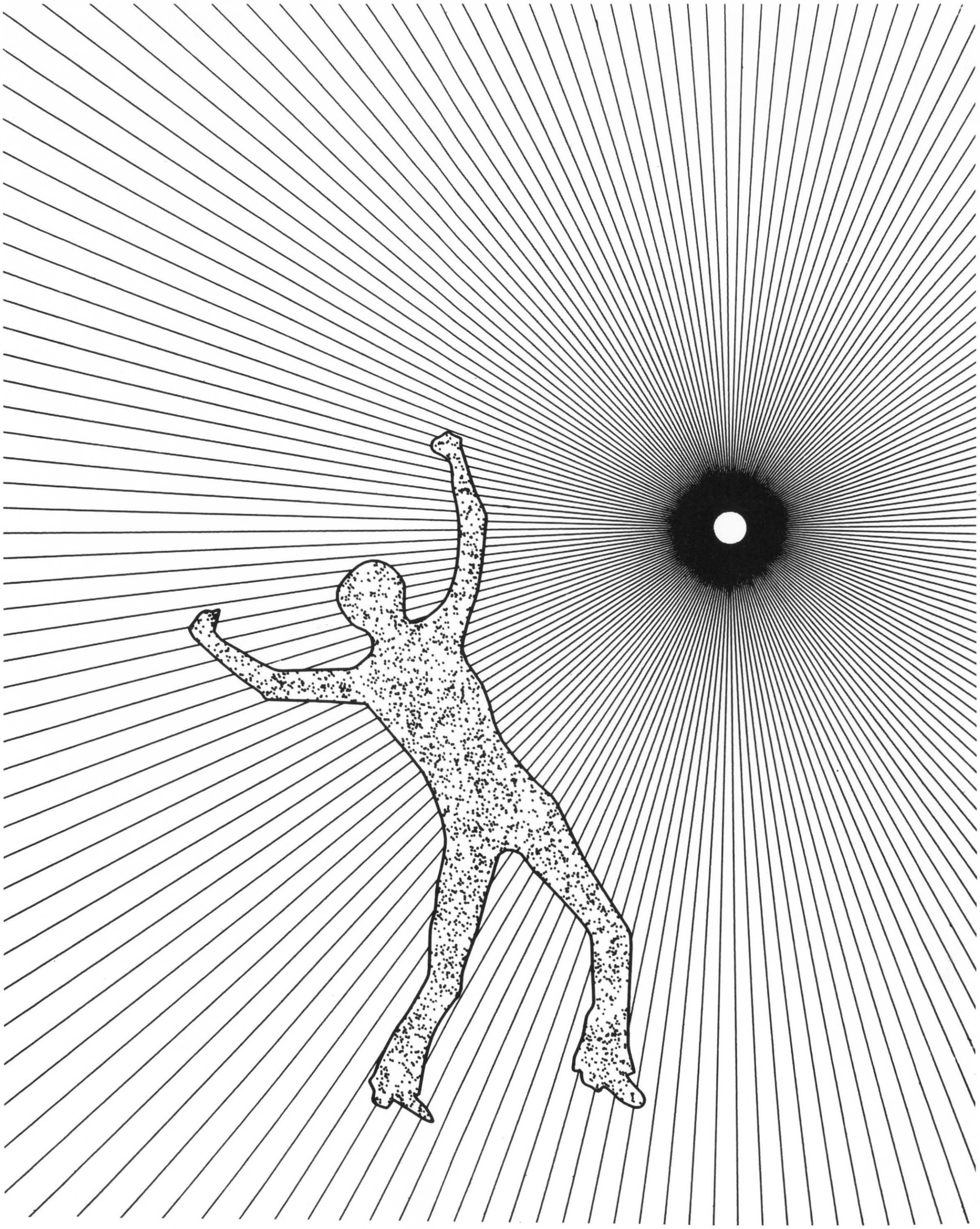
August, 1976
Vol. 25, No. 8

computers and people

formerly *Computers and Automation*

14TH ANNUAL COMPUTER ART EXPOSITION



FALLING MAN

Vol. 25, No. 8
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computers and people

formerly *Computers and Automation*

Computer Art and Computer Graphics

The Computer Industry

Computer Applications

Computers, Puzzles, and Games

Announcements

The magazine of the design, applications, and implications of information processing systems – and the pursuit of truth in input, output, and processing, for the benefit of people.

1976 COMPUTER ART EXPOSITION

An open invitation to all computer artists to enter their works for an exhibition, THE VARIED COMPUTER ARTS, which will tour the U.S. early in 1977.

Front Cover Picture

Falling Man by Kerry Jones. For other works by Kerry Jones, see pages 13 and 22 of the 14th Annual Computer Art Exposition, pages 8 to 31.

Key

[A]	–	Article
[C]	–	Monthly Column
[E]	–	Editorial
[F]	–	Forum
[N]	–	Newsletter
[R]	–	Reference

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NCC '76 ART REVIEW, DIRECTIONS AND QUESTIONS: THE ROLE OF THE COMPUTER IN COMPUTER ART

The NCC '76 Art Exhibition was the largest and most diverse exhibition of computer art shown in this country. The 361 works were gathered together by Jackie Potts of the Social Security Administration, and displayed as part of NCC '76 at the New York Hilton from June 7 - 10.

In giving daily gallery tours of the Art Show, I was exposed for seven hours each day to the 361 works of art, and discussed them with thousands of visitors to NCC '76.

Certain questions were asked repeatedly. New directions were strongly in evidence:

1. There are far more people engaged in making computer art than before. Who are they?
2. There are greater ranges of personal expression in today's computer art. Is there one "preferred" method of expression?
3. The tendency towards mixed media (computer art in art) dominates professional computer art. Can this still be considered "computer art"?
4. New hardware and software allow solid-appearing graphics and other new forms of art. What about the older techniques and forms?
5. Just what is the role of the computer in computer art?

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1. COMPUTER ART PRACTITIONERS

In the early days of computer graphics (the early and mid sixties), mathematicians, physicists, and computer scientists dominated the field. Now students have easier access to computer art, and people from many other fields engage in this new art form. Many computer professionals who work in research and utilitarian graphics, find computer art to be a satisfying, creative pastime. Computer artists are no longer an elitist group.

2. VARIETIES OF PERSONAL EXPRESSION

In reading the quotations of many computer artists in this issue, there are many different philosophies regarding subject matter, programming methods, etc. Mathematics vies with natural forms as a design source. Transformations of design contrast with emphasis on manipulating final designs in photographic media. In a mature art form, there should be varieties of personal expression, and this is what we see now.

3. COMPUTER ART AND MIXED MEDIA

In the invitational section of the NCC '76 Art Show, 216 of 361 works were by international (non-juried) prominent artists. Of this number (216) only 20 were on white industrial plotter paper. Still another example: In the 150 invited works of the ICCH/2 Exhibition that I organized, and a part of the 361 works of NCC '76, only 8 were on plotter paper. These were sketches for paintings and sculpture, and were displayed in this manner to show the computer's role in achieving new computer art.

However, in the juried section, comprising 145 works, 91 were on white industrial paper, and were executed with one line thickness of pen. Often these works were by students and individuals beginning their computer art careers.

What explains this tendency towards mixed media? White industrial paper is not rich enough to serve as final art presentation. One line thickness of pens is not diverse enough for variety, and the ballpoint pens and felt pens fade very quickly. This is why artists go to art papers, varied pen thicknesses and other art processes. By doing so they achieve large areas of rich color, and do not have to rely upon innumerable fine lines within interference patterns to achieve computer art. Further, it is relatively easy for artists to take computer art back into their known fields. Too many computer artists are unaware that plotter and CRT output are considered as intermediate, and not final art presentations. (See categories VI and VII for comparisons.)

In summary, computer art has become sufficiently absorbed by many kinds of people, and it has finally become "user-oriented". People are much freer to experiment, and they are more facile in their explorations of computers and art expression.

4. HARDWARE AND SOFTWARE DEVELOPMENTS

Software is more sophisticated, and it is disseminated, transported and shared much more. People are far more willing to share their programming systems, because algorithms for achieving variations are well known. Hence the prevailing "generosity" of computer artists to share. A capable computer artist can analyze a graphic and tell you how it was programmed, and very often is capable of reproducing and varying the work studied. In my advanced classes, this is a common exercise.

But the specific hardware developments of Evans and Sutherland in the areas of solid appearing graphics will cause a genuine revolution in utilitarian and art graphics (and films). The wire-cage or "line emphasis" will give way to dimensional, "solid" graphics. The Henry Christiansen Collection of continuous tone images (shaded drawings of finite element systems) using this system reveals sculptural graphics in attractive, brilliant colors. Another example: the 7' by 9' scanchrome reproductions of George Washington and Abraham Lincoln by E. T. Manning literally stole the show at NCC! Still another example is the work of Duane Palyka, using the Evans and Sutherland Frame Buffer System.

5. WHAT IS THE ROLE OF THE COMPUTER IN ART?

Since this is a periodical for computer professionals, I thought for some time as to the most complete way to convey this information, and then developed the chart on the next page. In studying this chart, it is apparent that computer art is a computer-based, computer executed art, and that the role of the computer is an important one. It is equally apparent that there are complex variables as to input, processing, and output, and that the final work may take many forms.

I believe we have a more mature, poetic art form today, and that if current trends continue, by 1980 we shall see a fully developed, accepted art form made possible by the use of computers.

Grace Hertlein

Grace C. Hertlein
Art Editor

ALTERNATIVES AND CATEGORIES OF INPUT, PROCESSING, AND OUTPUT OF COMPUTER ART

I – VARIED INPUT METHODS – WAYS OF GETTING AN ART GRAPHIC INTO THE COMPUTER SYSTEM

- CARDS– X/Y, IP ARRAYS
- CURSORS
- DIGITIZERS
- JOYSTICKS
- LIGHT PENS
- MOUSE
- RAND TABLETS

II – PROGRAMMING FILES, LIBRARIES TO ACHIEVE INPUT AND MANIPULATION OF ART GRAPHICS

- CARDS— SUBROUTINES NOT ON LIBRARY
- FLOPPY DISKS
- FOUNDATION PACKAGES FOR GRAPHICS
- LARGE DISK STORAGE, TRACKS FOR ARTISTS
- MAG TAPE
- SPECIAL EFFECTS, SPECIAL GRAPHICS ROUTINES
- TEMPORARY SCRATCH FILES

III – GRAPHICS LANGUAGES USED IN COMPUTER ART

- ALGOL BASED
- FORTRAN BASED
- PL/1 BASED
- MISCL: INNUMERABLE SPECIAL GRAPHICS LANGUAGES AT VARYING INSTITUTIONS, INSTALLATIONS—HIGH, LOW LEVELS OF PROGRAMMING—BECOMING VERY COMMON

IV – COMPUTER SYSTEMS USED IN PROCESSING COMPUTER ART

- MINI COMPUTERS: DEDICATED TO GRAPHICS, PARALLEL PROCESSING SYSTEMS, TIMESHARING SYSTEMS — WITH AND WITHOUT DISPLAY SYSTEMS
- PROGRAMMABLE CALCULATORS
- MEDIUM TO LARGE SYSTEMS: VARIED FORMS OF STORAGE, PROCESSING, TIMESHARING, ETC. — BECOMING LESS COMMON IN FAVOR OF MINI SYSTEMS FOR GRAPHICS

V – OUTPUT SYSTEMS FOR ART GRAPHICS

- ANIMATED FILM SYSTEMS
- DISPLAY SCREENS, VARIED
- DRUM PLOTTERS, LG. & SM.
- FLATBED PLOTTERS, LG. & SM.
- LINE PRINTERS
- MICROFILM PLOTTERS

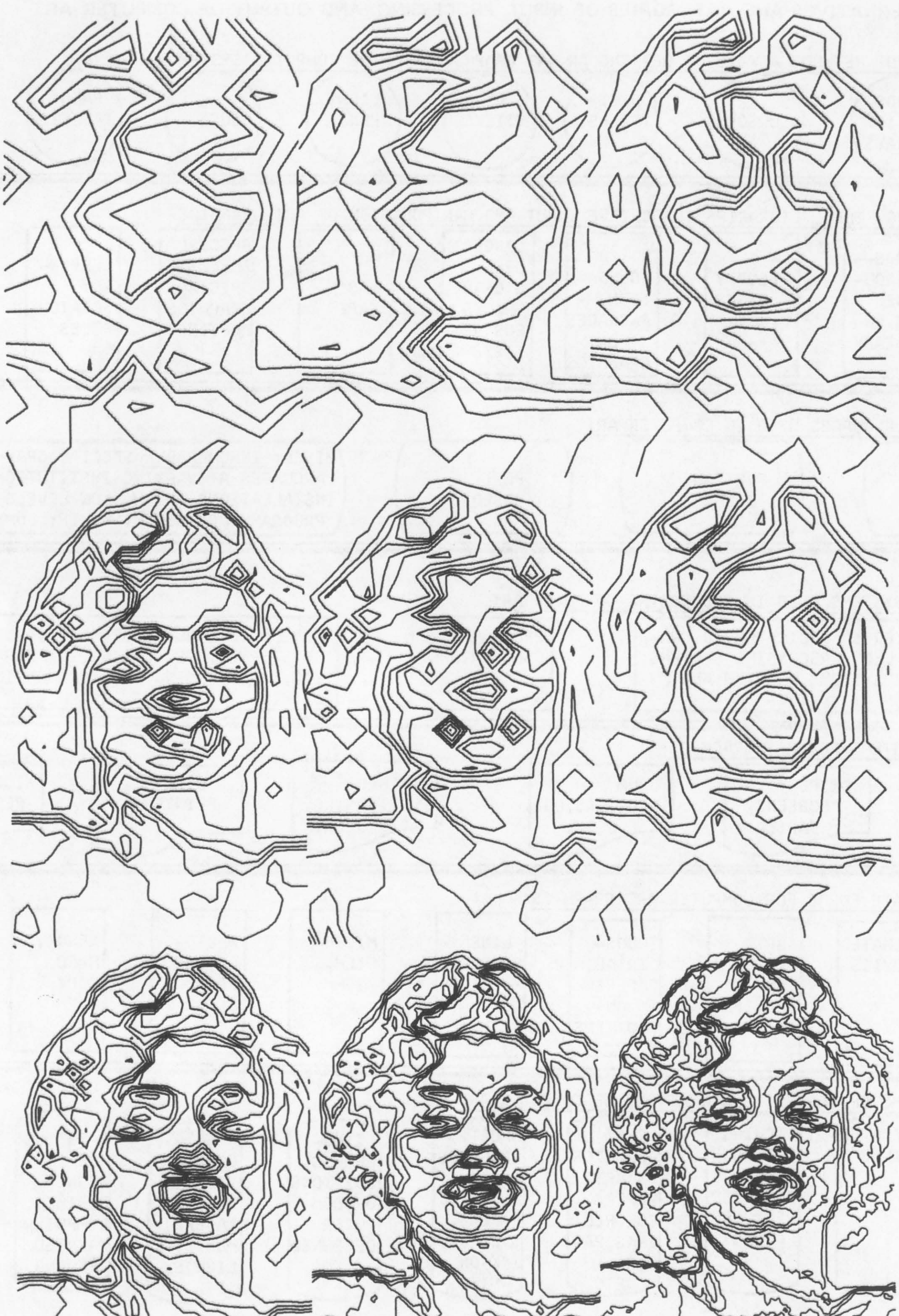
VI – INTERMEDIATE FORMS FOR COMPUTER ART GRAPHICS

- ANIMATED MOVIES
- ART PAPERS ON PLOTTERS
- INDUSTRIAL PAPERS ON PLOTTERS
- LINE PRINTERS
- MICROFILM, 35MM
- PHOTOGRAPHS FROM CRTS
- XEROX, HARD COPY

VII – FINAL FORMS OF VARIED PRESENTATIONS OF COMPUTER ART

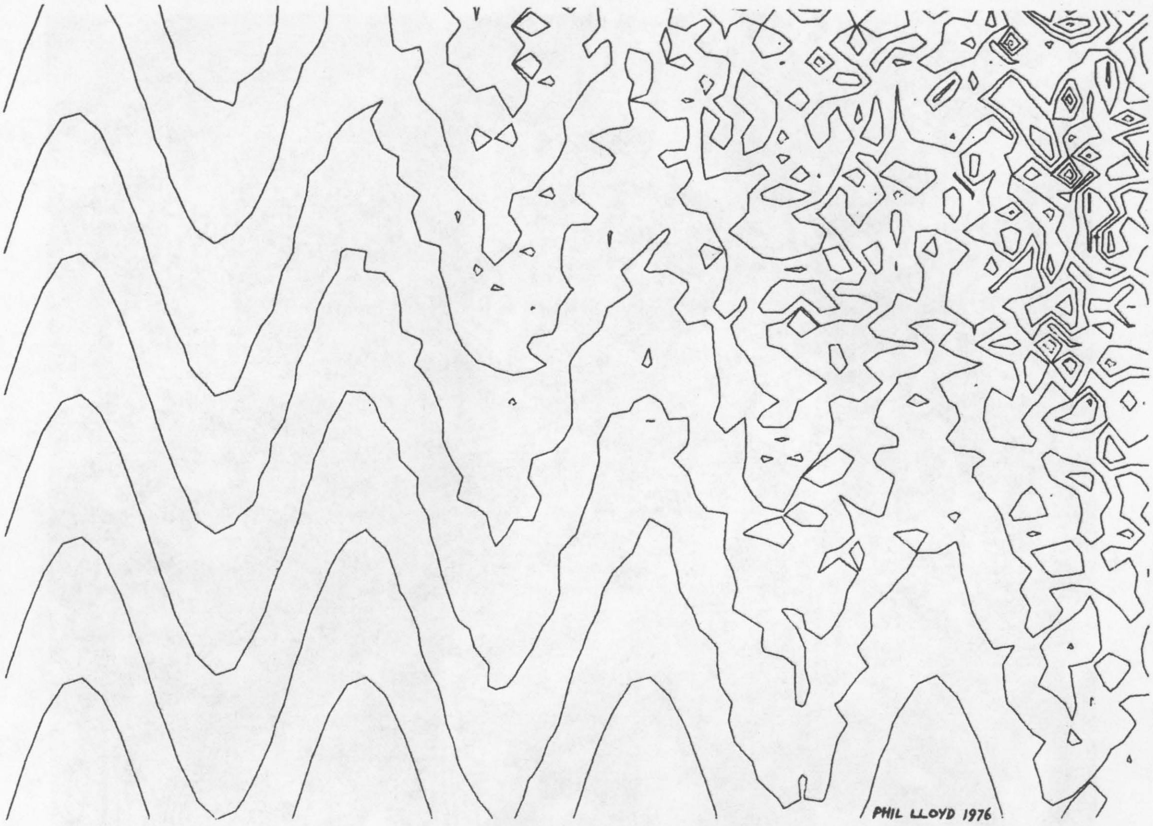
- ANIMATED FILMS
- ETCHINGS EDITIONS OF COMPUTER DESIGNED WORKS
- FLAT GRAPHICS ON ART PAPERS, COLORED INKS, PAPERS, ETC.
- FLAT GRAPHICS ON INDUSTRIAL PAPERS, 1 COLOR INK ON WHITE
- LITHOGRAPHS, EDITIONS OF, COMPUTER DESIGNED
- MEDIA COMBINATIONS: TV, FILM, LASERS, MUSIC, LIGHTS, ETC.
- PAINTINGS DESIGNED BY THE COMPUTER PAINTED BY HAND
- SCULPTURE MANUALLY OR AUTOMATICALLY MILLED
- SLIDE/MUSIC PRESENTATIONS
- STAMPS, ETCHED & PRINTED, COMPUTER DESIGNED
- STITCHERY RUGS & WALL HANGINGS COMPUTER DESIGNED
- TEXTILES SCREEN PRINTED BY HAND
- TEXTILES WOVEN BY COMPUTER & COMPUTER DESIGNED

THE ABOVE TABLE REVEALS THE COMPLEXITY OF INPUT, PROCESSING, OUTPUT, AND FINAL FORMS OF COMPUTER ART. NOTE THAT EACH CATEGORY (I THROUGH VII) INVOLVES CHOICES OF SYSTEMS AND PRODUCTS WITHIN EACH CATEGORY. A DECISION IS OFTEN MADE BY WHAT IS AVAILABLE TO THE ARTIST, THE LEVEL OF PROGRAMMING CAPACITY, AND THE AMOUNT OF ART TRAINING THE COMPUTER ARTIST POSSESSES.

