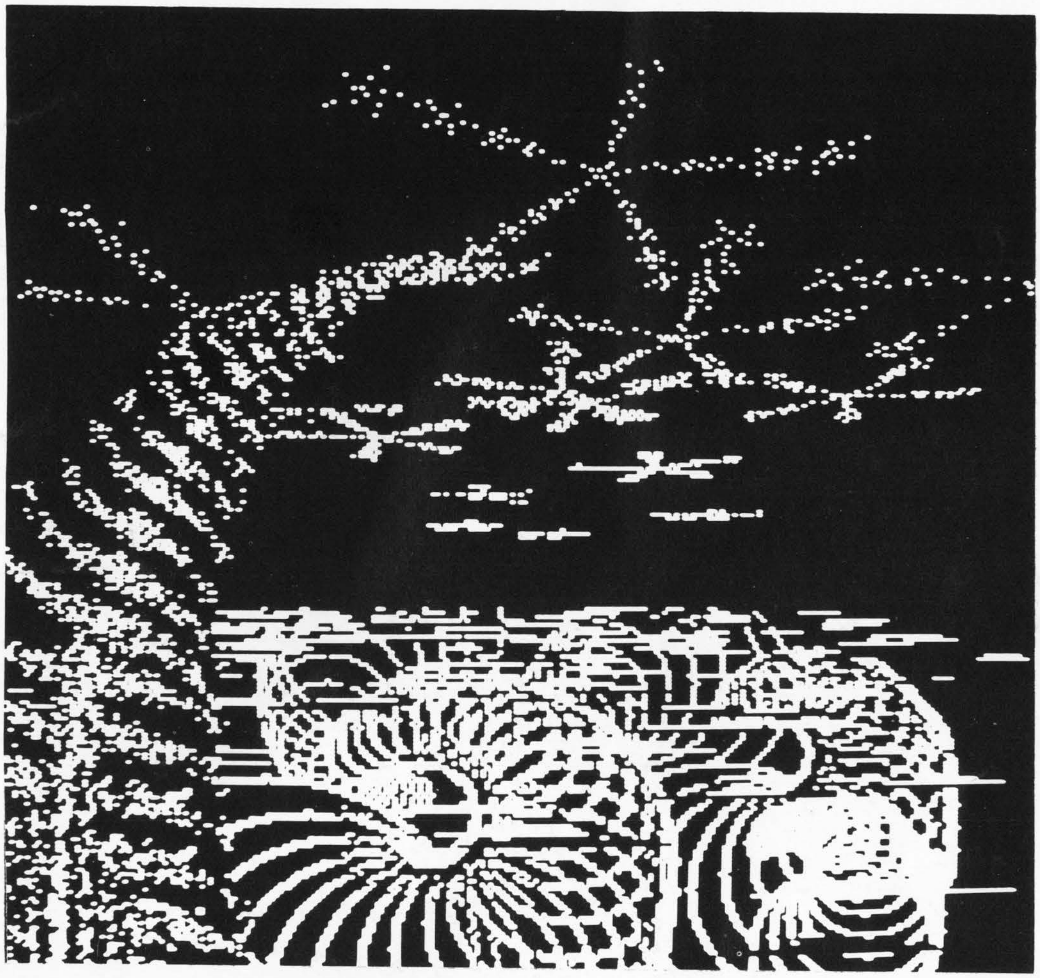
computers and people

Sept.—Oct., 1980
Vol. 29, Nos. 9-10
formerly *Computers and Automation*



OUR NEW WORLD – I *by Peter Stampfli*

The Computer Almanac and Computer Book of Lists — Instalment 15

Neil Macdonald
Assistant Editor

21 THREE-DAY SEMINARS IN COMPUTERS AND DATA PROCESSING OFFERED BY DATAPRO (List 800901)

Data Communications / an introduction to concepts and systems
Data Communications / advanced concepts and systems
Data Communications / effective network design
Teleprocessing Software / introduction
Distributed Systems / effective approaches and applications
Systems Analysis and Design / concepts and effective practice
EDP Project Management / a practical approach
Data Base Management Systems / concepts and planning guidelines
Data Base Management Systems / a comparative analysis
Minicomputer Systems / guidelines for successful selection
Advanced EDP Management / methods and techniques
Data Processing / introduction to concepts and systems
EDP Operations Today / effective scheduling and console operation
Effective Computer Operations Management
Computer Performance Measurement / tools and techniques
Word Processing / introduction, concepts, systems, applications
Word Processing / effective operations management
Integration of Word Processing and EDP Systems
Automating Your Office Today / planning and implementation methods
Electronic Mail / overview of concepts, systems, applications
Micro/Personal Computers / application, selection, and usage guidelines

(Source: Joe Menendez, Manager of Educational Programs, Datapro - a McGraw Hill Co., 1805 Underwood Blvd, Delran, NJ 08075, (609) 764-0100)

8 SESSIONS OF SEMINAR ON VERY LARGE SCALE INTEGRATED CIRCUIT (VLSI) DESIGN, FABRICATION, AND APPLICATIONS (List 800902)

1. Device Fundamentals and Scaling Laws / Dr. John L. Prince, Director of Reliability Assurance, Intermedics
   - fundamentals of VLSI device improvements
   - problem areas for VLSICs
   - MOS scaling anomalies
2. VLSI Device and Circuit Projections / Dr. John L. Prince
   - dry processing, device interactions
   - VLSI MOS technologies and complexity-performance projections
   - VLSI bipolar technologies and complexity-performance projections
   - summary of trends
3. Advanced Lithographic Techniques / Dr. Kent Watts, Bell Laboratories
   - optical lithography
