0462) 53331. Telex: 825962

A Potpourri of Computer Art and Music –
At a 31% discount!

Creative Computing is pleased to extend a special offer to members of the Computer Arts Society. We've put together a special package of material that gives an excellent overview of computer art and music today. The components are:

1. "Artist and Computer" by Ruth Leavitt. A 120-page book in which 35 artists each describe the way in which he or she uses the computer to make artistic vision a reality. Lavishly illustrated in colour and B&W, the book contains works by artists involved in graphics, film, sculpture, video and kinetics. (Reg. $4.95)

2. Philadelphia Computer Music Festival. This 12in LP record contains music played on seven different computer synthesizers ranging from huge multi-channel units to small homebrew circuits. The music includes Bach, the Beatles, Pachelbel's well-known Canon and many other folk and popular melodies. (Reg. $6.00)

3. *Creative Computing,* September 1977 and June 1979, and *ROM,* October 1977. These three magazines contain 19 articles on computer art and animation along with numerous examples of computer graphics done on both large and small computers. (Reg. $6.00)

The price of the separate elements in this package is normally $16.95 plus $2.00 shipping ($18.95 total). However, to Computer Arts Society members it is available for only $13.00 postpaid in U.S.A. or $15.00 elsewhere – a 31% discount off the regular price.

Order from *Creative Computing,* P.O. Box 789-M, Morristown, NJ 07960, USA.

S T O P   P R E S S

CALL FOR COMPUTER MUSICIANS AND ARTISTS to speak, exhibit, or perform at:

P C A F ' 8 0

Personal Computer Arts Festival, Philadelphia, USA. August 23,24, 1980
A two day festival of talks and papers, films and graphics, demonstrations and performances.

The PCAF-80 Saturday morning sessions will consist of tutorials and seminars about computer music and the visual arts, providing a forum for computer amateurs and artists to present their techniques, equipment, and results.
PAPERS for inclusion in a possible PCAF-80 Proceedings (to be available at the show) - contact PCAF-80 by June 1, 1980.
TO PARTICIPATE, please send a ½ page description of your topic, including hardware and software. Musical performance presentations should include a tape. Please submit by July 1, 1980.

The PCAF-80 Computer Music Concert will take place on Saturday evening.
TO PARTICIPATE, please send a performance tape, and an indication of the duration of your performance and number of selections. Please indicate who holds the copyrights. Please submit by July 1, 1980.

The PCAF-80 Computer Visual Arts Festival will include computer generated graphic art, being performed both in real time and on film or video; still graphics, and other forms of computer art.
TO PARTICIPATE, please send a sample or description of your art by July 1, 1980.

Held in conjunction with the Personal Computing '80 Show at the Philadelphia Civic Centre.

PCAF '80, Philadelphia area Computer Society, Box 1954, Phila, PA 19105

COMPUTER ARTS SOCIETY

BRITISH COMPUTER SOCIETY SPECIALIST GROUP

AIMS AND MEMBERSHIP

The Society aims to encourage the creative use of computers in the arts and allow the exchange of information in this area. Membership is open to everyone at £4 or $10 per year. Members receive PAGE four times a year, and reduced prices for the Society's public meetings and events. The Society is a Specialist Group of the British Computer Society, but membership of the two societies is independent.

Libraries and institutions can subscribe to PAGE for £4 or $10 per year. No other membership rights are conferred and there is no form of membership for organisations or groups, though members of other organisations are welcome to join the Society as individuals. Membership and subscriptions run from January to December. For further information write to John Lansdown, Dominic Boreham, or Kurt Lauckner (U.S.A.)

COMPUTER ARTS SOCIETY ADDRESSES

Secretary: John Lansdown, 50/51 Russell Square, London WC1B 4JX

Treasurer: Dr. George Mallen, 50/51 Russell Square, London WC1B 4JX

PAGE Editor: Dominic Boreham, 10 Archel Road, West Kensington, London W14 9QH
Tel: 01-385 5228

CASH – Dutch Branch: Leo Geurts and Lambert Meertens, Mathematisch Centrum, Tweede Boerhaaverstraat 49, Amsterdam, Holland.

CASF – French Branch: Bernard Demio, 12 Rue Rambuteau, 75003 Paris

CASUS – US Branch and Editor of US editions of PAGE: Kurt Lauckner, Mathematics Department, Eastern Michigan University, Ypsilanti, Michigan, 48197, U.S.A.

LONDON MEETINGS

The Society holds regular meetings at 7.30pm on the 1st Monday of each month at John Lansdown's office, 1st floor, 50/51 Russell Square, London WC1. Members and guests are welcome; there is no charge.

PAGE

COMPUTER ARTS SOCIETY QUARTERLY

PAGE is published quarterly, and mailed to subscribers, (see under Membership). Articles, papers, news, reviews, pictures, announcements, should be submitted to the Editor at least eight weeks prior to the month of publication. Please submit manuscripts typewritten. Photographs should be of good quality, high contrast and definition, and either the actual size intended for publication, or larger. Pages are layed out with 1 inch margins, leaving a maximum size for photographs of 6¼ x 9¾ inches. Please document photographs clearly on the reverse, with author, title etc., and indicate which way up they should be. It usually helps with layout if diagrams, flowcharts, etc., are presented in landscape format rather than portrait. Please enclose a pre-paid mailer if you wish your manuscript to be returned. PAGE is printed in Univers on A4 paper.

The Editor is pleased to receive articles from anyone with an active interest in the use of computers in the Arts, whether or not they are members of the Society.