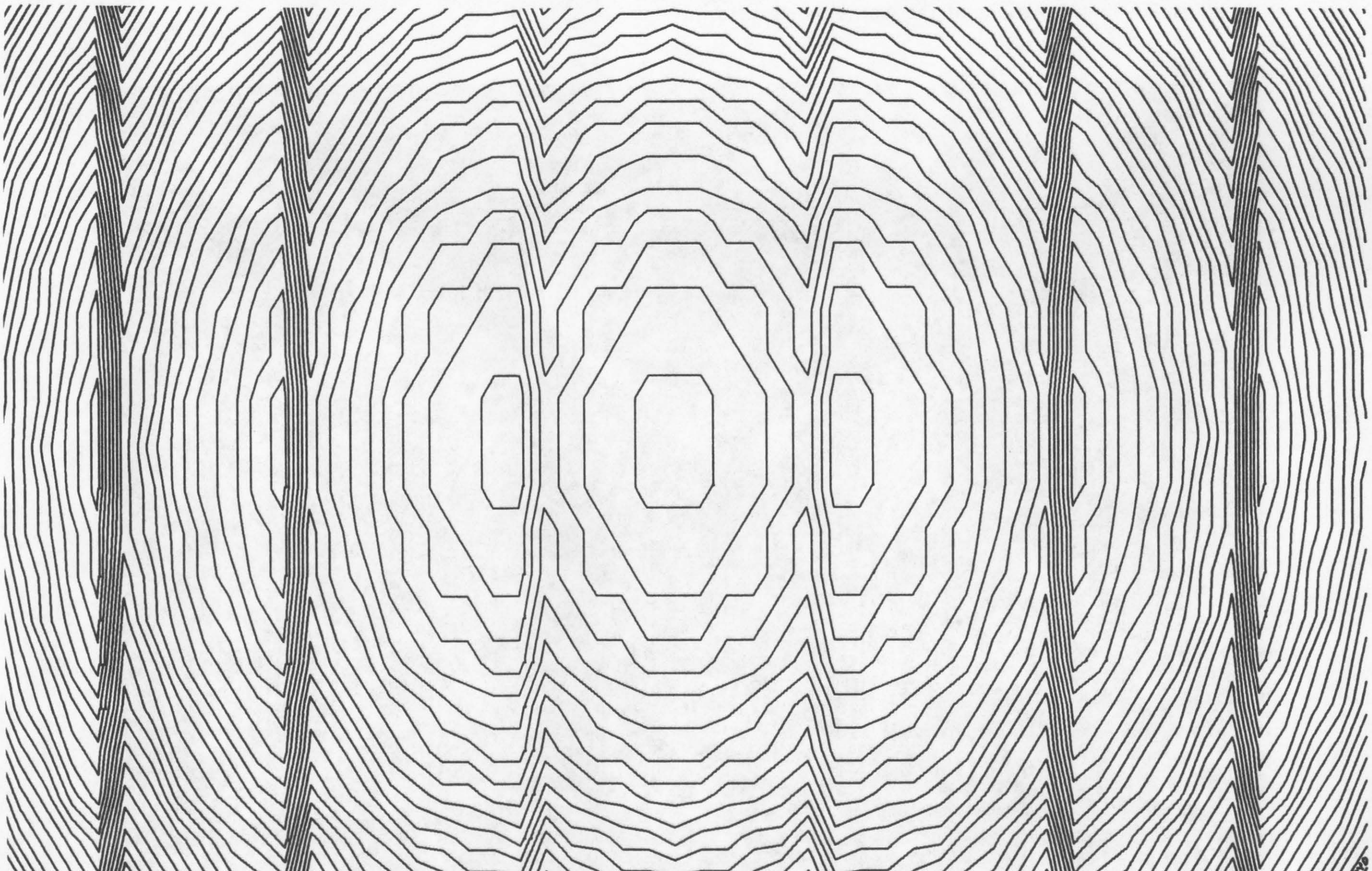


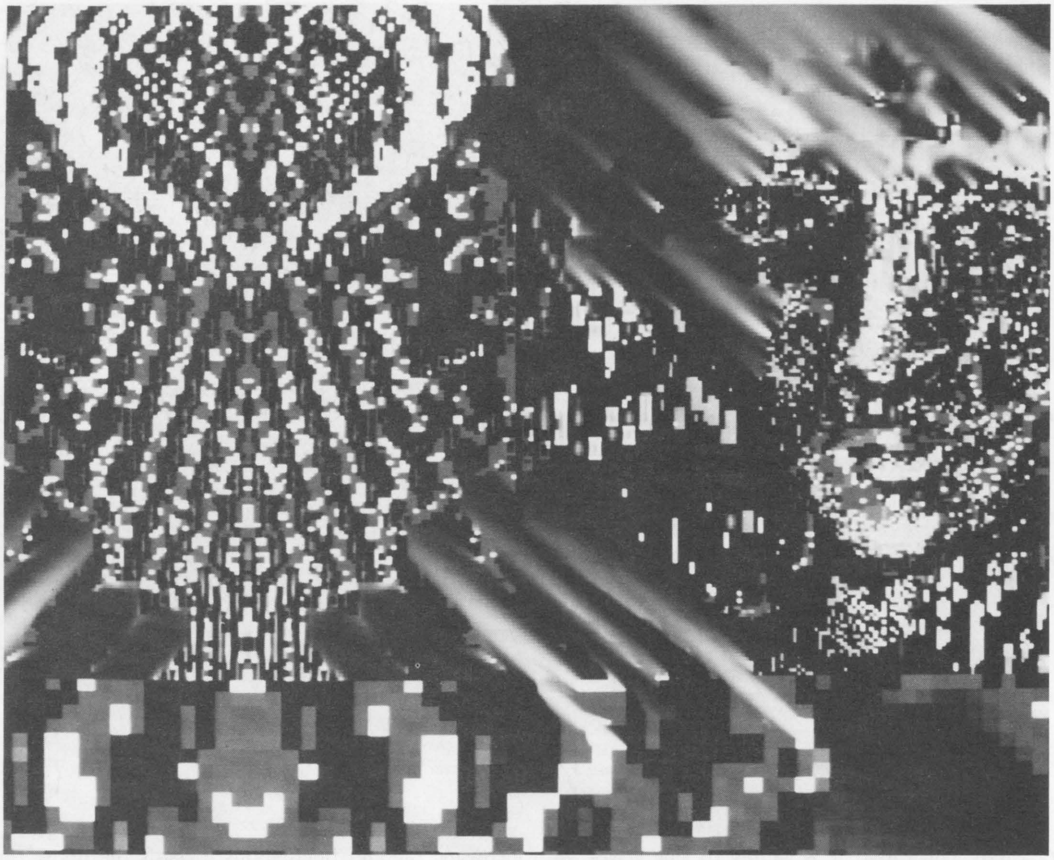
PHIL LLOYD – ENGLAND

EnigMA (above) by Phil Lloyd. "*EnigMA* is a sequence of pictures derived from a photograph of Marilyn Monroe. The original was scanned with a TV camera, the video being sampled, digitized, and stored as a two-dimensional array of integers. The array measured 79 x 125 elements, and the sequence of images was generated by taking every n^{th} element or every n^{th} line, for n = 9, 8, . . ., 2, 1. The software used in these graphics is an ALGOL 60 function contour plotting program which I wrote a year or so ago. The hardware is an ICL 1904S* computer driving a Calcomp 1934/6 plotter." (In all Phil Lloyd's work, a similar technique of mathematically varying the original image produces very novel, cubistic, angular forms.)

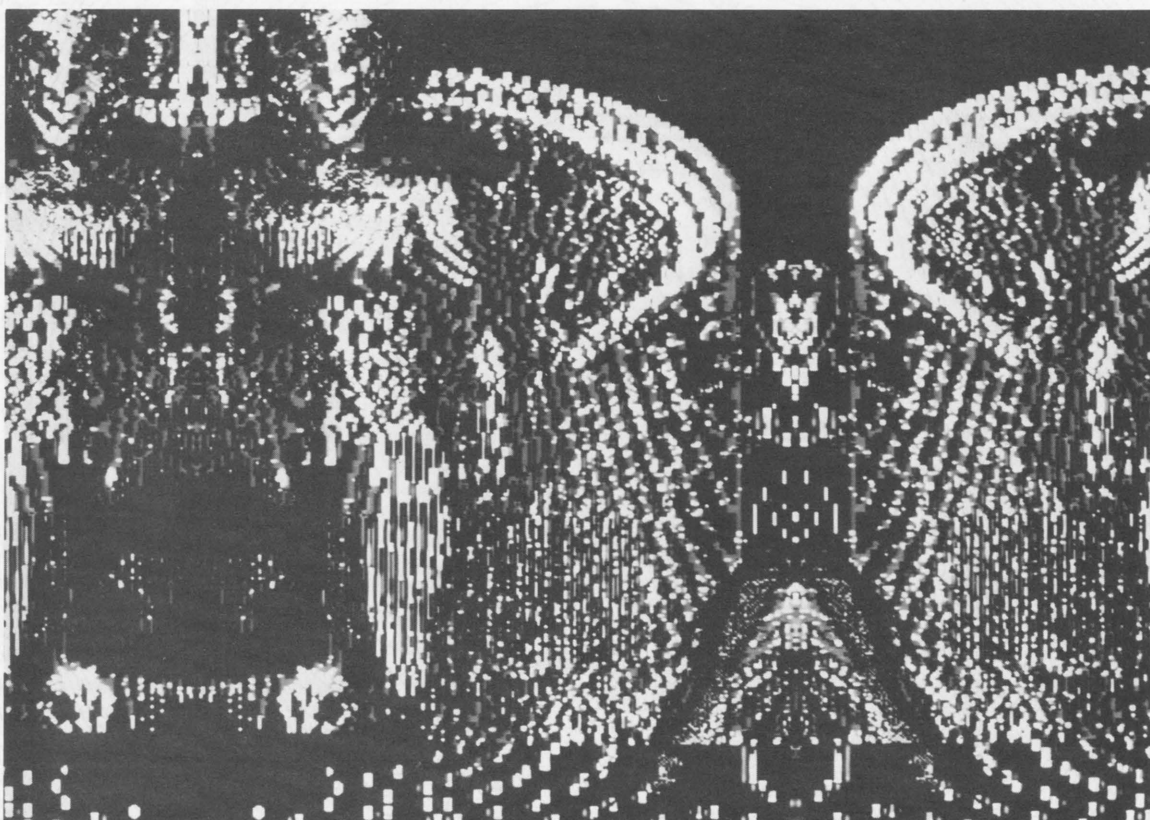


Top: *Rocky Coast* by Phil Lloyd. "A family of sine waves, with increasing random fluctuations towards the upper right." Below: *The Vortex* by Phil Lloyd. "Contours of a discontinuous function based on an ellipse."





Duane Palyka: Above, *Burning Figure*; below, *Two Figures*. The glittering images are a moment caught by the camera. The viewer imagines a series of changing images, in which the cathode ray tube presents sequential transformations of the works shown here.



DUANE M. PALYKA — U.S.A.

"Here are some new pieces, *Two Figures and Burning Figure*. (See opposite page for illustrations.) They were conceived in black and white by the following process:

"Some simple, three-dimensional shapes were generated procedurally and 'worked into' interactively via the following techniques:

1. Taking the differences in the 'X' direction for each pixel and its preceding pixel and replacing the current pixel with that difference. (An image is composed of 512 x 480 8-bit pixels.)

2. Selecting a section of the image and blowing it up to fill the entire image by duplicating pixels to fill the larger areas.

3. Reflecting sections of the image from right to left and from left to right.

4. Painting into the image with various brushes, including:

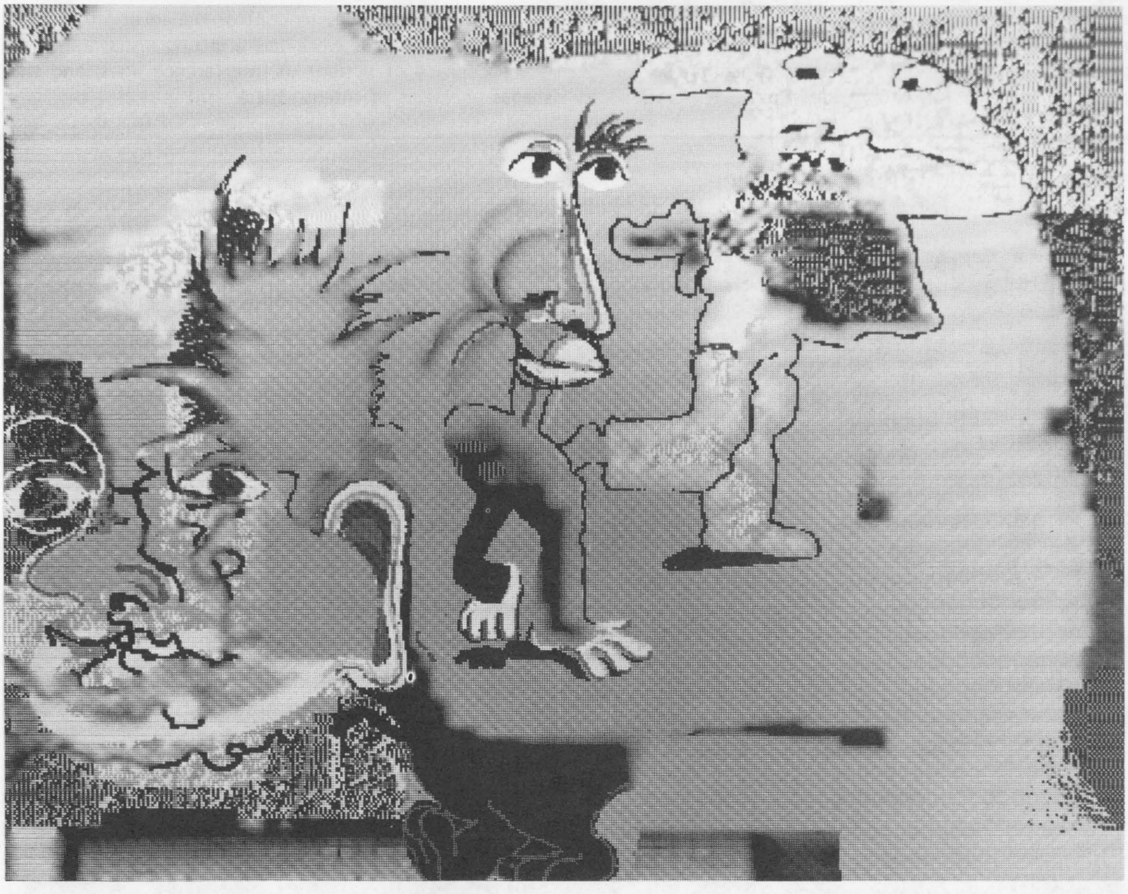
   A. A logical 'OR' brush,
   B. A logical 'AND' brush,
   C. Various filtering brushes.

"The first two brushes take a selected brush value, perform either a logical 'OR' or a logical 'AND' operation between that selected color and the colors within the brush area with the new values.

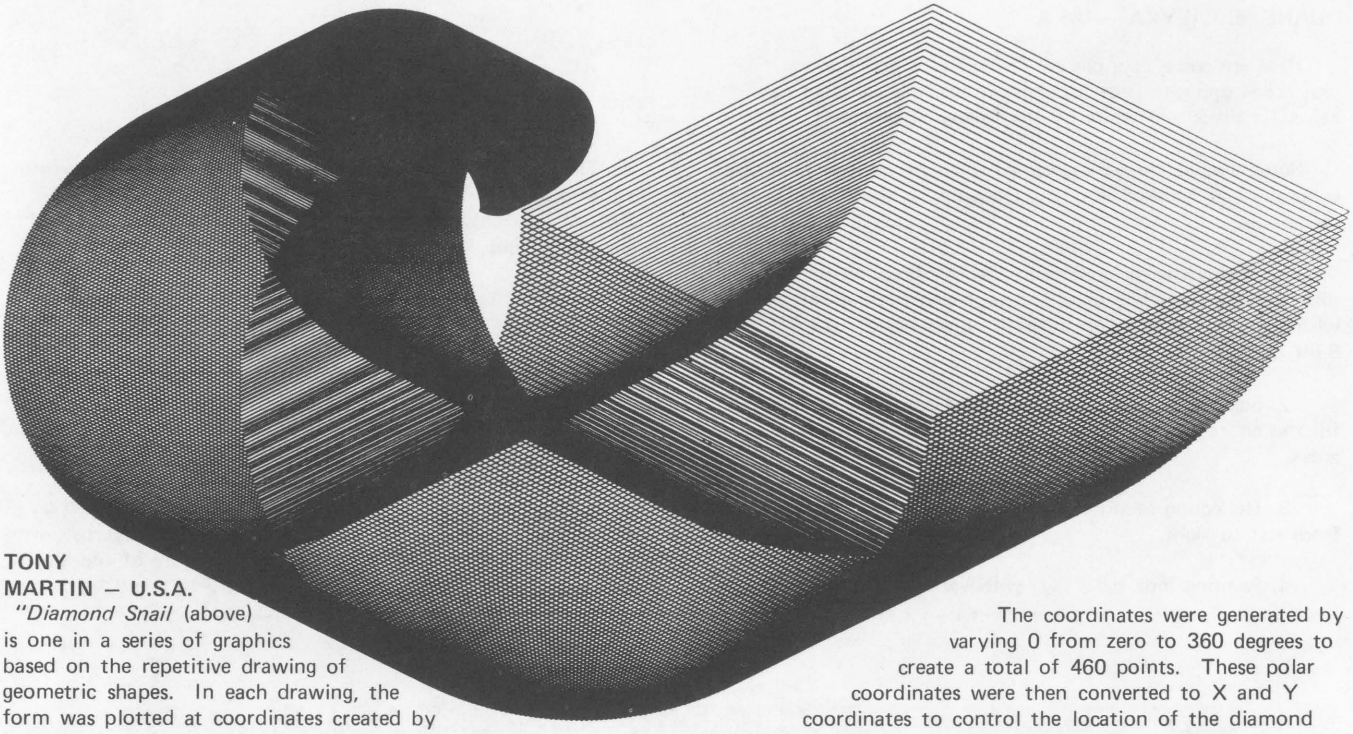
"The filter brushes simply change the pixel values within the brush area with some weighted combination of them and their neighboring values.

"The following equipment was used: PDP-11/45 computer with Evans and Sutherland Frame-Buffer, Evans and Sutherland picture system, tablet, BETA Scope, and camera station."

(For further details of the system and techniques used by Duane Palyka, see the February 1976 issue of *Computer Graphics and Art*, titled "A Personal Philosophy of Ideas, New Hardware, and the Results," pages 15-17.)



Above, *Strange Bird* by Duane Palyka. The dream-like, surrealistic quality of this work causes the viewer to question, "Who is the strange bird? Is it man?" Yet the subtle social commentary of Duane Palyka never becomes sermonizing — rather there is a quiet humor and tolerance, observing the condition of man. His many works show advanced programming techniques, the newest in hardware usage, a personal, artistic design, all blended in a very new realm of imagery that is unique among computer artists. This is a mature union of art and science. His work is such that one may look again and again — with delight and renewed appreciation. Artistically, he departs from the linear wire-cage drawings, to give us computer art that is truly art.