   - electron lithography
   - X-ray lithography
   - ion lithography
   - conclusions
4. Advanced Computer-Aided Design / Mr. Paul Losleben, Chief, Semiconductor Technology and ..., National Security Agency
   - what is computer aided design?
   - history
   - state of the art
   - perspective
   - management of complexity
   - structured design
   - functional design tools
   - physical design tools
   - design management
5. VLSI Architectures / Dr. Earl E. Schwartzlander, Jr., TRW Defense and Space Systems Group
   - VLSI technology basis
   - VLSI device architecture
   - VLSI system architecture
   - VLSI architecture case study
   - conclusions
6. Gallium Arsenide LSI and VLSI / Dr. Richard C. Eden, Rockwell International Science Center
   - performance advantages expected for GaAs ICs
   - circuit approaches for digital logic ICs
   - fabrication technology
   - performance results
   - summary, conclusions, projections
7. VLSI Applications and Testing / Dr. Barry H. Whalen, TRW Defense and Space Systems Group
   - VLSI applications
   - VLSI testing
   - conclusions
8. VLSI Work in Other Countries / Mr. Robert I. Scace, National Bureau of Standards
   - past major semiconductor programs
   - present national semiconductor programs
   - future prospects

(Source: Palisades Inst. for Research Services, 201 Varick St., 9th Fl.,New York, NY 10014;

course announcement, Boston, Oct. 20-23, 1980, San Francisco, Jan. 12-15, 1981; registration by mail or phone (212) 620 3377)

18 PRESIDENTS OF THE ACM (ASSOCIATION FOR COMPUTING MACHINERY (List 800903)

Year Starting	Name
1947	John H. Curtiss
1948	John W. Mauchly (Deceased)
1950	Franz L. Alt
1952	Samuel B. Williams (Deceased)
1954	Alston S. Householder
1956	John W. Carr III
1958	Robert W. Hamming
1960	Harry D. Huskey
1962	Alan J. Perlis
1964	George E. Forsythe (Deceased)
1966	Anthony G. Oettinger
1968	Bernard A. Galler
1970	Walter M. Carlson
1972	Anthony Ralston
1974	Jean E. Sammet
1976	Herbert H. R. Grosch
1978	Daniel D. McCracken
1980	Peter J. Denning

(Source: information from the ACM, 1133 Ave. of the Americas, New York, NY, 10036, (212) 265 6300)

4 OF THE MOST DESTRUCTIVE USES OF COMPUTERS (List 800904)

The built-in targeting of cities on the earth in missiles with nuclear warheads, which if used by anyone will produce millions of deaths, regional firestorms, vast lethal radiation, ...

The registering of all persons in a nation for purposes of controlling their political attitudes and behavior

The operation of "electronic money" without methods for almost complete prevention of computer theft

The disemployment of clerical labor without reeducation and retraining of clerks to perform new useful work

(Source: Neil MacDonald's notes)

4 OF THE MOST CONSTRUCTIVE USES OF COMPUTERS (List 800905)

Finding answers to human problems by computation that could never previously be answered in any way

Performing calculations in space navigation, engine design, statistical reasoning, ... , that could never previously be performed

Enabling routine office work, routine completion of phone calls, routine check clearing, ... in enormous quantities to be performed by machine and not human labor

Enabling productive operations in manufacturing, machining, raw material extraction, ... , to be controlled far beyond the power of human control

(Source: Neil Macdonald's Notes)

13 LAWS OF GENERAL SCIENCE (List 800906)

A cumulative impact never equals the sum of its impacts.
- Newell's Second Truism

Positive expectations yield negative results. Negative expectations yield negative results. Zero expectations sometimes yield positive results.
- Bernstein's Law of Expectations and Results, modified by Berkeley

Every practice or procedure is actually irrational; it is only a matter of time until it is seen to be so.
- Novotney's Corollary

The sooner you fall behind, the more time you have to catch up.
- Ogden's Law

When it is necessary to choose between ignorance and stupidity, choose ignorance. It is curable.
- Moos's Law

It is far better to play Hamlet in Denver than to play Laertes in New York.
- O'Toole's Rule

If a museum owns one cuneiform tablet, the likelihood is very high that it will be displayed upside down.
- Paper's Law

Historical fancy is more persistent than historical fact.
- Parson Weems' Law

Many are cold, but few are frozen.
- Peary's Observation

When the math starts to get messy - quit!
- Penner's Principle

I am lost but I am making record time.
- Pilot's Report

When anything is used to its full potential, it will break.
- Poulsen's Law

Technology is dominated by two types of people: those who understand what they do not manage; and those who manage what they do not understand.
- Putt's Law

(Source: "The Official Explanations" by Paul Dickson, Delacorte Press, One Dag Hammarskold Plaza, New York, NY, 10017, 1980, 270 pp) □

Vol. 29, Nos. 9-10
Sept.-Oct., 1980

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"Computers and People" (ISSN 0361-1442), formerly "Computers and Automation," is published every two months at 815 Washington St., Newtonville, MA 02160, by Berkeley Enterprises, Inc. Printed in U.S.A. Second Class Postage paid at Boston, MA and additional mailing points.

Subscription rates: United States, $14.50 for one year, $28.00 for two years. Elsewhere, add $6.00 per year.

NOTE: The above rates do not include our publication, "The Computer Directory and Buyers' Guide." To receive this, please add $15.00 per year to your subscription rate in the U.S., and $18.00 elsewhere.

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Please address mail to: Berkeley Enterprises, Inc., 815 Washington St., Newtonville, MA 02160.

Postmaster: Please send all forms 3579 to Berkeley Enterprises, Inc., 815 Washington St., Newtonville, MA 02160.

Change of address: If your address changes, please send us both your new address and your old address (as it appears on the magazine address imprint), and allow three weeks for the change to be made.

computers and people

formerly *Computers and Automation*

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.

Front Cover Picture

The front cover shows a scene "Our New World – I", the first one of a series of five scope photographs of computer art by Peter Stampfli. See more on page 8.