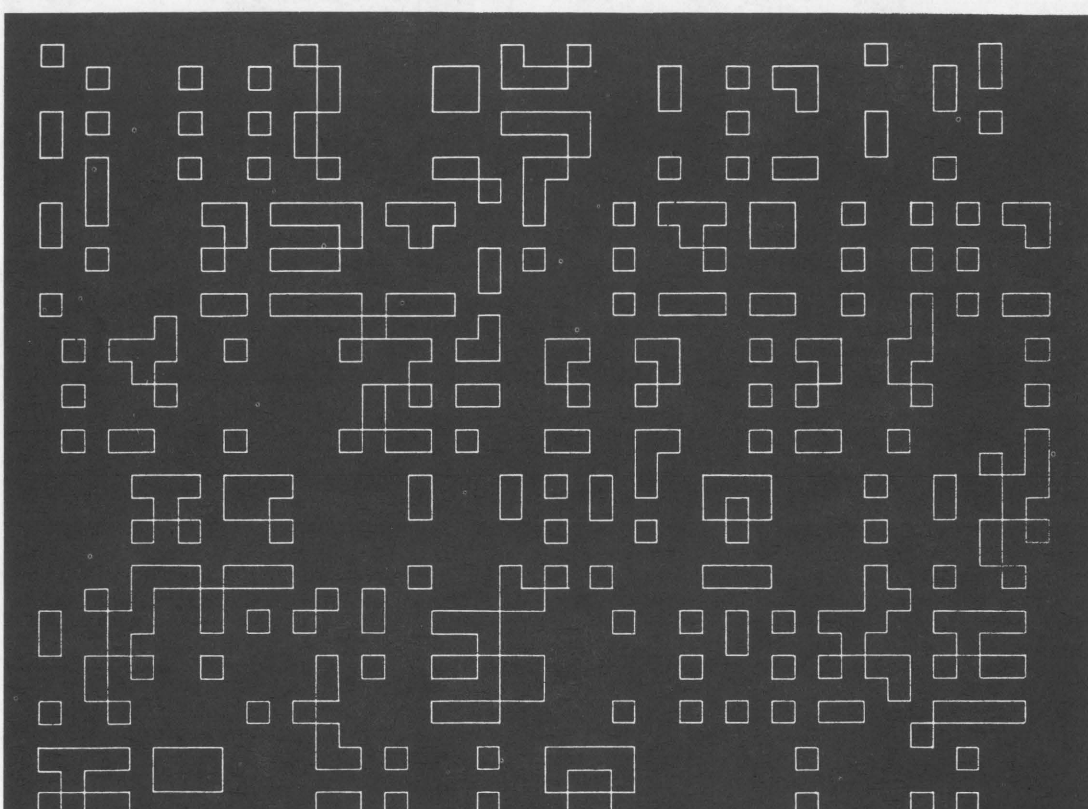


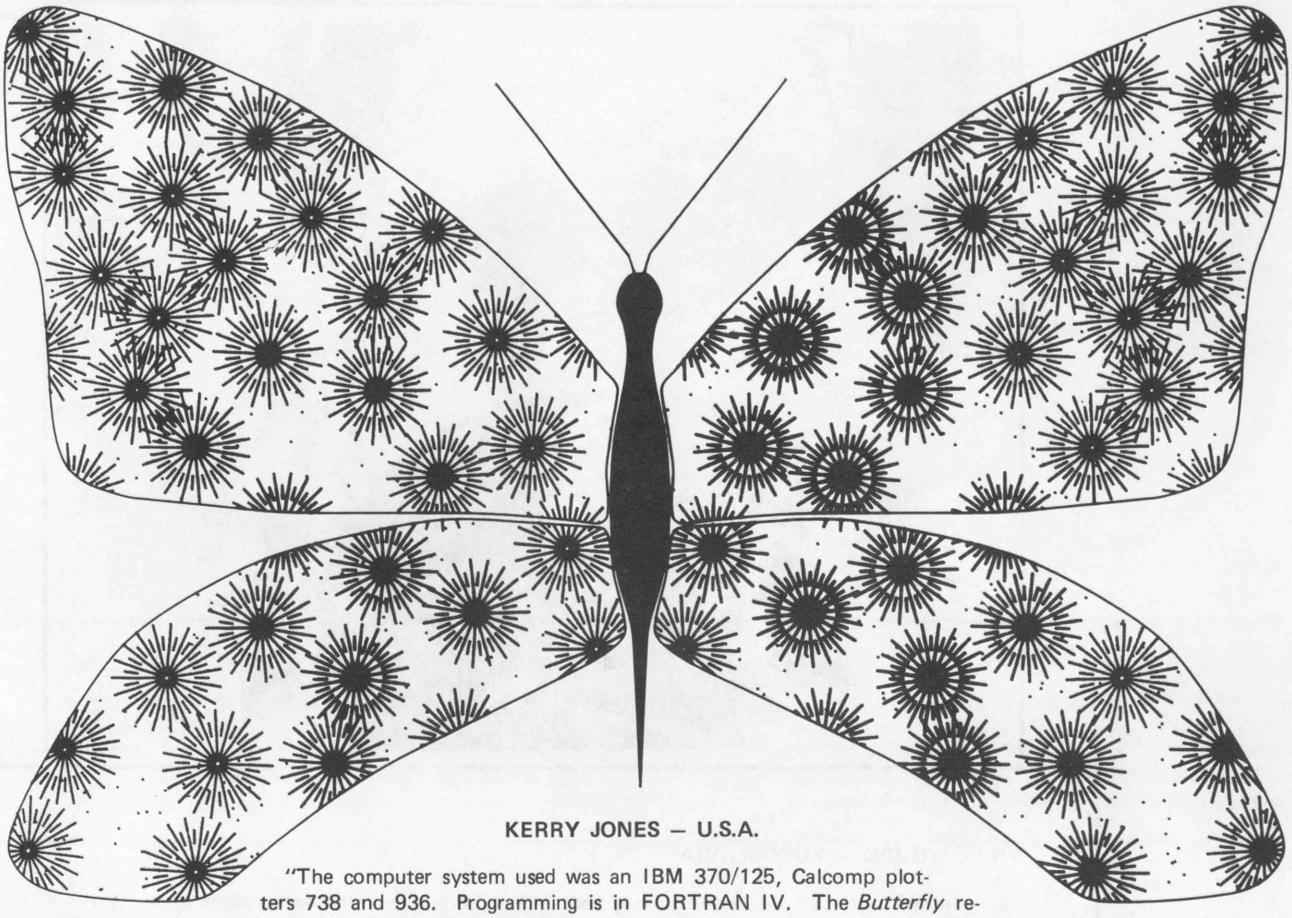
TONY MARTIN – U.S.A.

"*Diamond Snail* (above) is one in a series of graphics based on the repetitive drawing of geometric shapes. In each drawing, the form was plotted at coordinates created by formulas for curves. *Diamond Snail* was created by drawing increasingly larger diamond shapes at coordinates generated from the formula for Archimedes Spiral, R = AO. The coordinates were generated by varying 0 from zero to 360 degrees to create a total of 460 points. These polar coordinates were then converted to X and Y coordinates to control the location of the diamond plots." (This work has a strong visual appeal because of the delicacy of pattern of interference lines, and the many shades or values of intense black and gray.)

JEAN-CLAUDE MARQUETTE – FRANCE

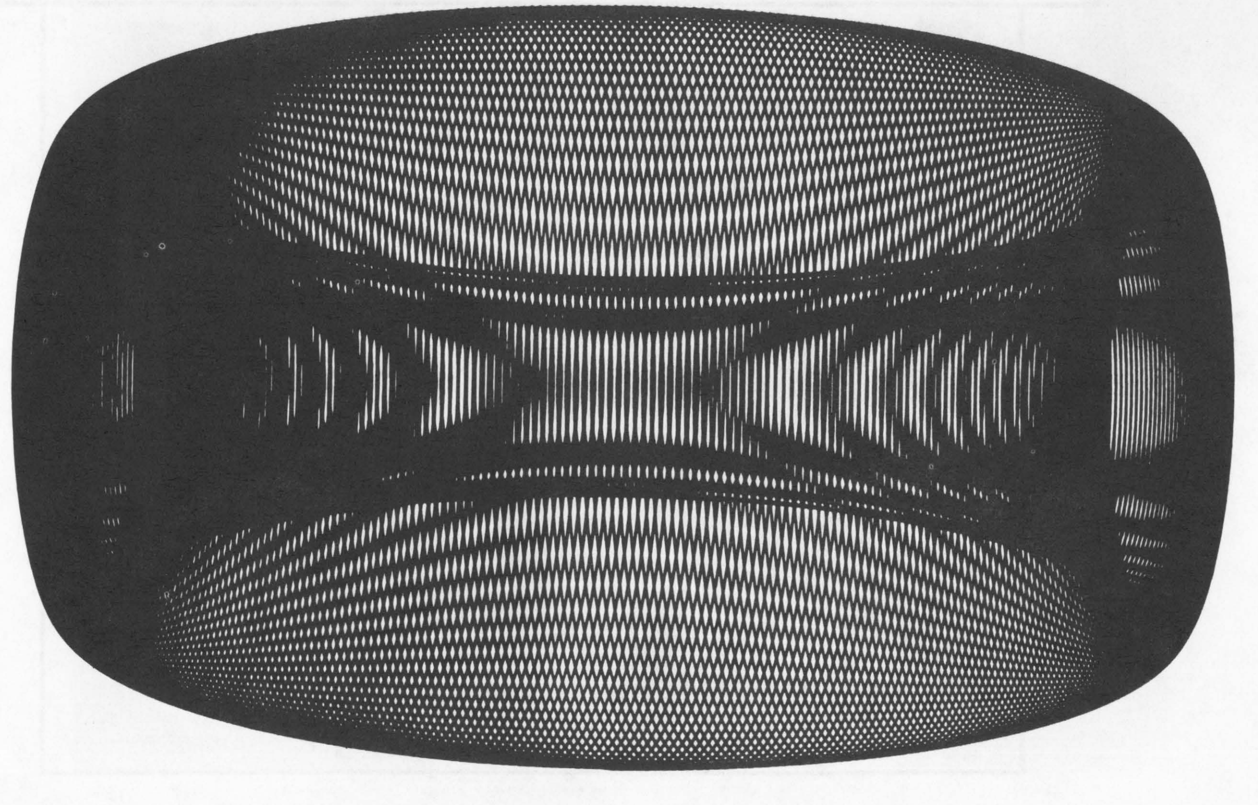
Below: *Vois-voie-voix-voyelles No. 2, 1976.* A design for painting is shown here in reversed form, white on black.

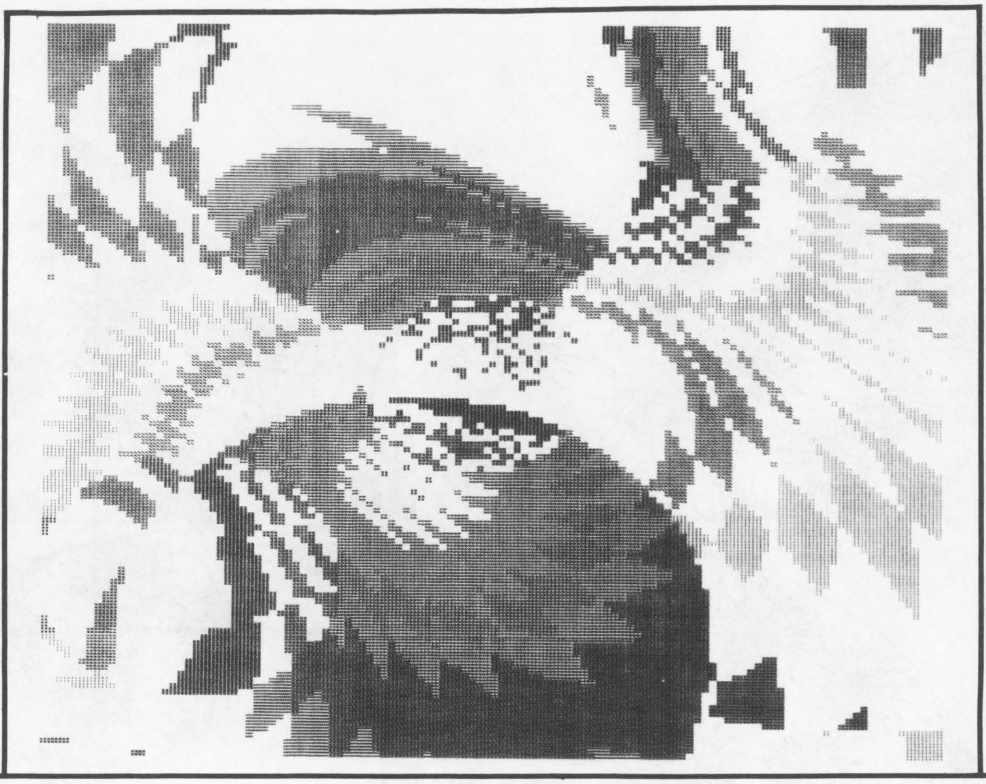




KERRY JONES — U.S.A.

"The computer system used was an IBM 370/125, Calcomp plotters 738 and 936. Programming is in FORTRAN IV. The *Butterfly* results from a line-smoothing algorithm by ACM, October 1972. The interior patterns are made up of dots plotted only within the confines of the wings, which can be considered as a group of line segments connected together. To determine if a point is within the circle, find the line segments through which a line drawn vertically passes. If it is below the top line segment and above the bottom segment, it's in the wing." Below: *Ellipse/Ellipse* by Kerry Jones.

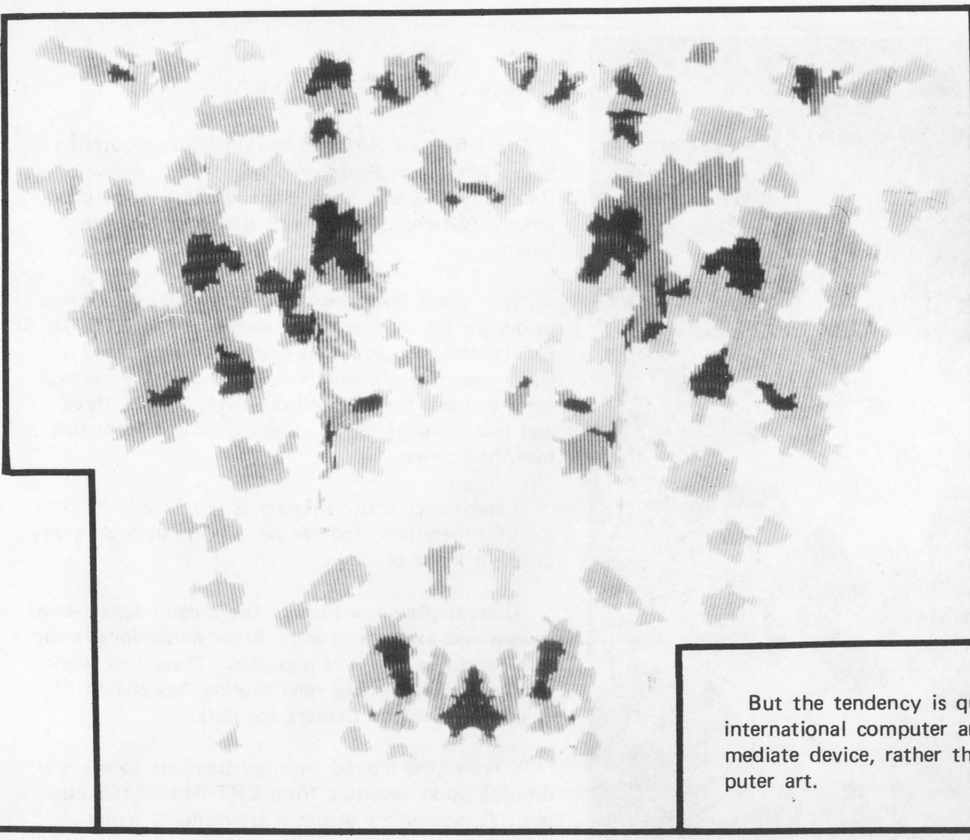




VILKO ZILJAK — YUGOSLAVIA

Two untitled works by the industrial engineer, Vilko Ziljak. The grid-like patterns of his work bring to mind ancient Byzantine mosaics. Yet the precision of the grid-like designs renders them highly adaptable to applications in woven textiles, rugs, or needlepoint. Important in all his graphics are the open (white) areas, making a foil for the darker values of black and many values of gray.

HERBERT FRANKE – GERMANY

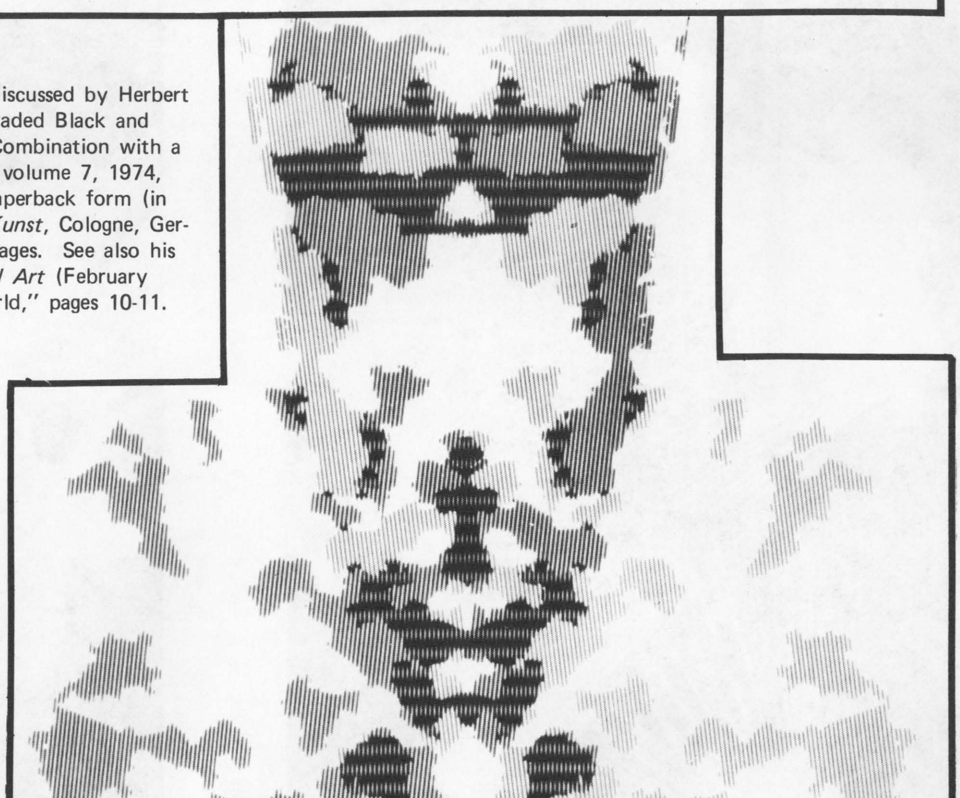


"Manipulation," or artistic playing with computer images, is becoming a very common practice. Twenty of some 150 works in a large international computer art showing were on industrial paper, from plotters. The remaining 130 works had been taken back into fine art: paintings, silk-screened editions, lithography, textiles, rugs, etc.

Works achieved by photographic manipulation are very different from CRT and plotter graphics. Computer professionals frequently voice the opinion whether this new art is art – whether it is more art than it is computer art.

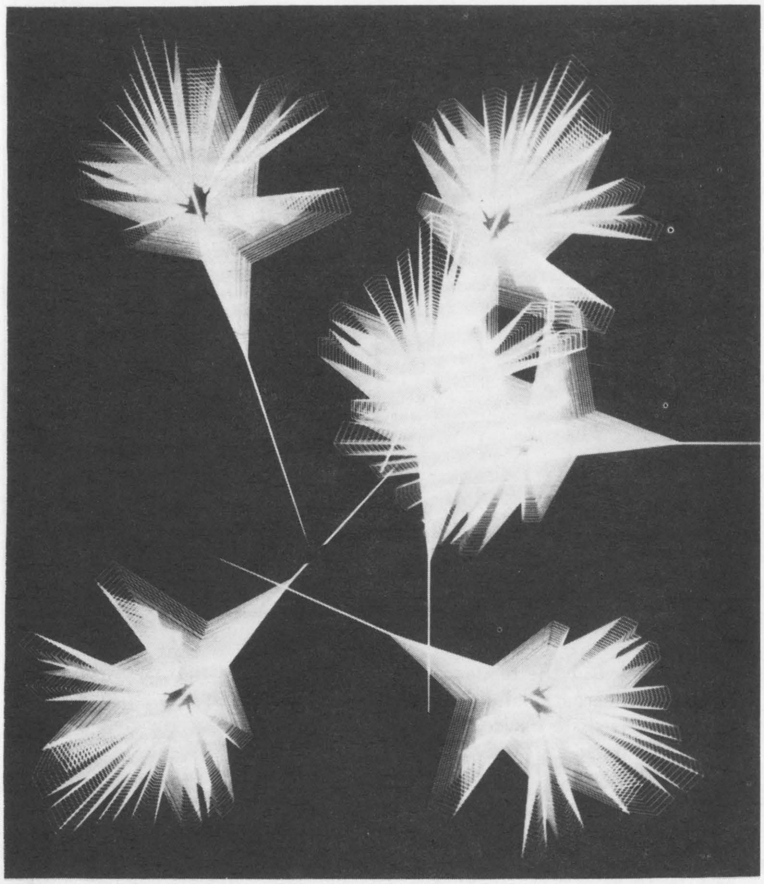
But the tendency is quite clear among the majority of international computer artists: the computer is an intermediate device, rather than a final form for the new computer art.

"Illustrations 2 (above) and 3 (below) are from the series *Bavaria* in which the output of images is from a microfilm plotter. The final graphic series was manipulated in a photographic way."



Microfilm plotter manipulations are discussed by Herbert Franke in his article, "On Producing Graded Black and White or Color Computer Graphics in Combination with a Photographic Technique," in *Leonardo*, volume 7, 1974, pages 333-335. An excellent text in paperback form (in German) by Dr. Franke is *Apparative Kunst*, Cologne, Germany: DuMont Schaubert, 1974, 214 pages. See also his recent article in *Computer Graphics and Art* (February 1976), titled "Art of the Technical World," pages 10-11.

The May editorial of *Computer Graphics and Art* compares early phases of this new art field, considers new and future trends. "The Microfilm Plotter and Computer Art" by G. Hertlein reviews in detail photographic manipulation of computer art output. See the *Proceedings*, CUCC/6, Texas Christian University, Fort Worth, Texas, June 1975.



GRACE C. HERTLEIN — U.S.A.

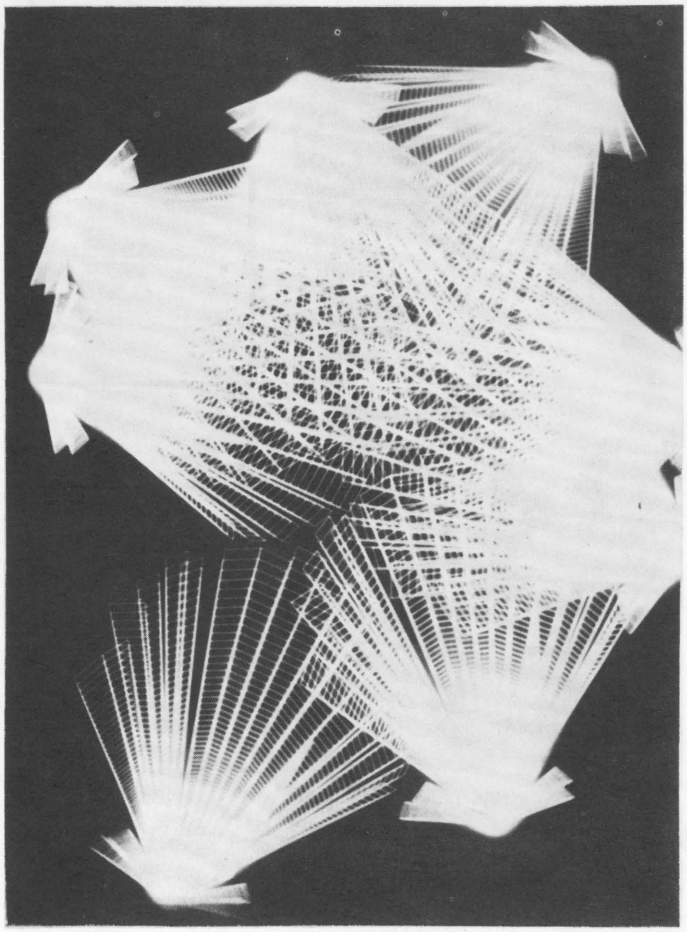
Top left: *Leaf Series*, microfilm plotter output. Below left: *Shell Series*, also microfilm. Below right: Detail of the *Leaf Series*, showing close-up of interference patterns possible with photographic manipulation.

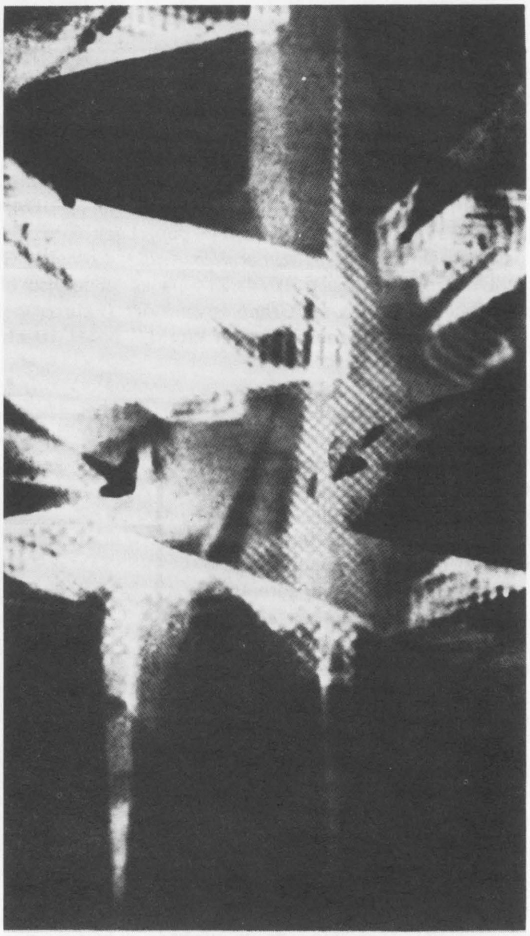
"Here are a few samples from recent explorations in designs for textiles, some shown at the NCC '76 Art Exhibition. All work was originally on microfilm, then developed photographically, and in the development process, manipulated creatively. Two, three, and four generations of graphics resulted from this microfilm series.

"Later direct photo-silkscreens were made from Kodalith negatives, and textiles silkscreened on many different kinds of cloth.

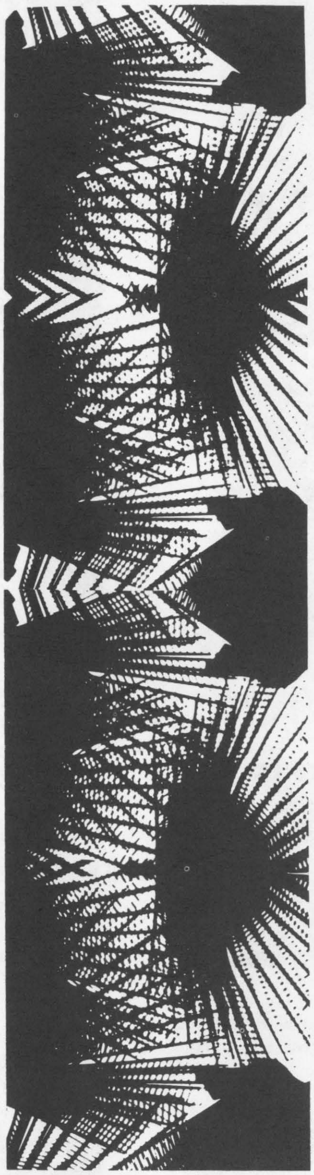
"Current plans are to take the present silkscreened designs and experiment with larger dimensional sculptural works in clay and plexiglas. These new works will be included in the new touring Association of Science-Technology Centers Exhibition.

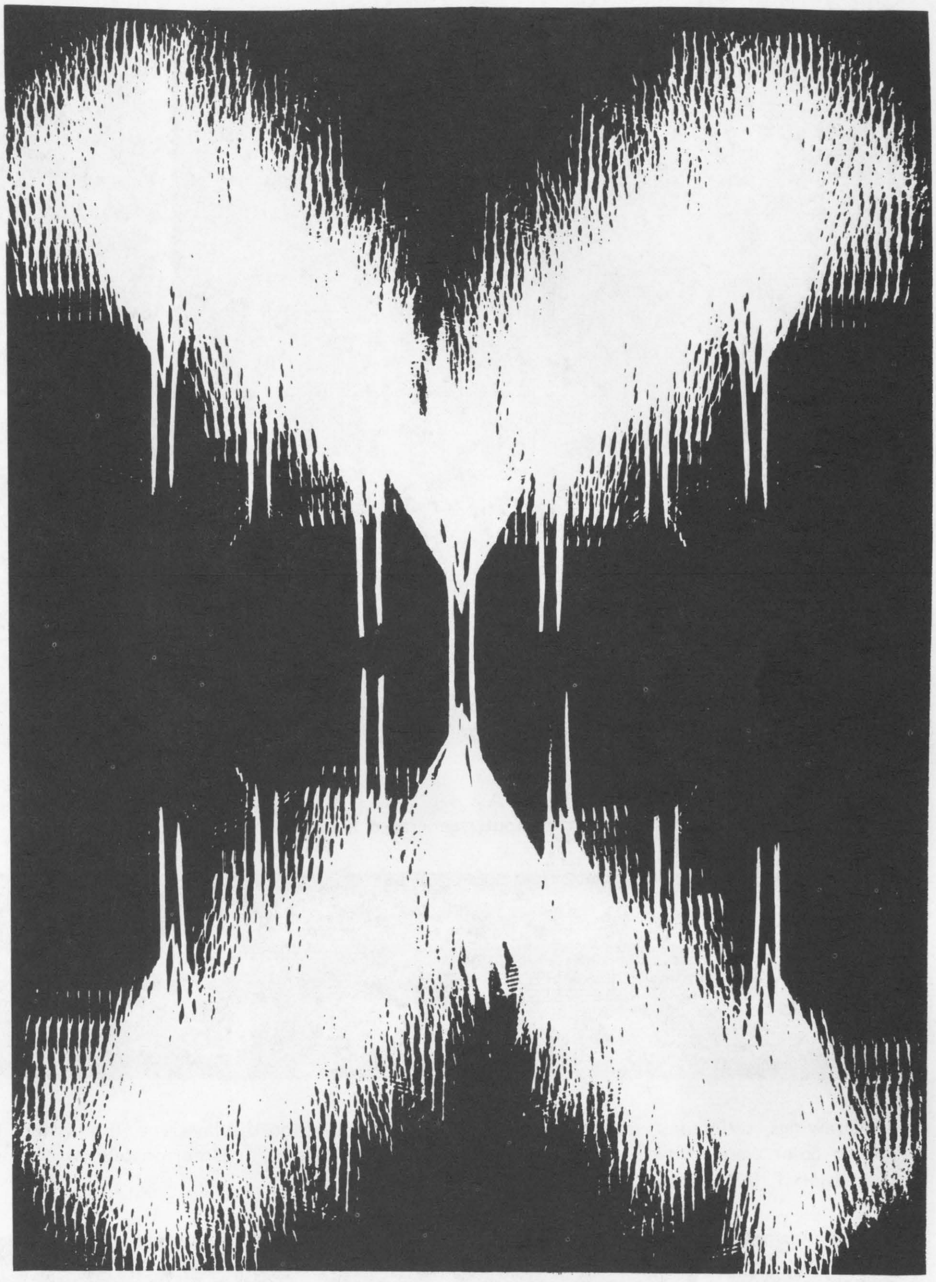
"I prefer the altered (manipulated) art to the traditional works resulting from CRT and plotter output. Computer art in other art media is much richer, more colorful, yet it retains the imagery and aesthetic of the computer."

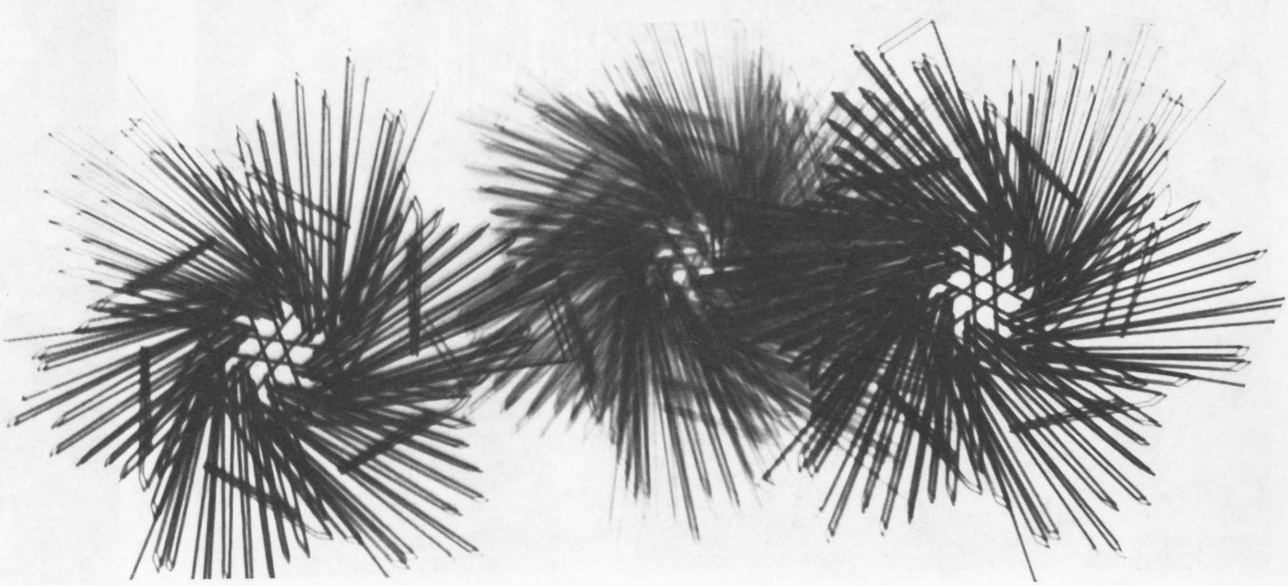


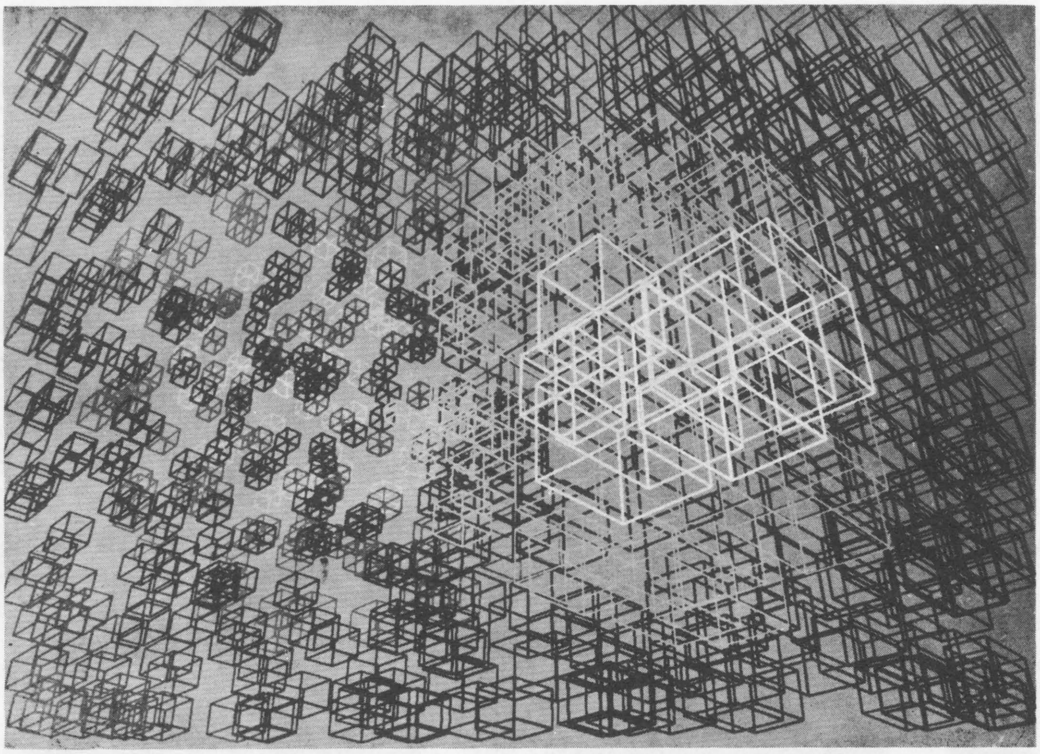


Textile Designs
by Grace C. Hertlein



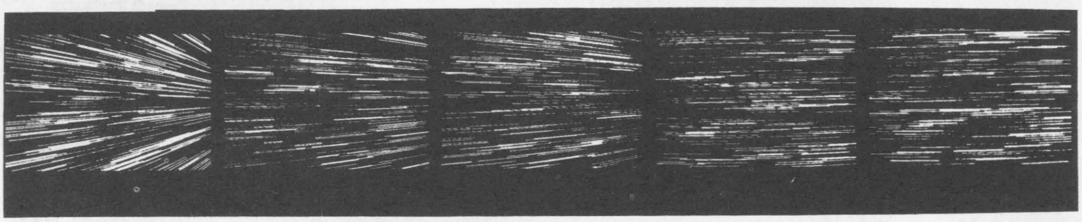




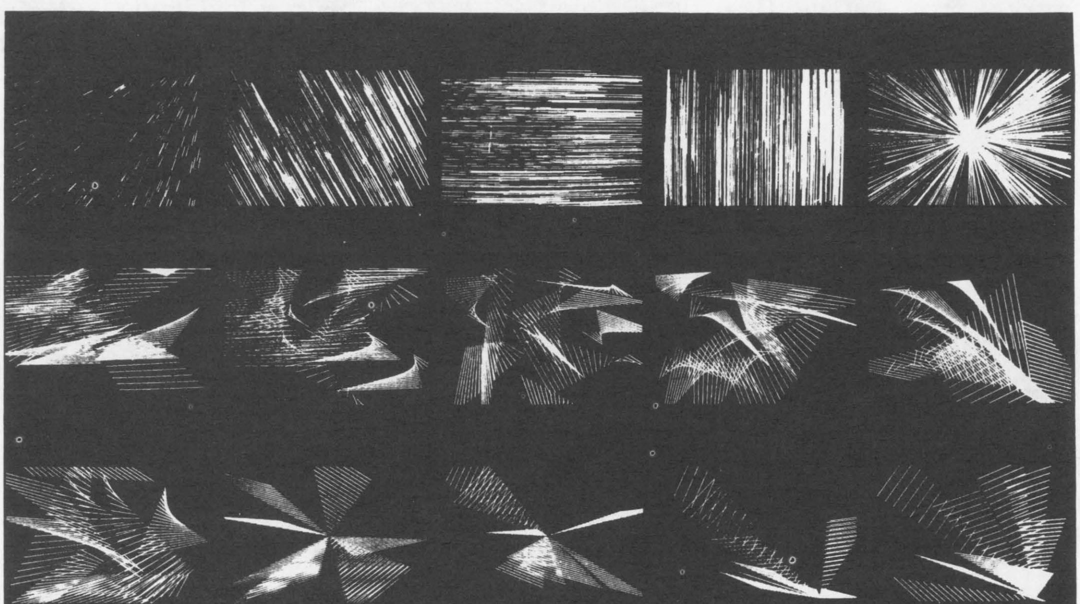


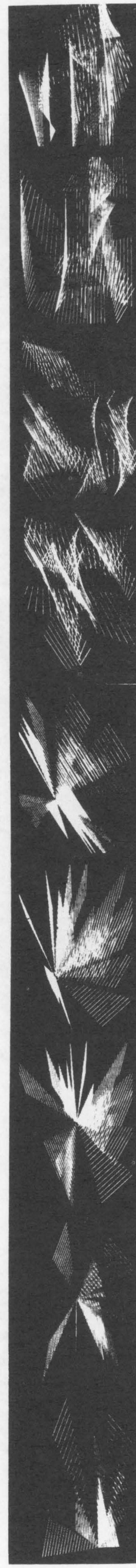
TOMISLAV MIKULIC – YUGOSLAVIA

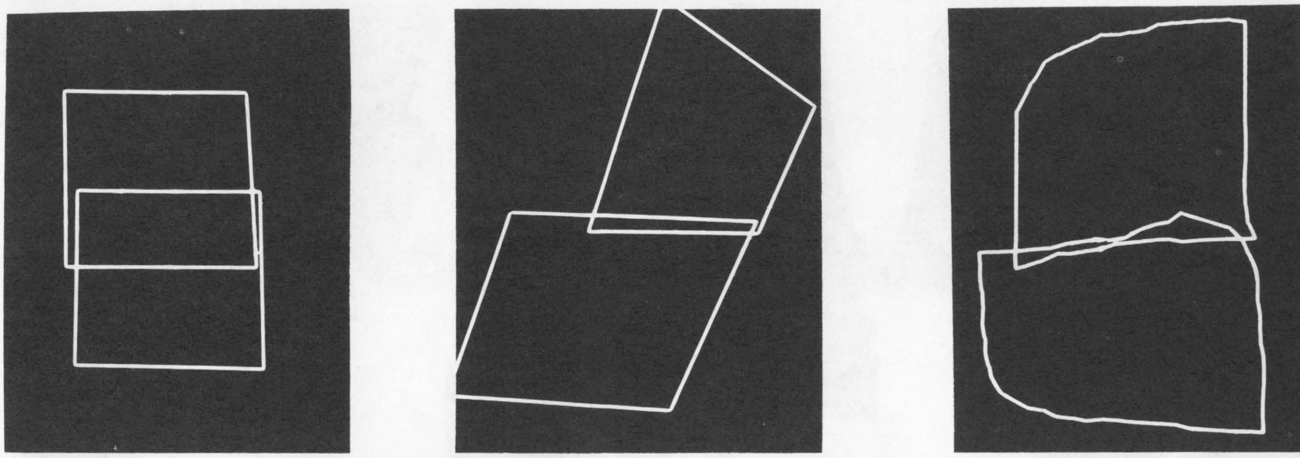
Illustrations of 16mm films of computer-generated art are shown on this page.



"Drawings, serigraphy, graphic terminal displays, multi-vision displays, and 16mm films in black and white and in color were shown in a recent one-man show in Zagreb." (Unfortunately, we cannot print the excellent colored illustrations from the catalog.)

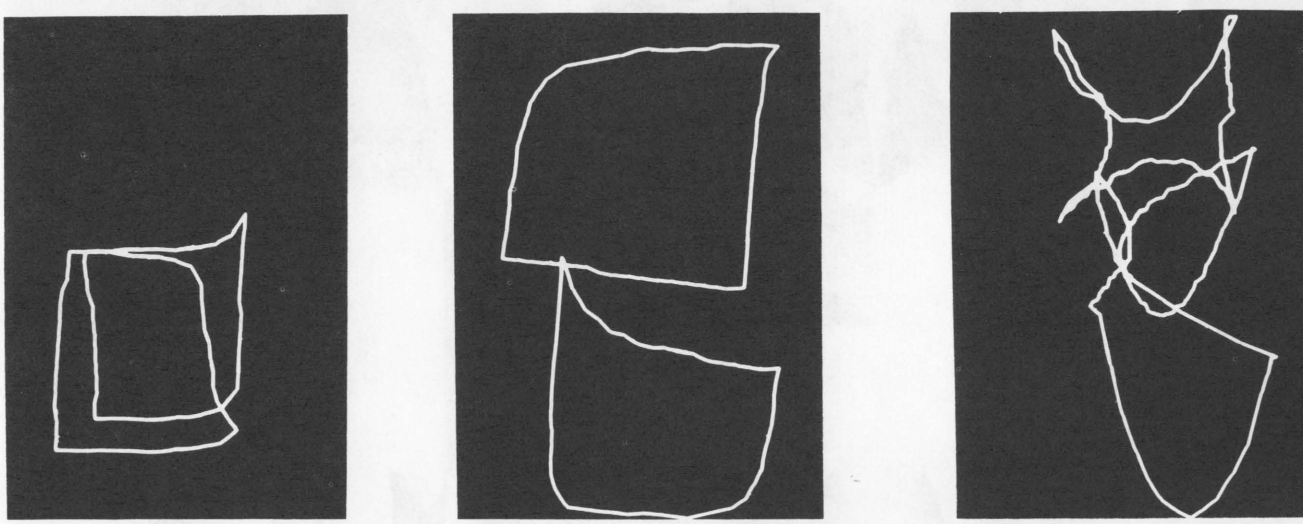






VERA MOLNAR — FRANCE

"Illustrations from a computer-picture book shown in London at the Polytechnic of Central London in June 1976 (Exhibition, Vera Molnar: TRANSFORMATIONS). The pictures are produced by manipulation on a CRT screen (IBM 2250) from a pattern of two equal squares. Computer used: IBM 370; programme: MOLNART 1." (For further details, see the discussion below.)



"The book is accompanied by a text (in French) generated by Jacques Mayer, by the permutation of the 33 letters of the title of the book (*Vera Molnar: Love-Stories — a l'Ordinateur*).

"Here are some sentences out of this permutation:

— Notre alto va danser sur le miroir ovale.

— Art: la télévision s'ouvre à l'ordre roman.