Key

[A]	–	Article
[C]	–	Monthly Column
[E]	–	Editorial
[EN]	–	Editorial Note
[F]	–	Forum
[FC]	–	Front Cover
[N]	–	Newsletter
[R]	–	Reference

Notice

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Editorial

Computer Art – New Directions?

Edmund C. Berkeley
Editor

As a result of discussion over a couple of years, we have decided to publish in this issue a selection of computer art that is different from prior years. This selection has had for its choices for content the following selection criteria:

1. Each submitted drawing should be interesting and artistic.

Of course, what is "interesting"? what is "artistic"? All we can say is that each drawing published here has seemed to us to be interesting and artistic.

2. Each drawing should show at least three kinds of forms. The forms could be crystals, leaves, and icicles. Or they could be trees, animals, and the sun. Or they could be pine needles, hoofprints, and pebbles.

Each of the drawings published here appears to us to have at least three kinds of forms.

3. The forms should appear in various sizes, perspectives, and orientations.

At least some perspective appears in each of the computer drawings here published; and each form appears in at least one other orientation, and one other size.

4. If a first form is in front of a second form, then the first form should appropriately conceal parts of the second form as in ordinary drawing.

Of course, if no form is in front of another form, then there is no concealment and this requirement is very easy to meet.

One of the philosophies of computer art is that whatever any person programming a computer produces calling it "computer art" is computer art. This view may be appropriate for the first decade of development of a new artistic form, such as a newly invented musical instrument, or a new style of poetry. But art evolves from decade to decade.

Abstract art, art that does not represent anything in particular, evokes chiefly mathematical ideas, wallpaper ideas, fabric design ideas, etc. Nonabstract art (which includes but is not restricted to representational art) can provide rather more:

- an impression of solidity in depicting three dimensions;
- the showing of familiar objects or themes to evoke moods;
- the representation of time, history, fate, drama, etc., to invite human interpretation and human emotions
- the expression of conundrums and humor, as in the art of Escher, Tenniel, ...
- the depiction of science fiction worlds and worlds that exist only on computer displays, such as Space War

This list is far from exhaustive.

After 18 years of publishing computer art (1962 to 1980), I think it may be time for computer artists to bring at least some of their art into a more powerful, emotional, broader appeal to human beings. After all it is human beings and not computers who wish to be stirred by computer art, and who pay for the machines by the income that humans earn.

Recently I was seeking to decide on what basis one poem may be compared to, better than, or preferred to another poem. Take for example:

- Full many a gem of purest ray serene
  The dark unfathomed caves of ocean bear.
  Full many a flower is born to blush unseen
  And waste its sweetness on the desert air.

- The fog comes
  On little cat feet;
  It sits on silent haunches,
  Looking over city and harbor,
  And then moves on.

So I made a list of nine propositions. Here are three of them:

- A poem with a deeply significant message is better than a poem with a relatively insignificant message (ceteris paribus, i.e., other things being equal)
- A poem with musical qualities, such as rhyme, rhythm, beat, alliteration, assonance, measure, is better than one without (c.p.)
- A poem with clarity, the property of being readily understandable, is better than one without (c.p.)

It seems to me that much the same thing is true of computer art or music or any kind of art, and that to deliberately choose always flat abstract design when three-dimensional nonabstract design could also be chosen is not necessarily a good direction for art to develop well. □

Forum

THE COURSE IN COMPUTER LITERACY AT VASSAR COLLEGE, POUGHKEEPSIE, NEW YORK

1. From Martin Ringle, Ph.D.
Asst. Prof. of Computer Science
Vassar College
Poughkeepsie, NY 12601

There has been a great deal of discussion and argument in the past few years about bringing "computer literacy" to the college curriculum. Time and again one hears about the efforts which are being made to acquaint all students (not just mathematics and science majors) with the uses and implications of computers. Yet virtually all the magazines and journals devoted to computers are written for the afficianado or the experienced user.

There is only one magazine which is designed for the intelligent layman, which contains valuable information about facets of computerization and which is nontechnical: "Computers and People".

In recognition of the unique service which this magazine performs, I have entitled the core course in computer literacy at Vassar "Computers and People", and I have used the magazine as a key source in reading assignments.

I hope that "Computers and People" will continue its role as a forum for the discussion of the impact of computers, and that its value towards achieving the goal of "computer literacy" will be widely recognized.

2. From the Editor

We appreciate very much the evaluation by Prof. Ringle, of the aims and the accomplishments of our magazine. Since we began in 1951, twenty nine years ago, our policy has been to publish what is factual, useful, and understandable about computers. Computers and computer science have changed from a small subject to an enormous subject, during this time. But I think it is true that even enormous subjects have certain parts and areas which are far, far more important than other areas. And we have tried over and over again to leave to other scientists, technicians, and writers important, intricate, difficult, advanced subjects, and to provide at least some discussion of important, simple, profound subjects, such as:

- Do machines think? and if so how?
- What can they think about? and if so how?
- How can computer scientists guarantee automatic prevention of errors in computer applications?
- Are computers a blessing or a curse?
- How do we make them a blessing? and stop them from being a curse?
- What are the dozen (or 30, or 60) most important ideas in the computer field?

and many more.

THE CRITERIA OF THE COMPUTER ART EXPOSITION OF "COMPUTERS AND PEOPLE" IN 1980 – SOME PERSONAL REACTIONS

Assoc. Prof. Grace C. Hertlein
Art Editor, "Computers and People"
Computer Science Dept.
Calif. State Univ. – Chico
Chico, CA 95926

First I should like to comment on Edmund C. Berkeley's criteria for the selection of computer art being chosen for the 1980 Annual Computer Art Exposition in "Computers and People."

As the editor and publisher of "Computers and People" (formerly "Computers and Automation"), the oldest magazine in the computer field, he has published more computer art than any other magazine. He has been an invaluable supporter of this new art medium. He has seen a great deal of computer art since 1962, when he began publishing this art medium. He is eager to see it fulfill a vast potential.

When I first read the selection criteria for computer art for the 1980 Annual Computer Art Exposition of "Computers and People", I found the requirements stiff and objectionable. My first reaction was "No one should set down requirements for artists." But on second thought I decided to try to execute some works showing perspective. As for three kinds of forms, much of my work already meets that criterion. After experimenting with perspective for a few days, I found that criterion easy to meet, pleasurable in fact, interesting. The specific requirements turned into parameters in my computer programming. I could view them logically and creatively.

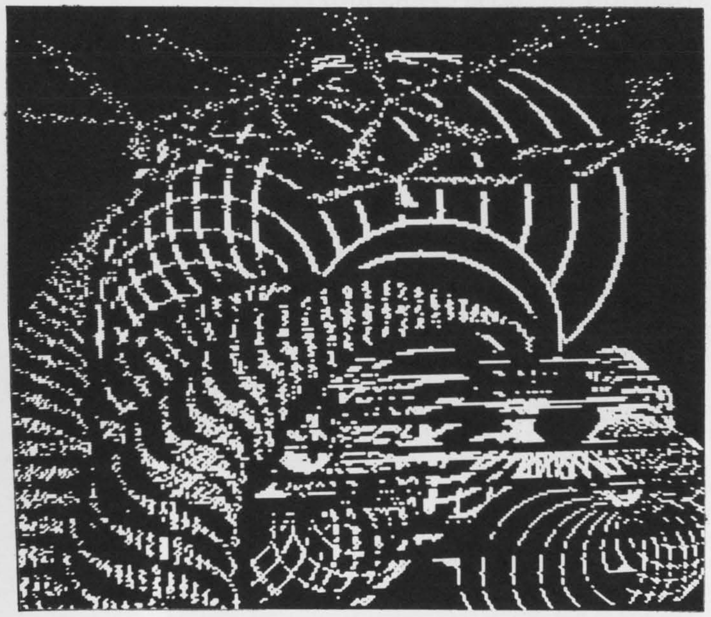
It seems to me that we disagree respectfully but not discordantly on some aspects of computer art. Certainly, the criteria for selection of computer art in the 1980 exposition of "Computers and People" are not to be taken as criteria for selection in 1981 or in other future years. This is a selection choice for this year's exposition, and may or may not be the choice for a future year. This is plain from the discussions we have had.