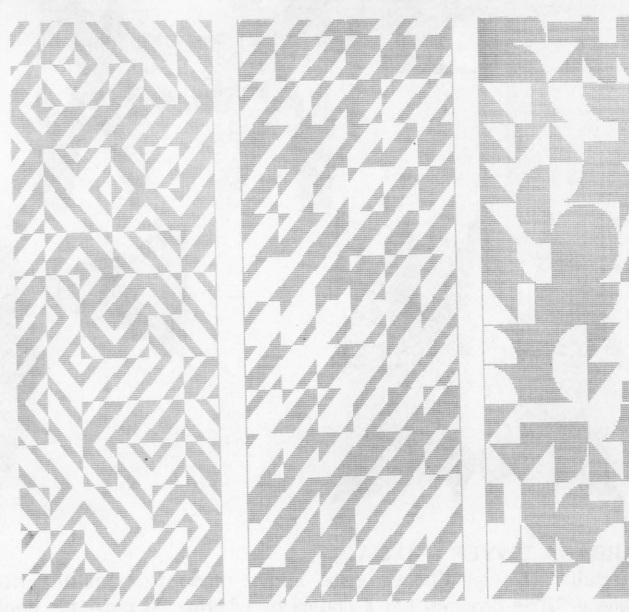
— Votre art réel: l'amour aride sans violon.

— A la radio: le tremolo sur son navire vert.

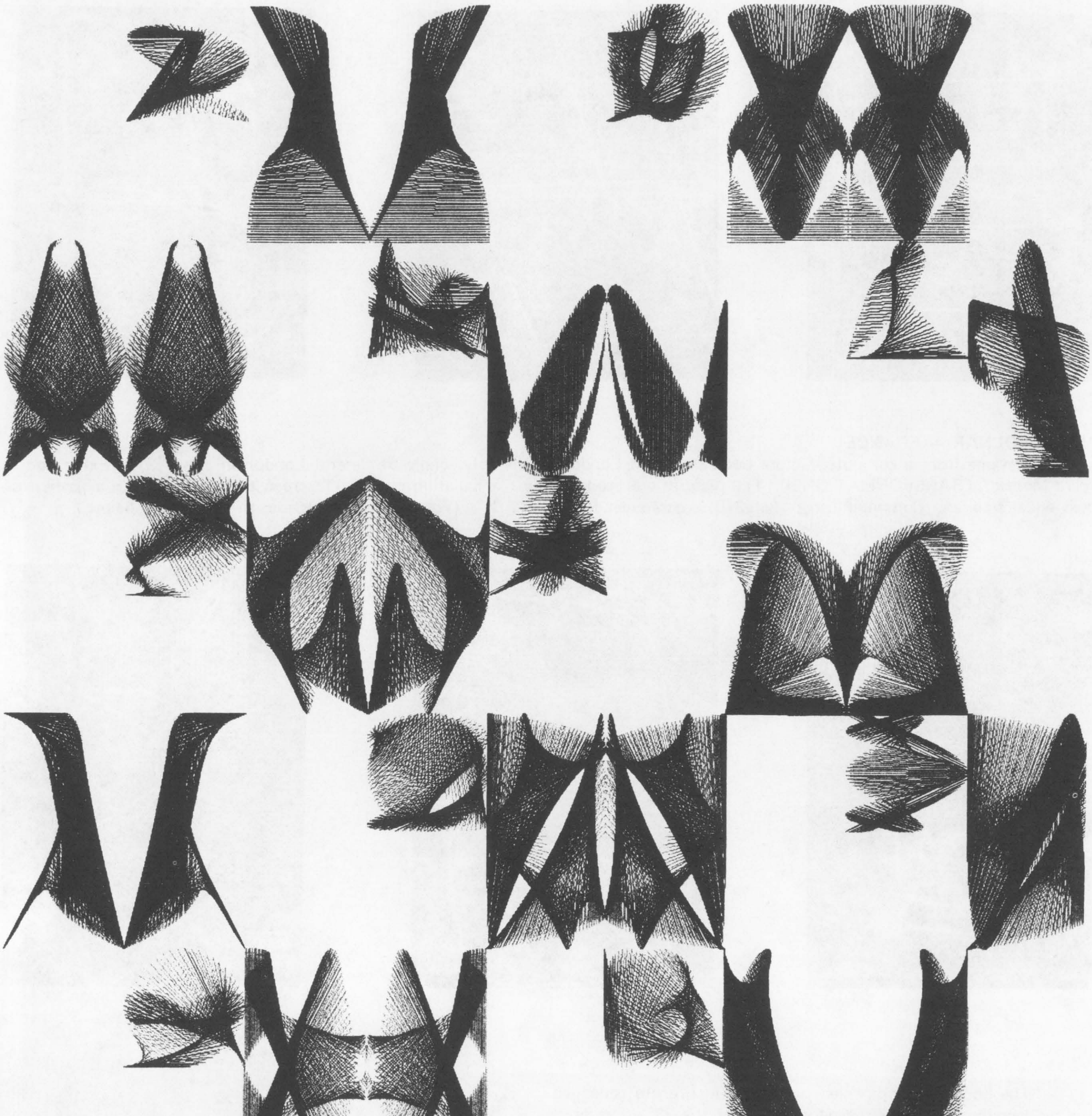
— Mon lasso verni lavera la route torride.

— Trésor d'amour, la raison te vole l'avenir."

(See *Computers and People*, August 1975, for examples of Vera Molnar's computer-designed canvases. She also uses the computer as a designing vehicle for manual paintings.)

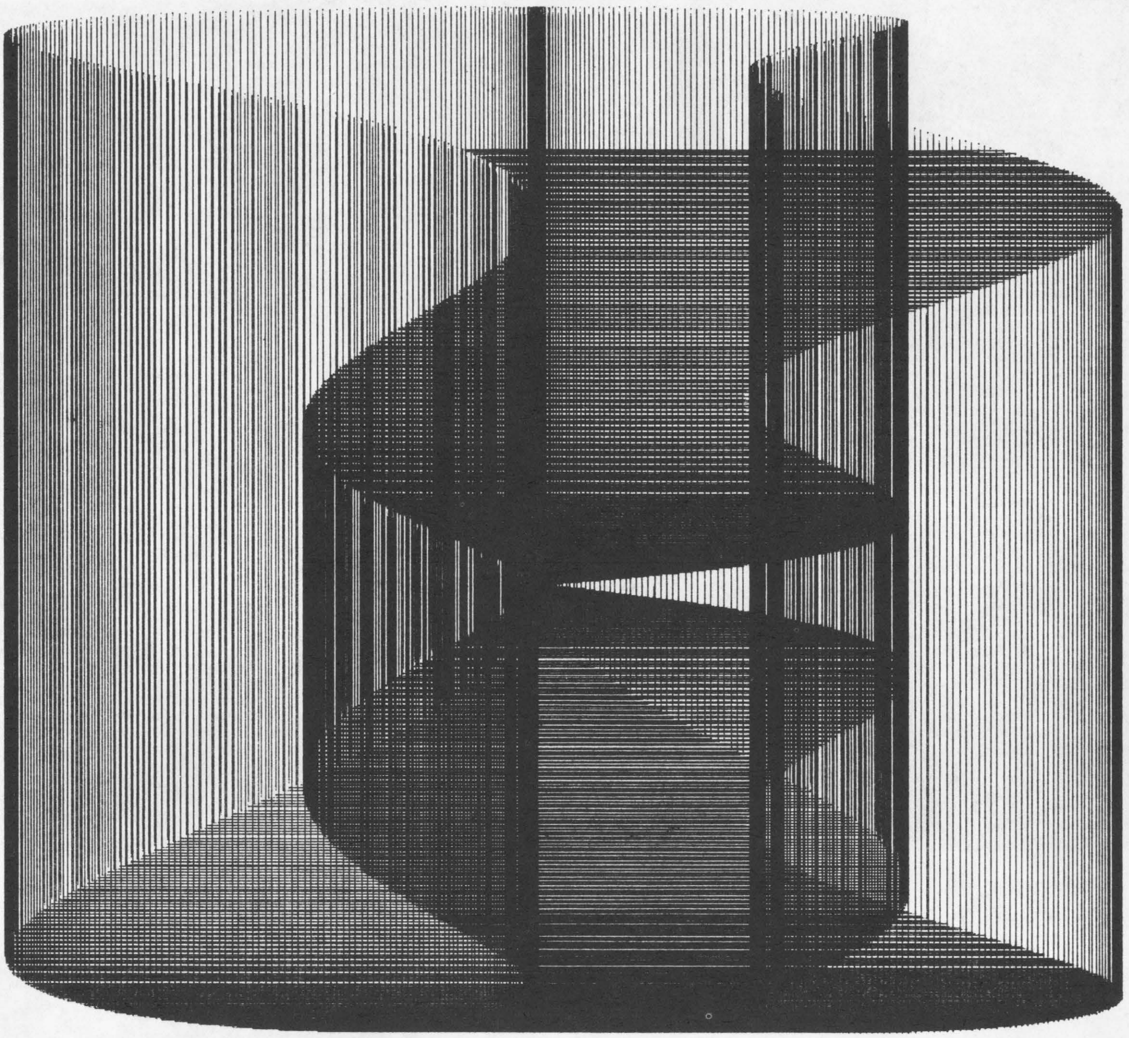


Details of large murals by Groupe Couleur de Belfort.



BARBARA DWYER — U.S.A.

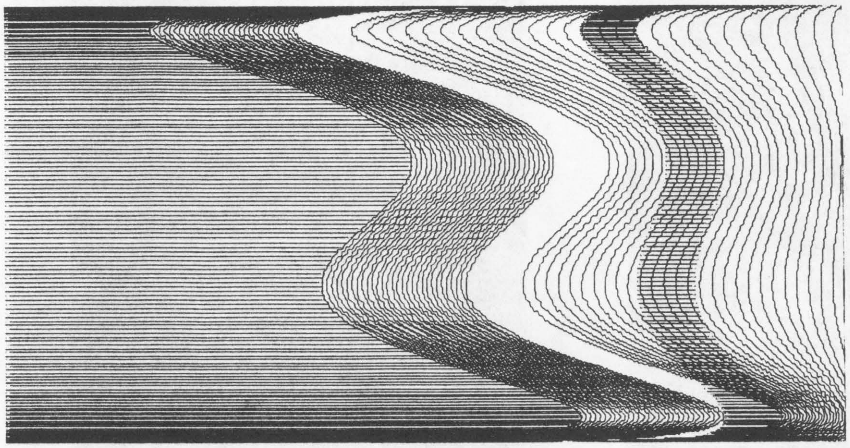
Detail of *Double Checkerboard*, above, randomizations of related patterns in a category called metamorphic or changing serial imagery. The program has a choice of whether to output a double (mirrored) image, or to merely draw one portion, or to leave the area blank.

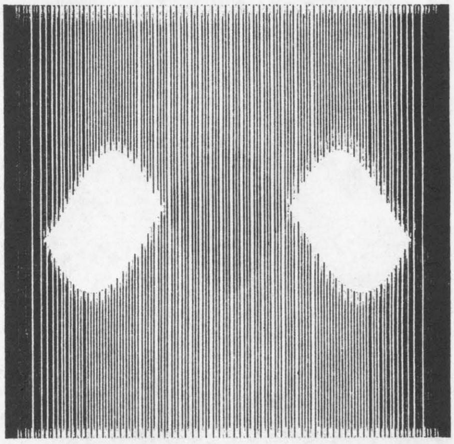


JEAN BEVIS – U.S.A.

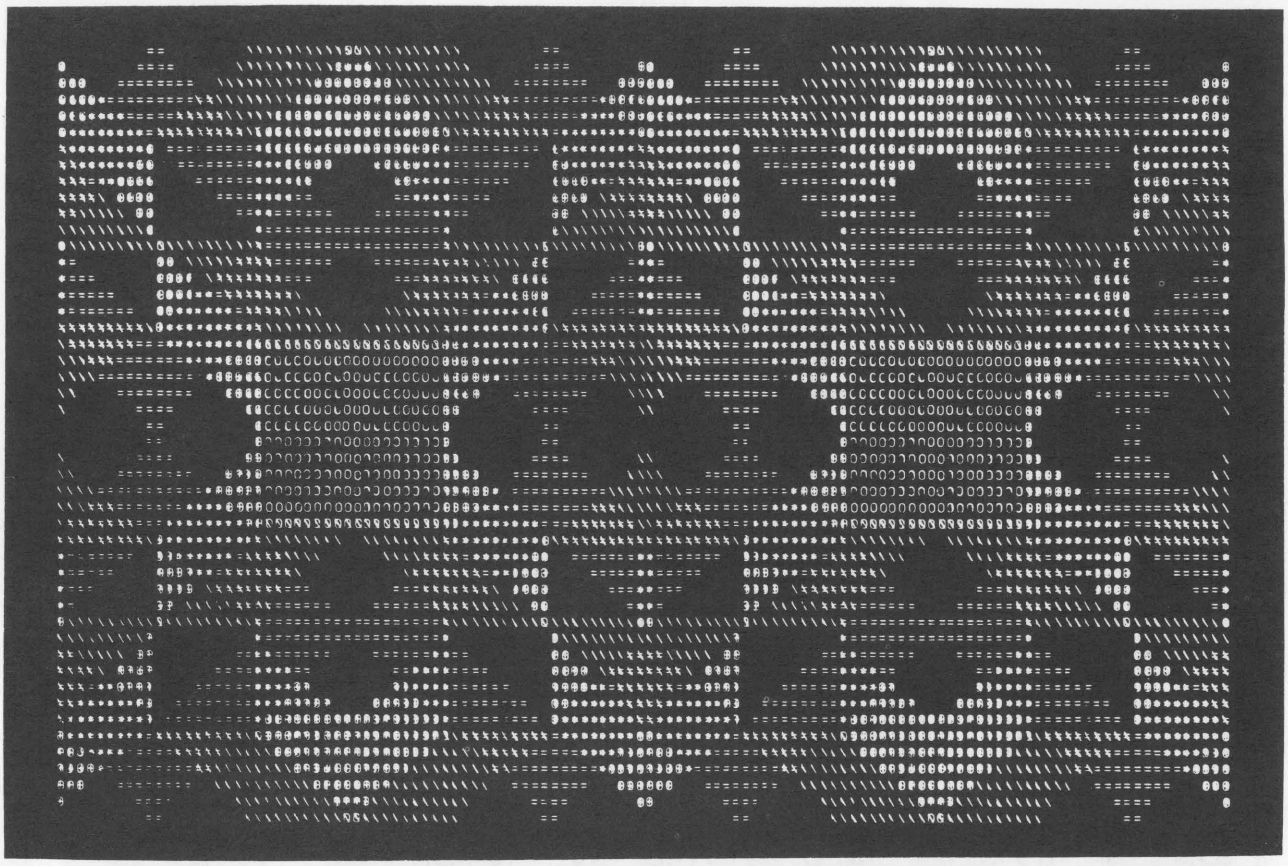
Horizontal/Vertical III by Professor Jean Bevis, Georgia State University. As a professor of mathematics, his works derive their programmatic design source from this discipline. Yet equally, they reveal a sensitivity to design and mathematics.

His graphic, *Princely Potential*, shown on page 31, was chosen as the symbol for the NCC '76 Art Exhibition and imprinted on souvenir buttons for art show guests. We hope to publish future graphics and programs by Professor Bevis in other issues of *Computers and People*.





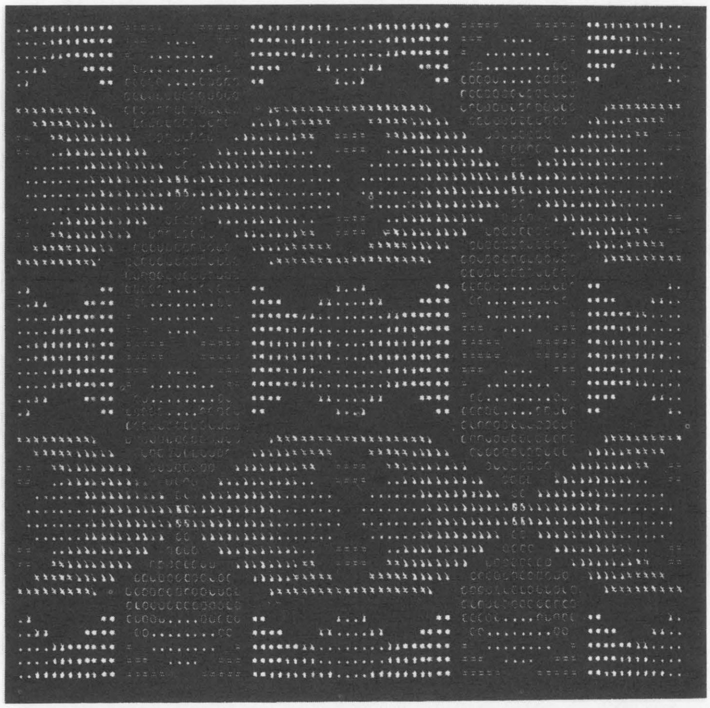
Untitled graphics, above, by Barbara Dwyer. Program written in FORTRAN IV; system used was a UNIVAC 707 with a Calcomp plotter. Work was executed at Georgia State University, Atlanta, Georgia.

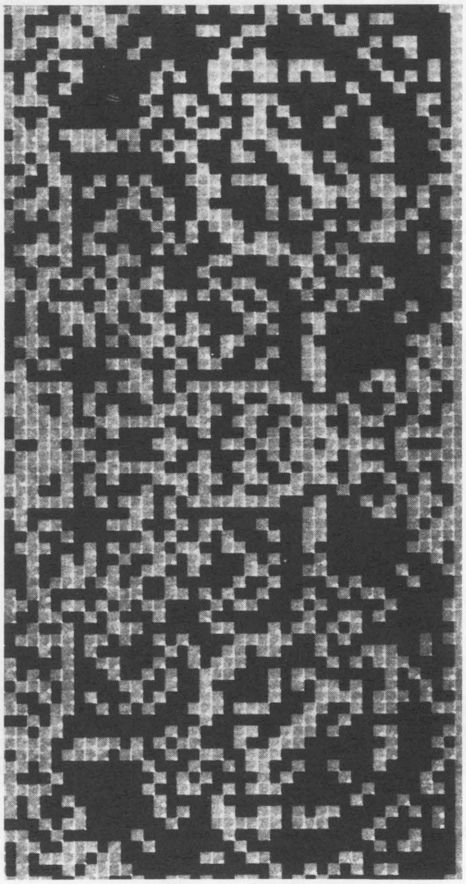


JAMES C. VER HAGUE, JR. – U.S.A.
Above: *Tapestry No. 27.* Below left: *Tapestry Detail No. 16.*

KERRY JONES – U.S.A.
Below right: A portion of *Random Tapestry.*

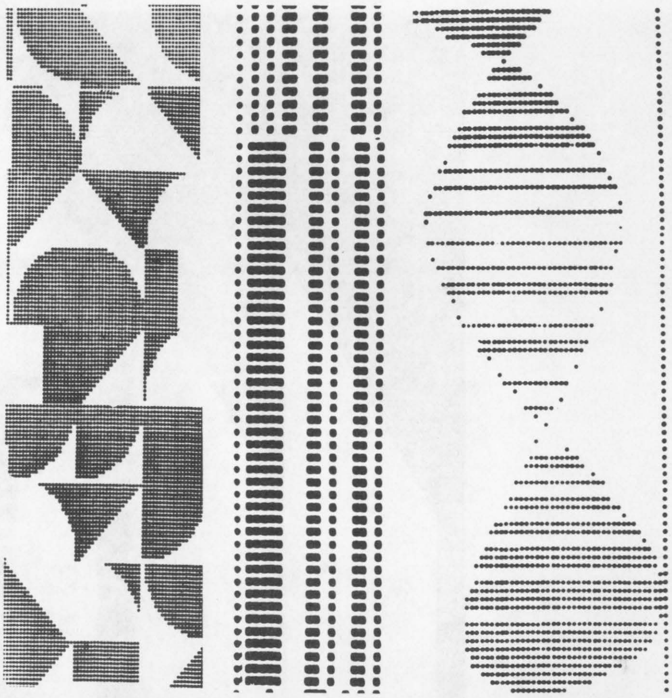
These works are ideally suited to woven textiles, stitchery, and rug design.





GROUPE COULEUR DE BELFORT – FRANCE

Details of industrial murals by a group of artists who work together to design monumental murals in public places. Their aim is to bring art to all people. Groupe Couleur is composed of the artists Luka, Noll, Normand, and Quemar. Their works are shown in subways, industrial buildings, etc., to "humanize" the industrial and urban environment.



MUTSUKO KUNII SASAKI – JAPAN

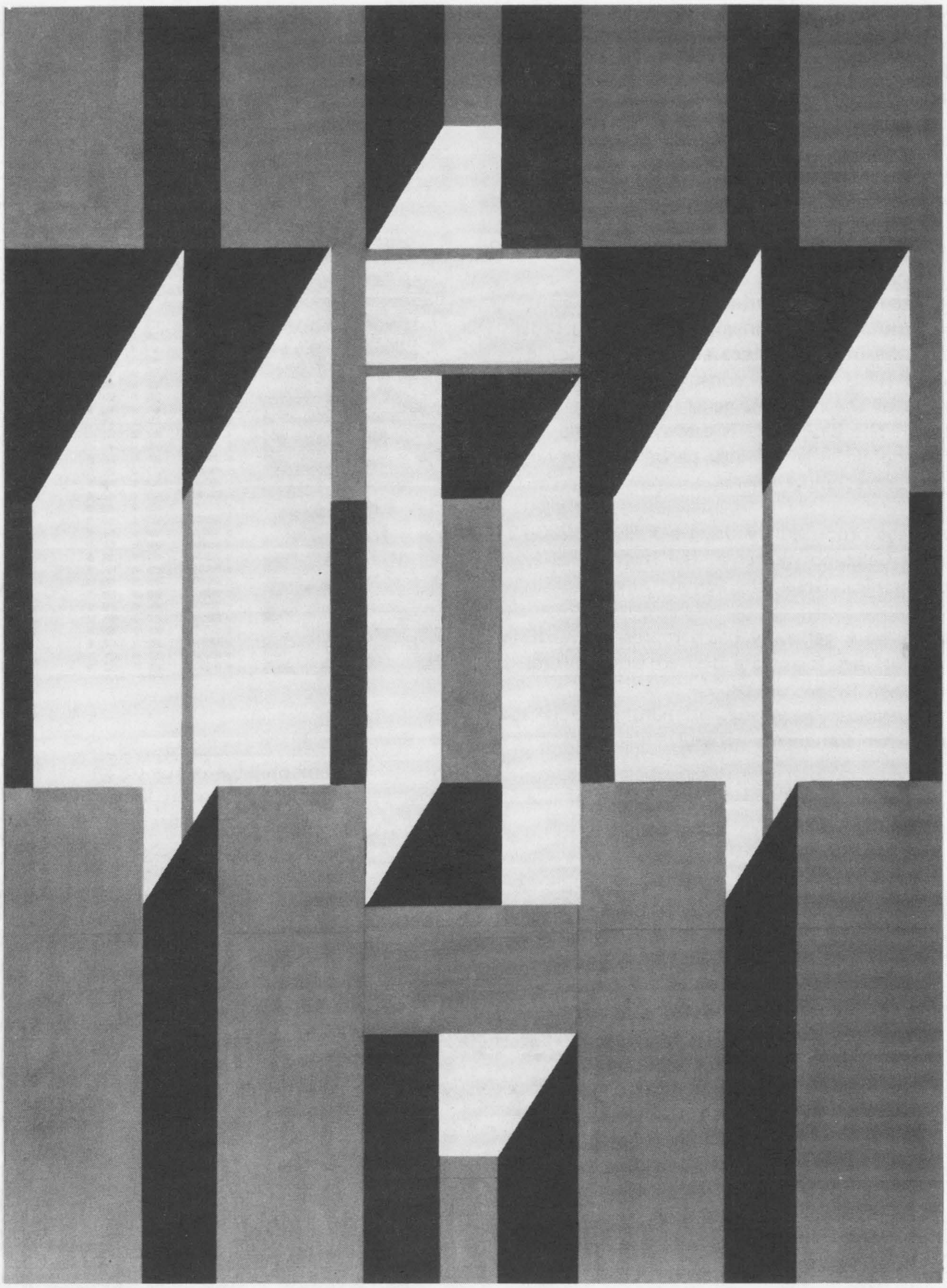
"Nature created many beautiful things, and human beings found artificial beauty in mathematics. In order to combine the beauties of nature and mathematics, a system named ART-3 has been constructed. This (*Nemophila*) is one of the drawings generated by the ART-3 System. The basic data is drawn from the shape of a nemophila* divided into parts, with varying textures of the leaves and flowers.

"This work was produced by using a FACOM 230-75 computer and a Calcomp plotter at the Institute of Physical and Chemical Research, Tokyo, Japan."

(Mrs. Sasaki's work generally has a representational basis, and most of her forms are derived from nature. In the work shown below, almost an "aura" of the flower form speaks of the mystery of nature alluded to by the artist in her statements above.)

Nemophila, below, by Mutsuko Kunii Sasaki of Tokyo, Japan.

* Nemophila: a genus of annual plants having diffuse brittle stems, pinnatifid leaves, and conspicuous blue or white flowers. They are common in California.



EDWARD ZAJEC — ITALY

"*Diagonal White* (above) is a program which I have been sporadically developing since 1970. The new developments regard the formation of modules through combinations of vertical, horizontal, and diagonal lines, and the color definition of planes in function of their shapes.

"White is the only color which can be combined with orthogonal* as well as nonorthogonal planes — whereas yellow, red, and blue combine only with orthogonal planes. Grey and black combine only with nonorthogonal planes. The perceptual ambiguity of the diagonal on the plane has been thus chromatically counterparted by the color white.

"The program was accomplished in cooperation with Dr. M. Ameljak, and was run on a CDC 6200 at the Computer Center of the University of Trieste. The plotted output was transferred onto canvas and painted with acrylics."

(The idea of using the computer to design a series of paintings, as an aid in creation, is explored by Edward Zajec, Hiroshi Kawano, and Manuel Barbadillo in the May (Art) issue of *Computer Graphics and Art*, pages 11-16. The works of Edward Zajec are structural components.

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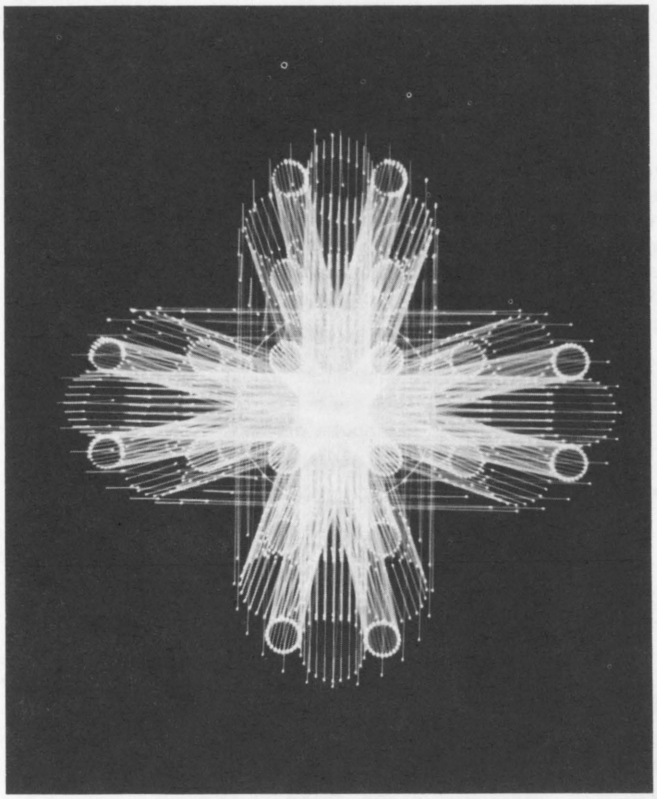
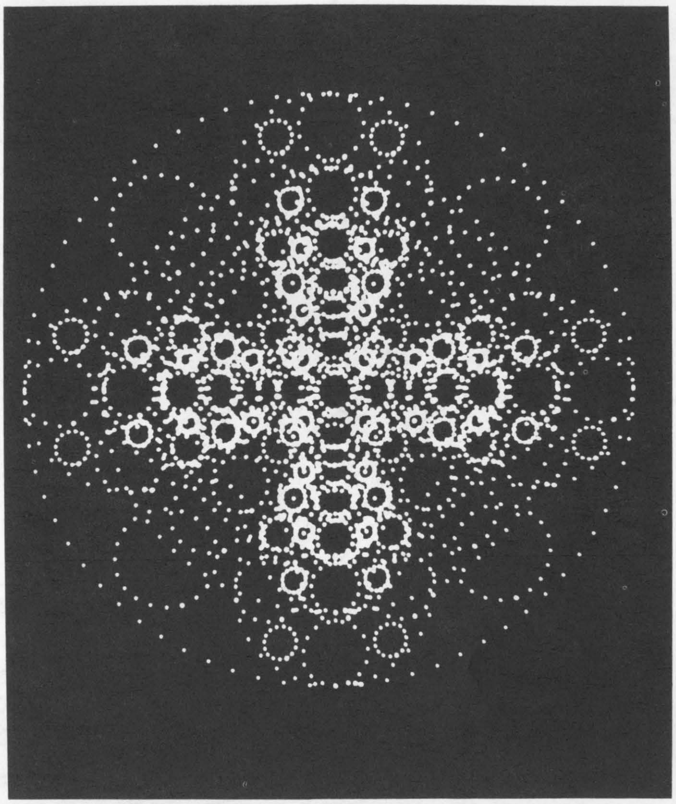
* Orthogonal: having to do with right angles and planes; right-angled; rectangular — in geometry and architecture, a projection in which the projecting lines are perpendicular to the plane of projection.



Mandala 4, above. Photographed from the cathode ray tube display system. Graphics resulting from this technique reveal large areas of white that are, perhaps, aesthetically more pleasing than their reversed counterparts from plotters, in which black lines on white paper are the final graphic form.



Mandala 5, above. This work is related to the entire series of MANDALAS, while here points of circular forms contrast to the related patterns at the left, with the latter forms differing in lines to the central point or center of the graphic. *Mandala 6*, below, features circles, rather than points of light.

SOZO HASHIMOTO – JAPAN

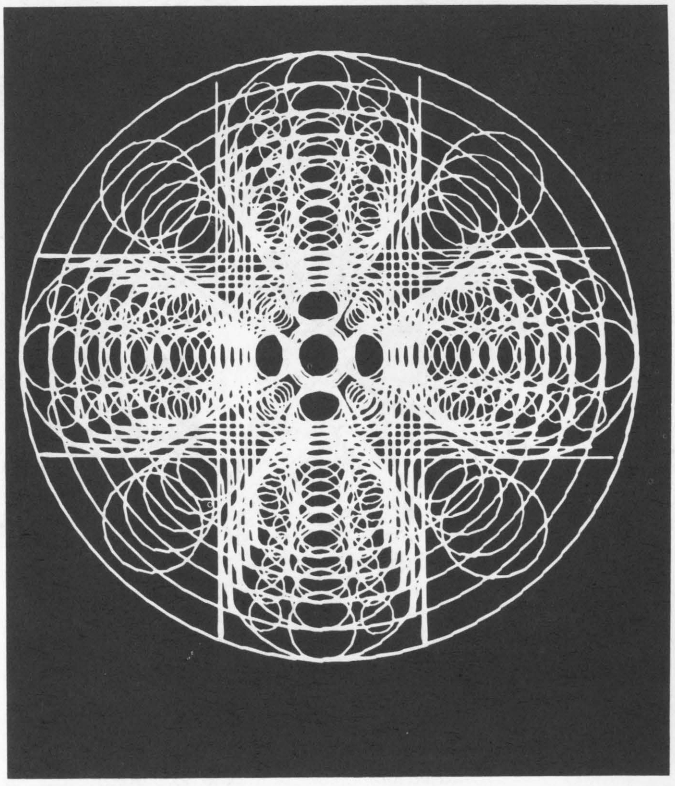
"A mandala is a useful means to transcend. Because the MANDALA has perfected a symbolic system, which symbolizes the man-universe relations in a more abstract and (perhaps) more meaningful way, the MANDALA offers the computer artist a meaningful subject to explore.

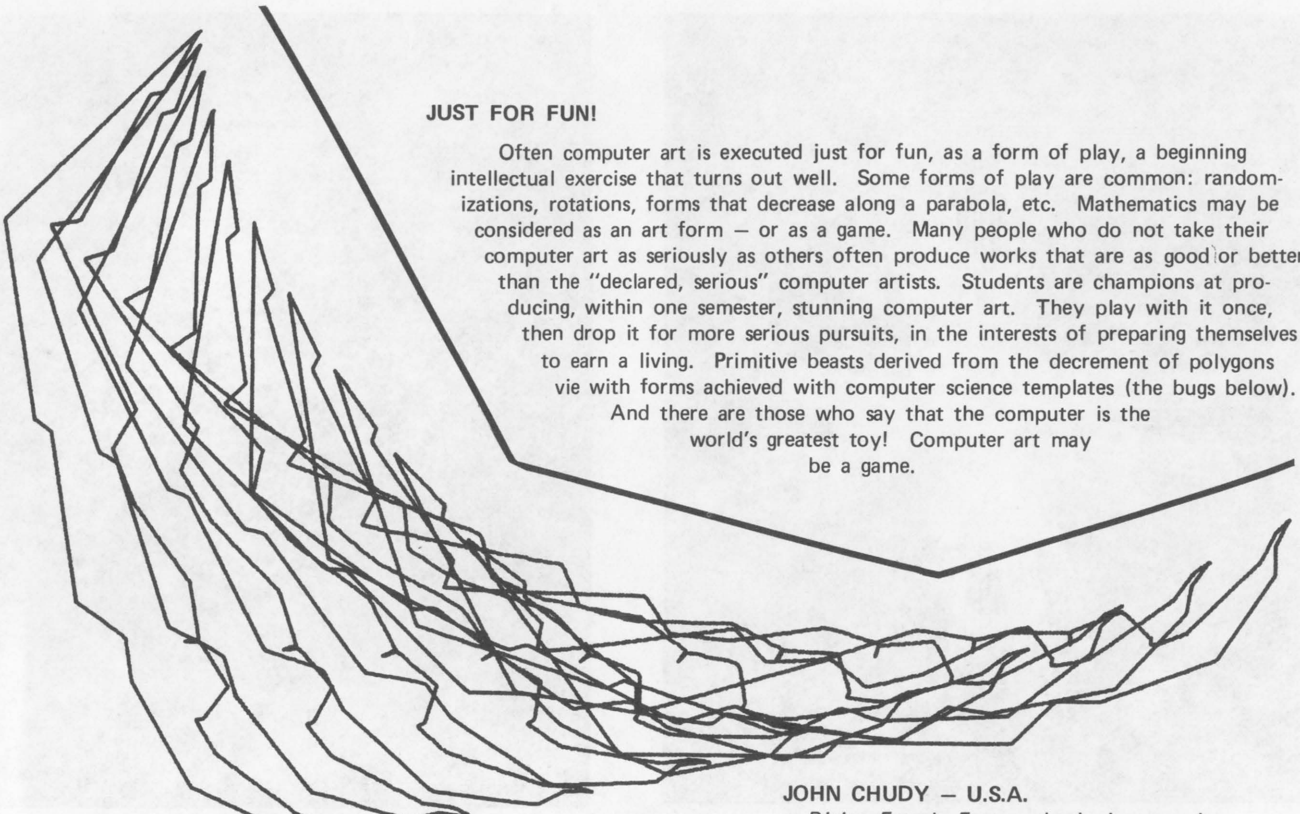
"An artist who produces a MANDALA uses mathematical order. Mathematical order is also a symbol of man's existence.

"Computers are a powerful means to expand the human's information processing ability that contains calculation. In these works, I hope to synthesize the powerful means of the computer, combined with the symbolic system of the MANDALA.

"The computer used is a FACOM 230-38; the output is on a FACOM 6233A Graphic Display System. Programming language used is FORTRAN."

(The MANDALA in computer art is a symmetric form attained by regular repetitions of the module, generally in a complete circle. The MANDALA is used as a focus of attention in varied forms of meditation.)



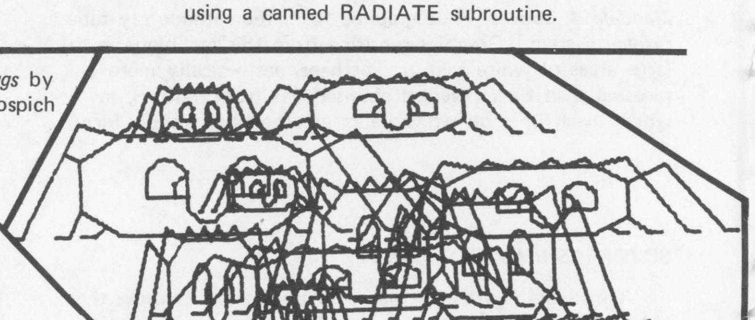


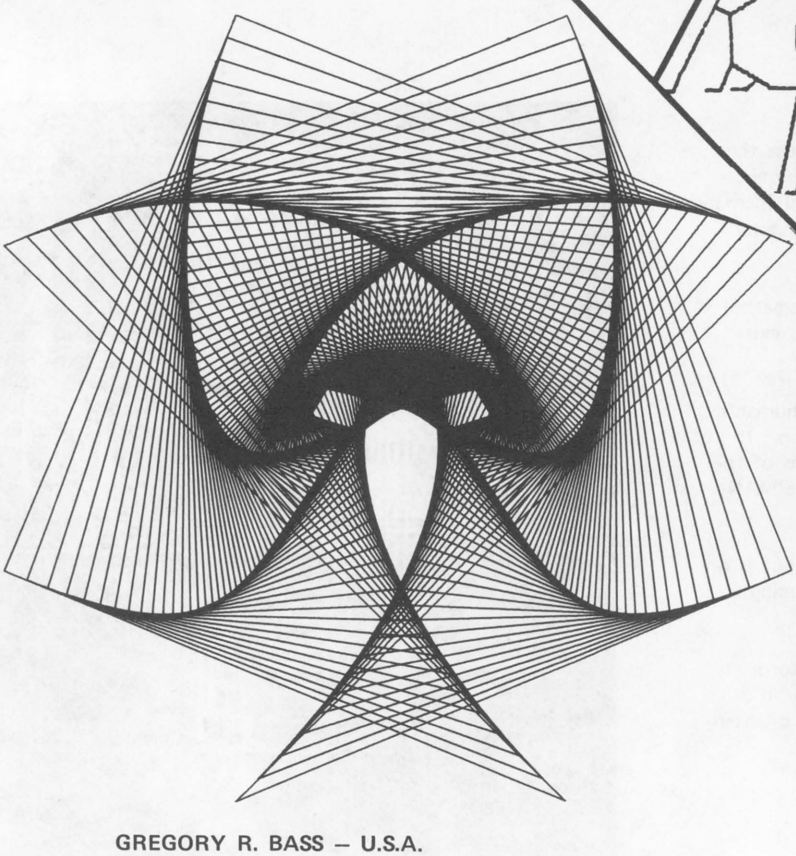
JUST FOR FUN!

Often computer art is executed just for fun, as a form of play, a beginning intellectual exercise that turns out well. Some forms of play are common: randomizations, rotations, forms that decrease along a parabola, etc. Mathematics may be considered as an art form — or as a game. Many people who do not take their computer art as seriously as others often produce works that are as good or better than the "declared, serious" computer artists. Students are champions at producing, within one semester, stunning computer art. They play with it once, then drop it for more serious pursuits, in the interests of preparing themselves to earn a living. Primitive beasts derived from the decrement of polygons vie with forms achieved with computer science templates (the bugs below). And there are those who say that the computer is the world's greatest toy! Computer art may be a game.

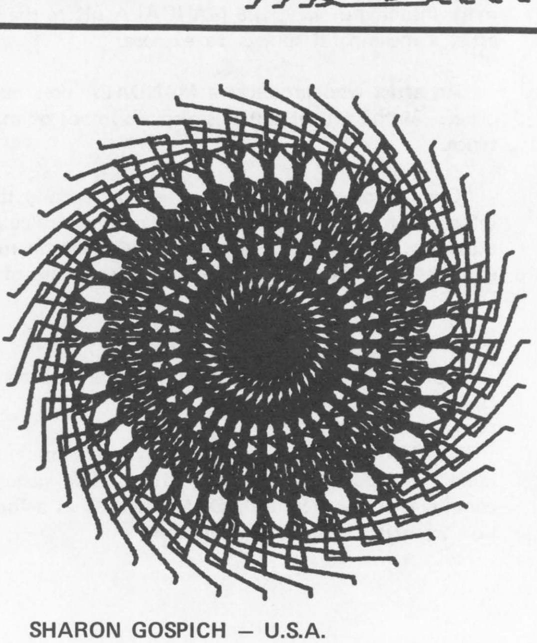
JOHN CHUDY — U.S.A.
Diving Female Form, a beginning exercise, using a canned RADIATE subroutine.

Random Bugs by Sharon Gospich

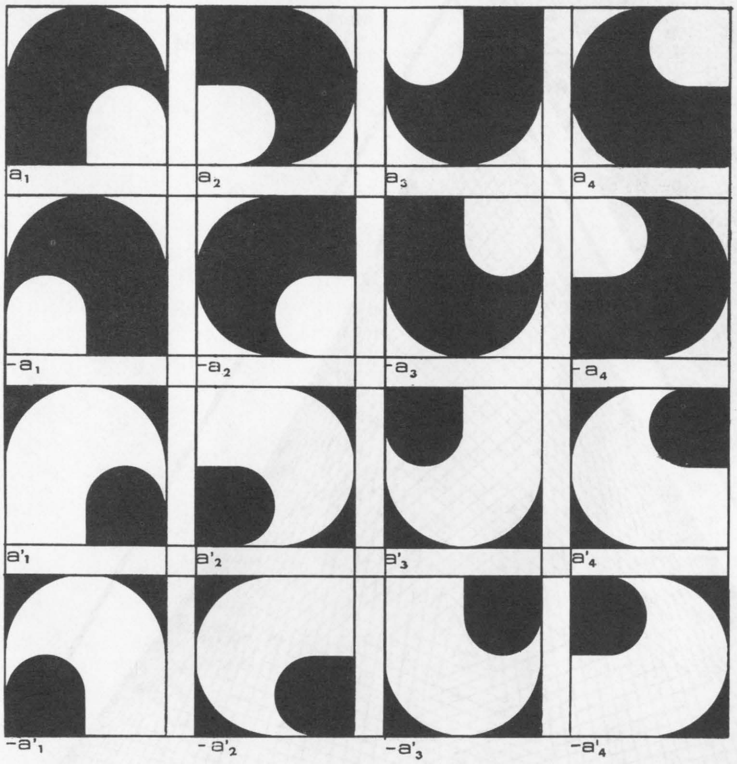




GREGORY R. BASS — U.S.A.
Untitled graphic — sent (and executed) "just for fun."



SHARON GOSPICH — U.S.A.
Bug Mandala, a beginning exercise in rotation.