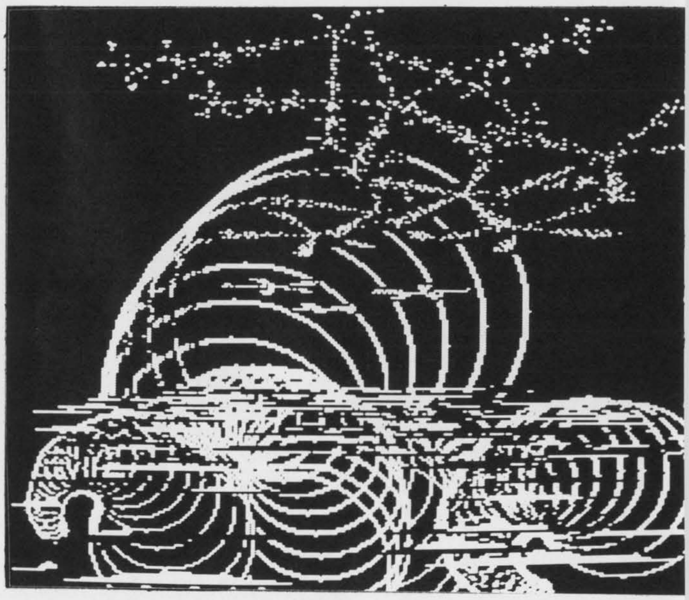
It seems to me also that a person is to be classified as a computer artist when that person consistently produces high quality computer art or shows promise of producing this quality of computer art consistently. Evidence of the quality of computer art produced by an artist is shown in publication of his or her art in important books and magazines and displaying of his or her art in important international exhibitions.

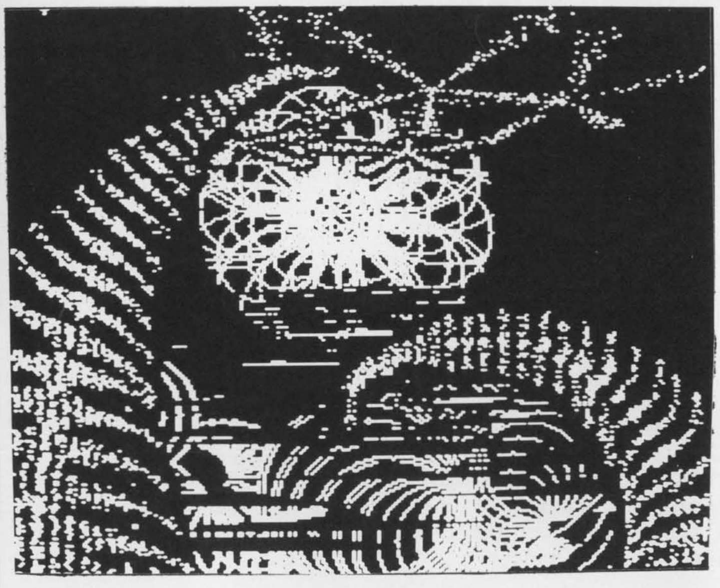
(please turn to page 13)