MANUEL BARBADILLO – SPAIN

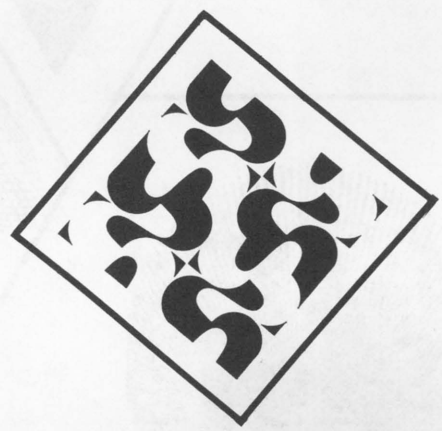
"I am not so interested in making pictures with the computer as in using the computer to understand better what I produce by traditional, intuitive means.

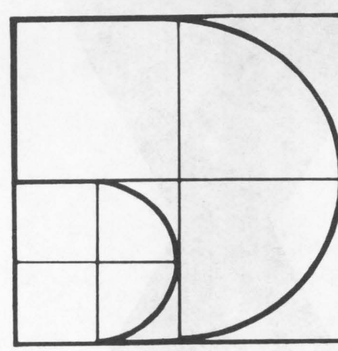
"My aim is to confirm my belief that underneath an aesthetic phenomenon there is always a reason that could be represented in terms of mathematical relationships or rhythms, which in my view are the true language of Art.

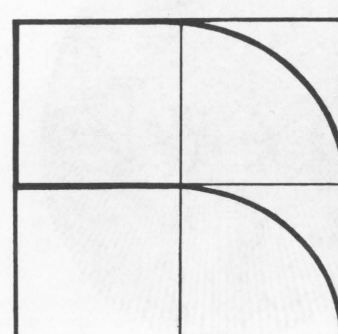
"These prints are from the output of a broad program, carried on in phases, analyzing a period of my artistic work ranging from 1965 to 1968, during which my paintings were compositions consisting of repetitions of a single shape, in different positions, in black and white versions.

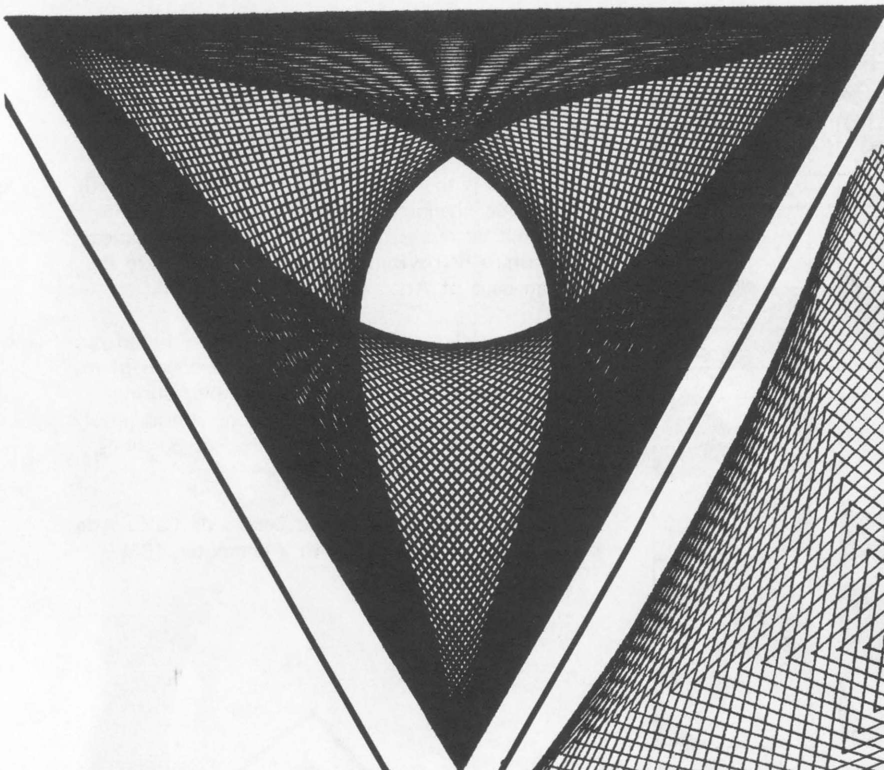
"The work was done at the Centro de Calculo de la Universidad de Madrid with a computer, IBM 7090, and a line printer."

An "alphabet" of related forms, above, shows varying placements of the A module. Below, a detail from a line printer graphic of the same A module. At bottom right, further illustrations of this module. In the small diamond area, an illustration of a finished painting, using the alphabetical module approach.

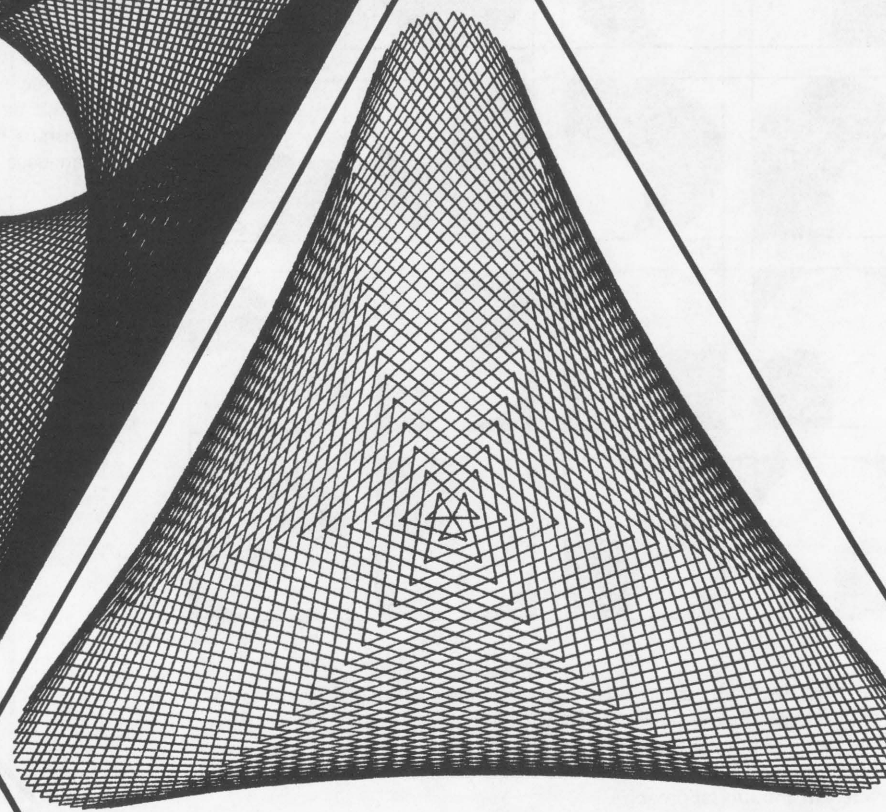




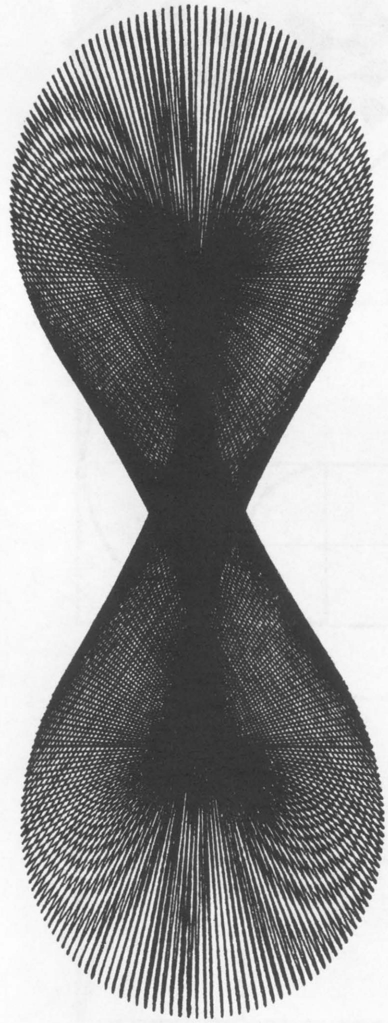


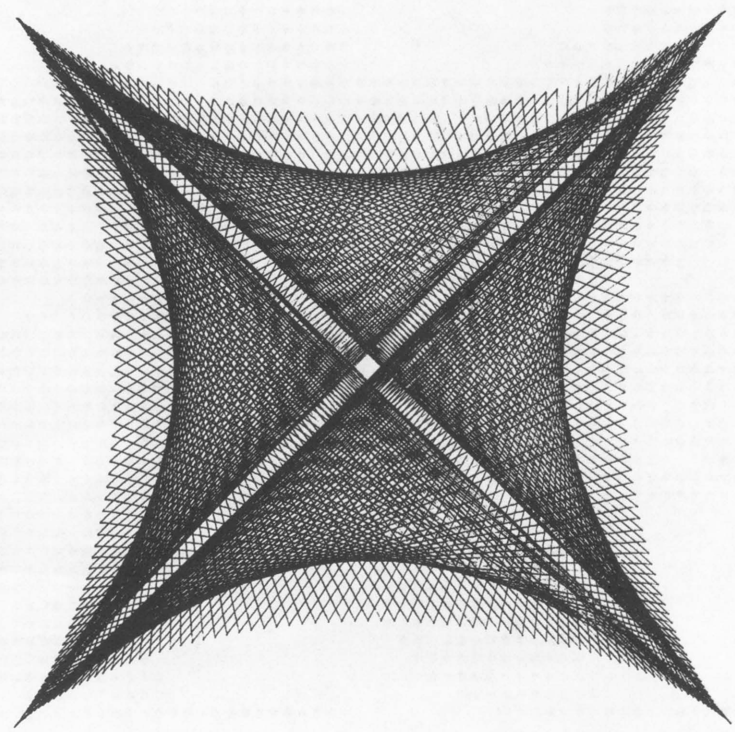


Math Functions
by Joseph Ovadia

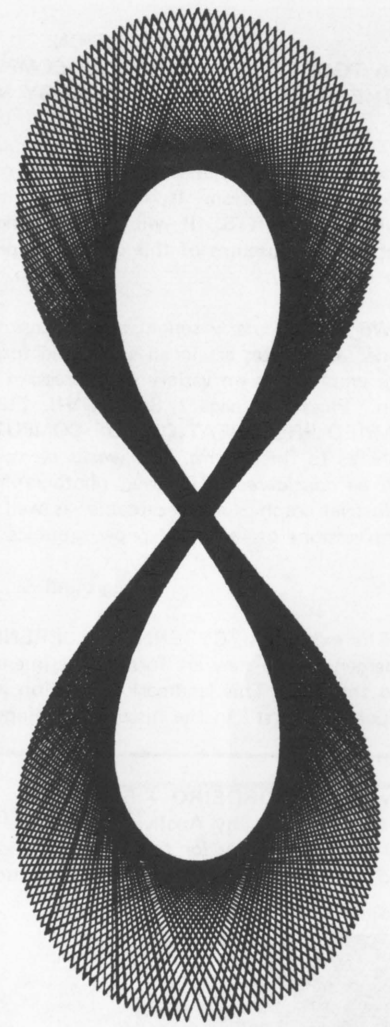


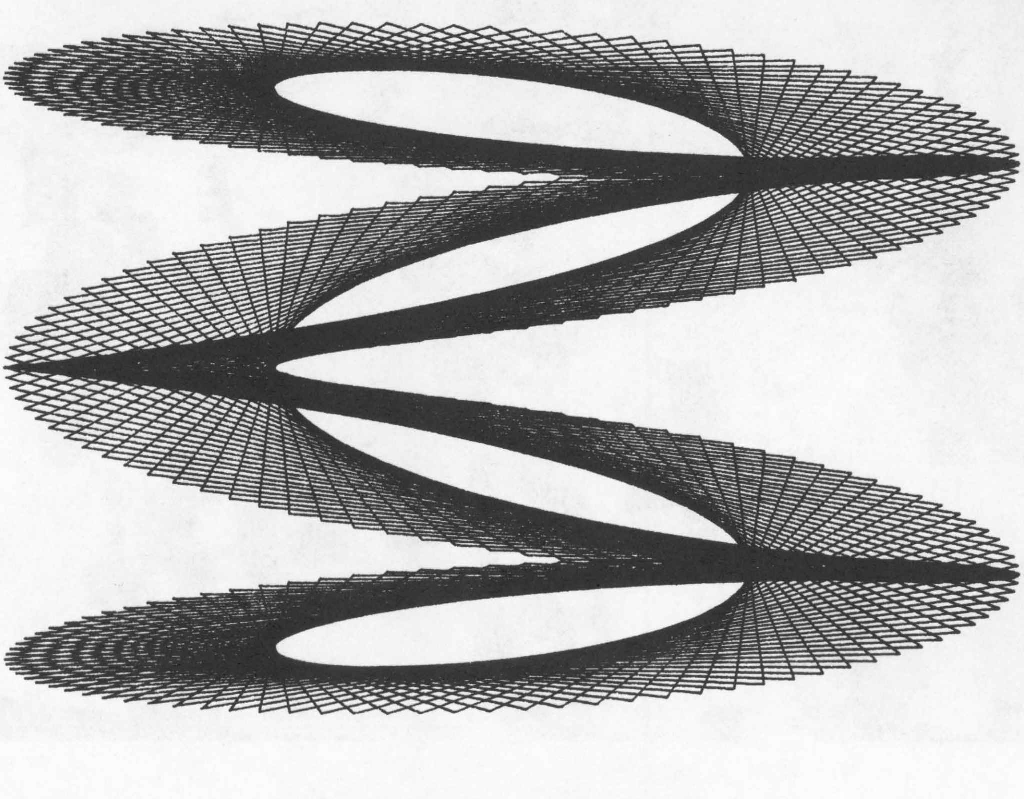
The designs shown here can readily enliven any introductory mathematics course, particularly for the nonmathematically oriented. Figures derived from mathematics were some of our first computer art — and because of its complexity, mathematics will continue to inspire many computer artists.





Above: The untitled graphic by Joseph Ovadia appears to be exhorting somebody about mathematical things. Perhaps the Methuselah-like figure is pointing out the importance of mathematics. All graphics are math functions.





INVITATION:
A TOURING EXHIBITION OF COMPUTER ART FOR THE SCIENCE AND TECHNOLOGY MUSEUMS, U.S.A.

This is an open invitation to all computer artists to send slides, photographs, and descriptions of new computer art for the above exhibition. It is tentatively titled THE VARIED COMPUTER ARTS. It will begin touring the science and technology museums of this country approximately in February of 1977.

Works *particularly* sought are dimensional, nonflat presentations. Computer art in all styles and forms will be considered. The emphasis is on variety of expression and final presentation. Please see page 7, Section VII: FINAL FORMS OF VARIED PRESENTATIONS OF COMPUTER ART for suggestions as to final forms. *No works on white industrial paper will be considered.* However, photographic reversals of white industrial graphics are acceptable, as well as transparent sheet film versions of industrial paper graphics.

Background

The exhibition, CYBERNETIC SERENDIPITY, marked the emergence of a new art form: experiments in the computer and the arts. This landmark exhibition will remain as an important "first" in the history of computer art.

However, great changes are occurring in the computer arts: varieties of final forms reveal computer design in films, editions of lithographs, etchings, serigraphs, and stamps designed by the computer. Textiles are not only being woven, but screen-printed with computer designs. Sculpture and paintings designed by the computer (and man) afford new dimensions in the computer arts. Television programs combine many forms of art: lasers, music, graphics, and dance.

Deadline for Receipt of Descriptive Materials

The deadline for receipt of slides, photographs, and descriptive material about the work is October 15, 1976. Please send these materials to:

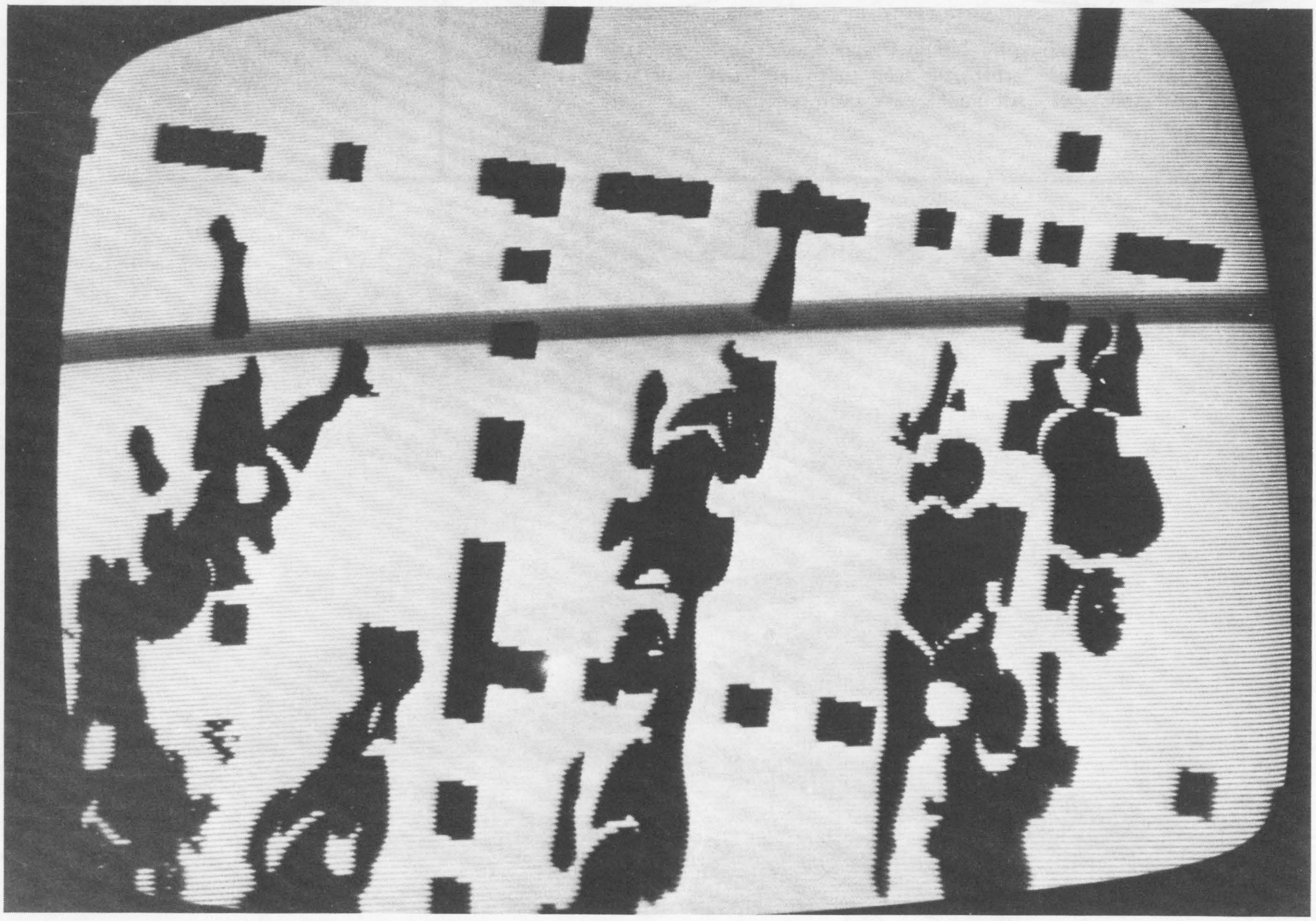
Grace C. Hertlein, Editor
COMPUTER GRAPHICS and ART
Berkeley Enterprises, Inc., Chico Branch
555 Vallombrosa, No. 35
Chico, CA 95926

Notification of selections for the new exhibition will be sent on November 1, 1976. Works accepted for the science and technology exhibition are due in Chico by December 20, 1976. More details will be available early in November.

You are warmly invited to consider this show.

ANALIVIA CORDEIRO – BRAZIL

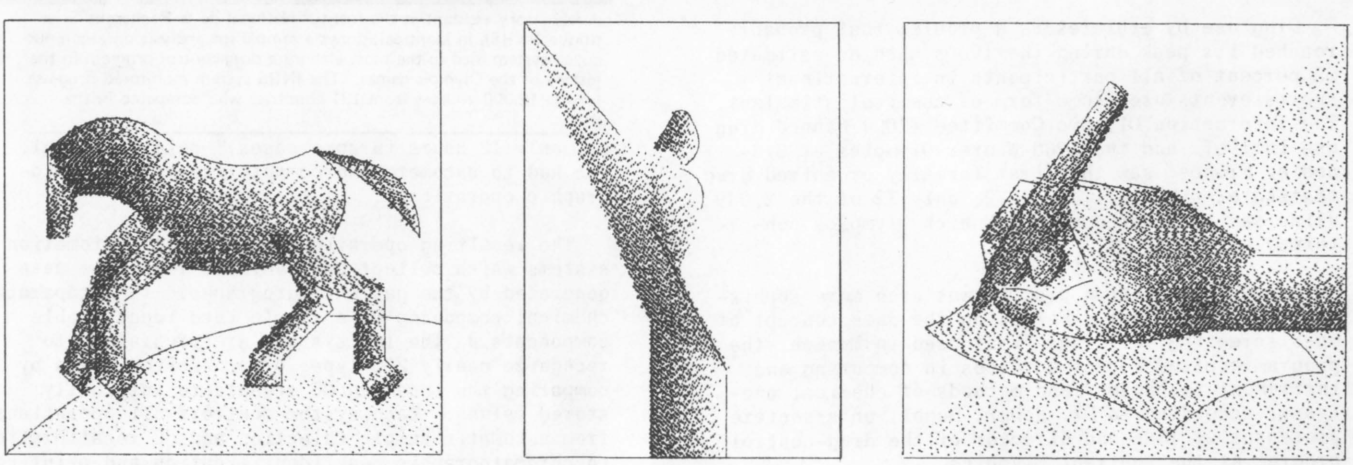
M3X3, below, by Analivia Cordeiro. "This is a computer-aided choreography for television. The dancers, cameramen, and TV director interpret a set of instructions which is the output from the computer. Processed at the Computer Center of State University of Campinas, Brazil."



Princely Potential by Jean Bevis of Georgia State University, Atlanta, the symbol for the NCC '76 Art Exhibition.

ROSTER OF ARTISTS

1. Manuel Barbadillo - Malaga, Spain
   page 27
2. Gregory R. Bass - Norfolk, Virginia, U.S.A.
   page 26
3. Jean Bevis - Atlanta, Georgia, U.S.A.
   pages 21 and 31
4. John Chudy - Chico, California, U.S.A.
   page 26
5. Analivia Cordeiro - Sao Paulo, Brazil
   page 30
6. Michael Davis - San Francisco, California, U.S.A.
   page 31
7. Barbara Dwyer - Atlanta, Georgia, U.S.A.
   pages 20 and 21
8. Herbert Franke - Munich, Germany
   page 15
9. Sharon Gospich - Chico, California, U.S.A.
   page 26
10. Groupe Couleur de Belfort - Belfort, France
    pages 19 and 23
11. Sozo Hashimoto - Tokyo, Japan
    page 25
12. Grace C. Hertlein - Chico, California, U.S.A.
    pages 16 and 17
13. Kerry Jones - Eufala, Alabama, U.S.A.
    pages 1 (front cover), 13, and 22
14. Phil Lloyd - Surrey, England
    pages 8 and 9
15. Jean-Claude Marquette - Paris, France
    page 12
16. Tony Martin - Eufala, Alabama, U.S.A.
    page 12
17. Tomislav Mikulic - Zagreb, Yugoslavia
    page 18
18. Vera Molnar - Paris, France
    page 19
19. Joseph Ovadia - San Francisco, California, U.S.A.
    pages 28 and 29
20. Duane M. Palyka - Salt Lake City, Utah, U.S.A.
    pages 10 and 11
21. Mutsuko Kunii Sasaki - Tokyo, Japan
    page 23
22. James C. Ver Hague, Jr. - Niagra Falls, New York, U.S.A.
    page 22
23. Edward Zajec - Trieste, Italy
    page 24
24. Vilko Ziljak - Zagreb, Yugoslavia
    page 14



MICHAEL DAVIS – U.S.A.

Three drawings by Michael Davis illustrate his own ARTRAN (art language system) that he developed at San Francisco State University.

From left to right: *Horse*, *Dancer*, and *Document*. His system shapes, shades, and outlines the final forms, as well as bordering the graphic.

Computing and Data Processing Newsletter

COMPUTERS SPEED DRUG DETECTION AT MONTREAL OLYMPIC GAMES

Michael S. Fournell
Hewlett-Packard
1501 Page Mill Road
Palo Alto, CA 94304

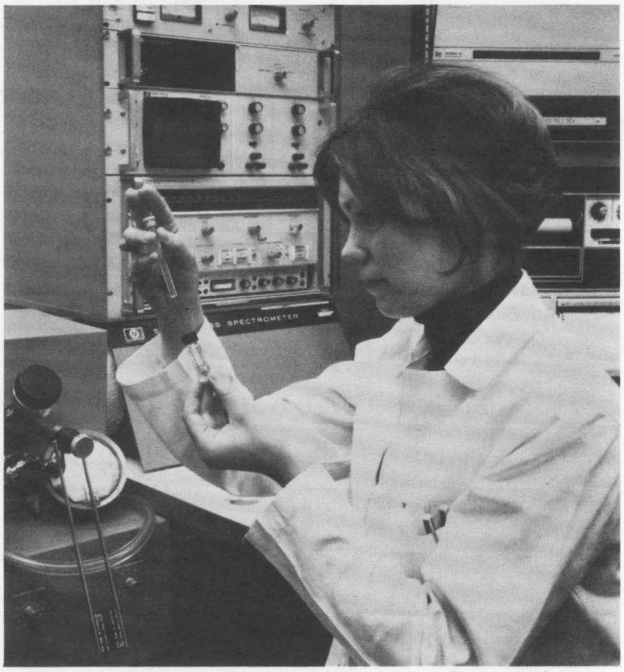
The private and public pressures exerted on today's athletes are staggering — especially during the Olympic games. To cope with these pressures and to push the human physiology to its very limits, many competitors are tempted to use drugs to gain an unfair advantage over their rivals.

To discourage this kind of drug use, during the 21st Olympiad in Montreal, the most elaborate drug-control program in the history of the Olympic games was carried out by the Biomolecular-Analysis Center of the Institut National de la Recherche Scientifique (INRS) of the University of Quebec. The Montreal laboratory used two lab automation systems to control twelve gas chromatographs (GC) and two gas chromatograph/mass spectrometers (GC/MS) with the minicomputer data systems to monitor the 12,000 athletes from 131 countries who competed in the Olympics.

Drug use by athletes is a problem that probably reached its peak during the 1960s when an estimated 35 percent of all participants in international sports events used some form of chemical stimulant. The Internation Olympic Committee (IOC) banned drug use in 1967. and the 1968 Winter Olympics at Grenoble, France, saw the first formally organized drug testing of athletes. By 1972, only 12 of the 2,049 urine samples tested at the Munich Olympics contained banned drugs.

The drug detection program was even more sophisticated in Montreal. Following the same concept of mass screening for drugs first used in Munich, the program applied recent advances in computing and instrument technology and methods of chemical analysis, according to Dr. Robert Dugal, an associate professor at INRS and director of the drug-control program at the Montreal Olympics.

Since the INRS laboratory was selected by the IOC medical commission to carry out the program, its prime concern was to develop a sensitive, completely accurate, and fast system. "In order to process about 3,000 urine samples in the brief time allotted


A laboratory assistant at the Institut National de la Recherche Scientifique (INRS), in Montreal, draws a sample for analysis on a computerized system used in the most elaborate drug-control program in the history of the Olympic games. The INRS system monitored drug-use for the 12,000 athletes from 131 countries who competed in the games.

us, only 12 hours in some cases," said Dr. Dugal, "we had to automate and computerize all chromatographic operations."

The resulting operation includes lab automation systems which collect and evaluate real-time data generated by the gas chromatographs. (GCs separate chemical compounds in a sample into identifiable components.) The lab systems are programmed to recognize nearly 200 types of prohibited drugs by comparing the incoming GC signals to internally stored values. Each system controls all operations from automatic sample injection and GC recalibration to chromatographic peak identification and printing the finished analytical report.

When a data system recognizes the presence of a banned drug, the sample is run on one of the two gas chromatograph/mass spectrometer systems for positive identification. It is estimated that about 10 percent of all samples reach this stage. This does not necessarily reflect a high rate of drug incidence, but is due to the presence of nicotine whose peak (the response of the system to the presence of a compound) may hide banned drugs.

The computerized GC/MS uses a gas chromatograph as a sample introduction and purification technique and the mass spectrometer as the principle of compound detection. A minicomputer with 16K words of memory and a disc with 5 Mbytes of data storage make up the systems' processor. It controls the scan operations of the mass spectrometer, stores spectral data on the disc, then displays and tabulates the data at operator command.

Like the two laboratory automation systems, both GC/MS systems are mirror images and have identical disc-resident data on known prohibited substances, which is compared to the acquired data for drug identification.

"The system's software capabilities of data acquisition, reduction, and statistical normalization enable rapid confirmation of drugs, which is essential to the proper functioning of the drug-control program," said Dr. Michel Bertrand, an associate professor at INRS and deputy director of the drug-control program at the Olympics.

"Actual biological samples, obtained from individuals known to have taken the drugs, were processed to give us actual qualitative and quantitative results," added Dr. Bertrand. "The research data is stored in the systems' data libraries and is used as reference in the identification of actual drug traces in samples. Acquisition of that data was an essential part of our preparation to bring our mass screening operation under computer control."

The INRS laboratory prepared for the Olympic events for over two years during which many excretion and metabolism studies on banned drugs were completed to supplement already existing drug data. Believed to be one of the largest and most modern drug-detection laboratories on the continent, the INRS facility will ensure that athletic competitions are based on natural abilities of the participants and not on unfair advantages offered by drugs. The IOC medical commission is determined not to let sports events become competitions between pharmacologists and physicians using athletes as guinea pigs.

The INRS systems included two HP 2100-based lab automation systems, twelve HP 5700 Series gas chromatographs, an HP 2100 Series minicomputer, and an HP 2644A data terminal. Half of these instrumentation systems for chemical analysis were on loan to the INRS from Hewlett-Packard especially for the Olympic games.

SCIENTISTS DEVISE COMPUTER PROGRAM TO DESCRIBE BEHAVIOR OF EXPLODING STARS

A. R. Hill
Thomas J. Watson Research Center
P.O. Box 218
Yorktown Heights, NY 10598

One of the most spectacular stellar events occurs during the first 40 days after a star explodes. Called supernovae, these giant dying stars can attain a luminosity greater than the combined brightness of all the stars in an entire galaxy. This incredibly intense light eventually evolves into a "tail" of weaker light, lasting for a year or longer.

Although there is general agreement on many aspects of the life cycle of certain kinds of stars, explanations of supernovae and their causes are still the subject of intense scientific debate. Now a group of scientists has developed a computer model describing the general behavior of stars during the first 40 days after they explode. The model, potentially of great usefulness in furthering understanding of stellar evolution, has shown an "encouraging fit" when compared with the actual observations of 38 Type 1 supernovae, originally collected and organized by a team of Italian astronomers.

A Type 1 supernova is one in which the spectrum of light emitted by the exploding star shows no evidence of hydrogen. Beyond that, it is a matter of scientific controversy whether those supernovae that do emit light characteristic of hydrogen should be considered as one type or divided into four types. At any rate, about half of all observed supernovae fall into the Type 1 category. About 10 Type 1 supernovae are seen per year.

The supernovae behavior model was devised by Gordon Lasher of IBM's Thomas J. Watson Research Center in Yorktown, New York, and elaborated by him and two scientists on post doctoral appointments at the Yorktown center: Alan Karp from the University of Maryland and Kwing Lam Chan from Princeton University. The general concept of this work was based on that of Charlotte Gordon, another visitor at the Research Center, from the University of Paris.

"The model gives us a start toward a quantitative understanding of what a star is like at the end of its life," says Lasher. "It is one more piece of the puzzle of how the universe evolves. However, the equations don't tell us precisely when a given star is going to explode."

The sequence of events in a supernova appears to be so complex that reducing the phenomena to mathematically acceptable terms for the computer would be extraordinarily difficult, if not impossible. However, analysis of the first calibrated spectra of a Type 1 supernova, obtained by workers at the Hale Observatories in 1972, indicated that a simpler mechanism might be at work; this is, that the quick rise of emitted light energy originates almost entirely from the collapse of the star's core, resulting in the formation of an explosively expanding envelope of helium gas.

By accepting the collapsed core theory, the scientists were able to base their model on only three parameters: the total amount of energy released by the collapsing core, the mass of the expanding helium envelope, and the initial density of that envelope. The result is a roughly parabolic curve that fits the first month's record of the 38 observed supernovae. After this period, there is a tailoff of light emission for which the equations do not account.

"There is still a great deal of mystery about the last stages of stellar evolution," says Lasher. "We hope our model will pave the way for further inquiries."

Eventually, Lasher and his associates hope to extend their model to describe the velocity at which the gas envelope expands. The supernovae model was developed with an IBM System/360 Model 91 computer. An IBM System/370 Model 168 computer is currently being used to do further calculations.

EUROPEAN COMPUTER CHESS CHAMPIONSHIP TO BE HELD IN AMSTERDAM

I. Bakker
European Conference on Informatics
Passeerdersgracht 32
Amsterdam - C
The Netherlands

On the occasion of the first conference of the European Conference on Informatics (E.C.I.), the European championship computer chess tournament will be held at the Studiozaal of the Vrije Universiteit in Amsterdam on August 9, 10, and 11. Every day, eight computer programs will compete for four places for the world championship of 1977, to take place in Toronto.

Both chess players and scientists have wondered during the last few years if and when a computer program will be able to equal the playing strength of a chess master. At this moment, there is no computer which can rival the capacity of an average chess club player.

The "participants" of this championship are: Beal (United Kingdom, Control Data); Master (United Kingdom, IBM); Tell (Switzerland, Hewlett-Packard); Daja (West Germany, Telefunken); Papa (Hungary, Control Data); Orwell (West Germany, Univac); Schach (West Germany, Digital Equipment); Charlie (West Germany, Siemens).

Each participant represents three components: the author who has developed the strategy and tactics of the computer chess program, the program itself (as usual indicated by a beautiful name, like Tell), written by the author in close cooperation with the programmer, and finally the computer, which processes the program. It is evident that the author should be a good chess player. The author of the program Papa, for instance, is the Hungarian top chess player, G. Rajna (Elo rating 2410).

The communications problem is solved through the installation of terminals in the tournament hall. Every terminal, one for each participant, is connected, via a direct telephone line, to a computer, which is in most cases located in the country of the participant. A move of the opponent computer is typed on the terminal, after which the computer calculates the answer and records its move on the terminal in a typed form. There is no other human intervention.

During the tournament, a team of experts will discuss both the technical and chess characteristics of the games, using large demonstration boards.

The European championship computer chess tournament is held under the auspices of the World Chess Federation, and is funded by the computer manufacturers and the Nederlandse Middenstands Bank.

NEW CONTRACTS AND NEW INSTALLATIONS

● Goodyear Aerospace Corp., Akron, Ohio, has received a $16 million order from McDonnell Douglas Corp. for two F-15 flight simulators.

● Amdahl Corp., Sunnyvale, California, has installed four of its $3.8 million to $5.2 million large-scale computer systems as follows:

— National CSS, a computer-time-sharing company in Stamford, Connecticut.

— Liberty National Insurance Co., Birmingham, Alabama, in connection with its $8.5 billion of life insurance in force.

● Recognition Equipment, Inc., Dallas, Texas, has received a $3.6 million order from a major oil company for the lease of a large-scale, credit-card-processing system.

● Saab-Univac, the Sperry Rand Corporation joint venture marketing organization in Scandinavia, has received a $3.3 million order from Oy Wartsila, a leading Finnish shipbuidling firm, for two SPERRY UNIVAC 110/11 computer systems to be connected to remote terminals in Wartsila's total communications network.

● NCR Corporation, Dayton, Ohio, has received a $2.3 million order from Takashimaya Department Stores, a leading Japanese retailing chain, for a point-of-service network.

● Ampex International, Redwood City, California, has received a $2 million contract from Datasaab, a major computer peripherals manufacturer in Stockholm, Sweden, to supply core memories.

● Recognition Equipment, Inc., Dallas, Texas, has been awarded a $2 million contract from the European-American Banking Corporation of New York, New York, for the lease of a TRACE check-processing system.

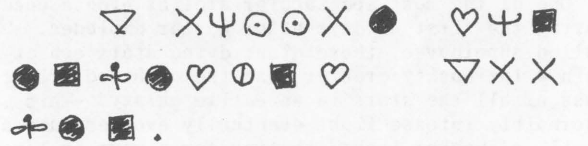
● Burroughs Corporation, Detroit, Michigan, has received a $1.4 million order from Southern Bank & Trust Company, Greenville, South Carolina, for a host computer, on-line to the bank's Item Processing System.

● Recognition Equipment, Inc., Dallas, Texas, has received a $1.4 million order from the Bank of Canada, Ottawa, Ontario, for two document-processing systems to be used in connection with the bank's administrative management of Canada's public debt.

● NCR Corporation, Dayton, Ohio, has installed two NCR Century 8200 minicomputers at Lego, the Danish manufacturer of children's construction kits, facilities in Denmark and the United States. Other 8200 systems will be installed at Lego facilities throughout Europe during the next two years as part of the company's expansion of marketing and manufacturing operations. The systems will provide information to control inventories and materials, plan production, and evaluate sales potential.

● NCR Corporation, Dayton, Ohio, has installed four Century computers at JCD Data a/s, one of Denmark's largest data processing centers, headquartered in Vejle, Denmark. These systems will act as central processors for a network of minicomputers which will be installed at various customer sites over the next 18 months.

● Control Data Corporation, Minneapolis, Minnesota, has shipped a CDC 38500 Mass Storage System to Lawrence Livermore Laboratory, Livermore, California. The system is the first of seven modules to be shipped during the next three months, and will be used by the Lawrence Livermore Laboratory in its Octopus time-shared computer network. □



GAMES AND PUZZLES for Nimble Minds – and Computers

Neil Macdonald
Assistant Editor

It is fun to use one's mind, and it is fun to use the artificial mind of a computer. We publish here a variety of puzzles and problems, related in one way or another to computer game playing and computer puzzle solving, or to the programming of a computer to understand and use free and unconstrained natural language.

We hope these puzzles will entertain and challenge the readers of *Computers and People.*

NAYMANDIJ

In this kind of puzzle an array of random or pseudorandom digits ("produced by Nature") has been subjected to a "definite systematic operation" ("chosen by Nature") and the problem ("which Man is faced with") is to figure out what was Nature's operation.

A "definite systematic operation" meets the following requirements: the operation must be performed on all the digits of a definite class which can be designated; the result displays some kind of evident, systematic, rational order and completely removes some kind of randomness; the operation must be expressible in not more than four English words. (But Man can use more words to express it and still win.)

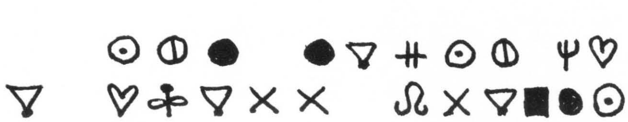
NAYMANDIJ 768

```
4 6 5 2 3 8 1 9 8 4 3 1 2 1 5 0 2 3 5 2
9 0 3 1 7 6 1 7 1 2 2 0 4 1 2 9 7 1 4 9
2 0 3 0 2 3 2 7 7 3 5 3 6 0 0 7 9 9 1 0
0 6 4 1 1 4 8 9 0 8 2 8 0 3 8 9 8 4 8 8
8 4 7 9 6 0 6 2 5 5 9 3 6 9 2 2 9 4 3 9
9 9 1 7 3 4 9 0 5 5 3 9 2 5 7 7 4 3 4 8
6 3 7 6 9 8 9 9 9 9 5 9 5 1 7 7 1 3 3 6
7 2 8 7 0 9 8 9 3 2 3 6 3 5 5 2 0 2 7 7
0 5 9 2 4 9 1 2 3 4 5 7 8 7 7 3 5 1 4 6
6 4 9 9 9 1 8 8 3 7 1 1 8 8 3 8 0 6 9 1
```

MAXIMDIJ

In this kind of puzzle, a maxim (common saying, proverb, some good advice, etc.) using 14 or fewer different letters is enciphered (using a simple substitution cipher) into the 10 decimal digits or equivalent signs for them. To compress any extra letters into the 10 digits, the encipherer may use puns, minor misspellings, equivalents like CS or KS for X or vice versa, etc. But the spaces between words are kept.

MAXIMDIJ 768



NUMBLES

A "numble" is an arithmetical problem in which: digits have been replaced by capital letters; and there are two messages, one which can be read right away and a second one in the digit cipher. The problem is to solve for the digits. Each capital letter in the arithmetical problem stands for just one digit 0 to 9. A digit may be represented by more than one letter. The second message, which is expressed in numerical digits, is to be translated (using the same key) into letters so that it may be read; but the spelling uses puns, or deliberate (but evident) misspellings, or is otherwise irregular, to discourage cryptanalytic methods of deciphering.

NUMBLE 768

```
                          E V E R Y
Y = I               x       S H O E
                    ---------------
F = V                   I O E M H R
                      C Y R O R T
C = S               P E S N S O
                  F P M O Y V
N = T             -----------------
             =    I T N H T M E M R

         53149   64770   62661
```

We invite our readers to send us solutions. Usually the (or "a") solution is published in the next issue.

SOLUTIONS

NAYMANDIJ 767: Make V of 1's.

MAXIMDIJ 767: Not to see is often wise.

NUMBLE 767: People are complicated.

Our thanks to the following individuals for sending us their solutions: Ronald C. Graves, Ashland, MA: Naymandij 765, Maximdij 765, Numble 765 – Steven S. Shulman, Edison, NJ: Naymandij 765, Maximdij 765, Numble 765, Maximdij 766, Numble 766 – Byung Sun Choung, San Diego, CA: Numble 766 – Diane Huard, Des Plaines, IL: Naymandij 766, Maximdij 766, Numble 766.

COMPUTER GRAPHICS AND ART

FIRST TWO ISSUES NOW PUBLISHED

Partial Table of Contents — Vol. 1, Nos. 1 and 2

COMPUTER GRAPHICS and ART is a new international quarterly of interdisciplinary graphics for graphics people and computer artists. This new periodical is aimed at students, teachers, people from undergraduate and graduate institutions, researchers, and individuals working professionally in graphics. Its topical coverage is broad, embracing a variety of fields. It is useful, informative, entertaining, and current. Our goal is excellence, and to achieve this objective, we invite our readers to participate actively in the magazine, and to advance the state of the art of computer graphics by communication, sharing, and dissemination of ideas.

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( ) Additional Comments (attach another paper if needed):____________________