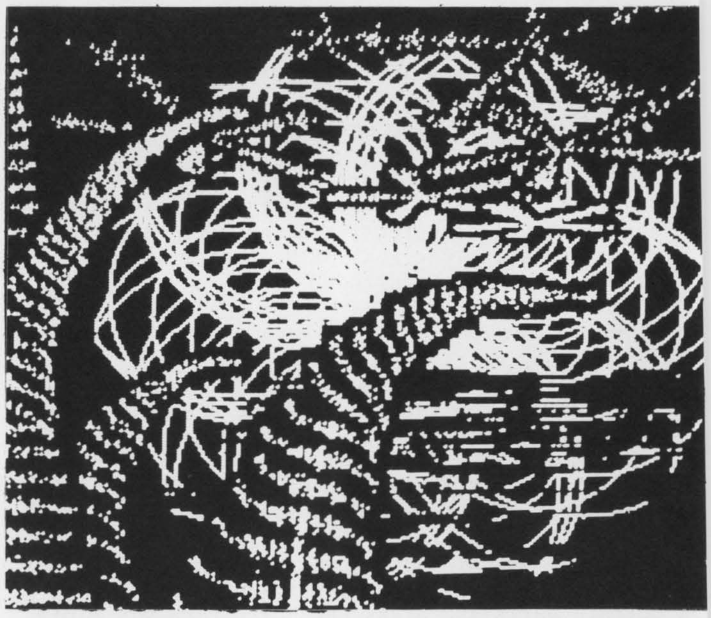
The 1980 Annual Computer Art Exposition of "Computers and People"

lmund C. Berkeley, Editor







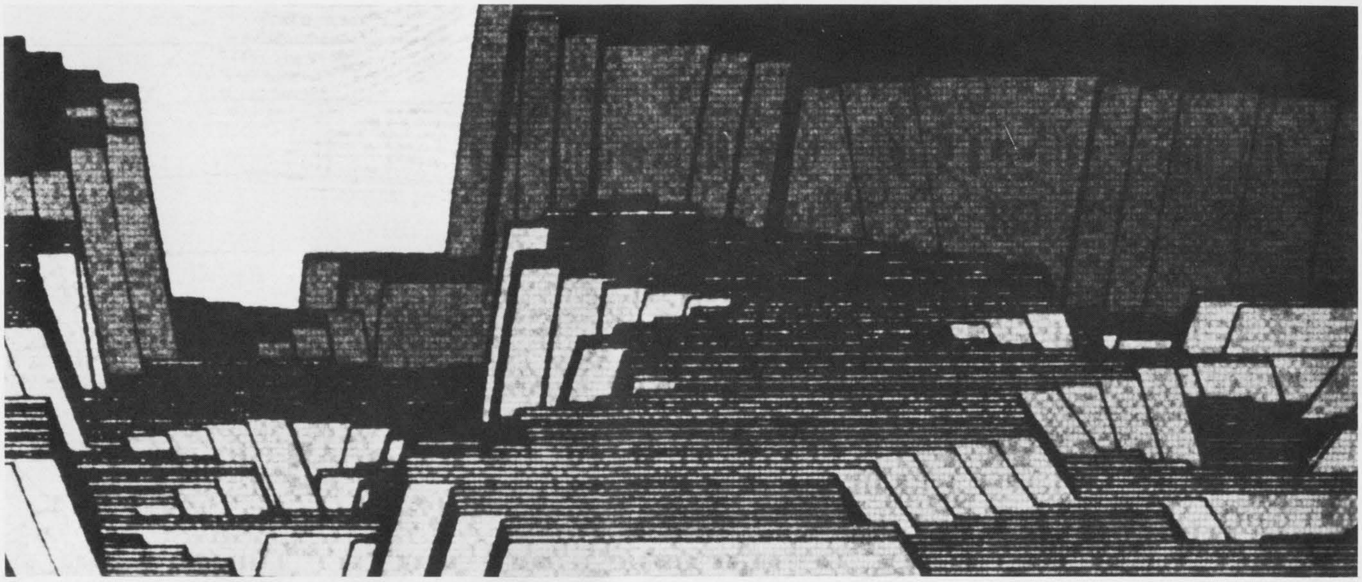


ur New World II to V

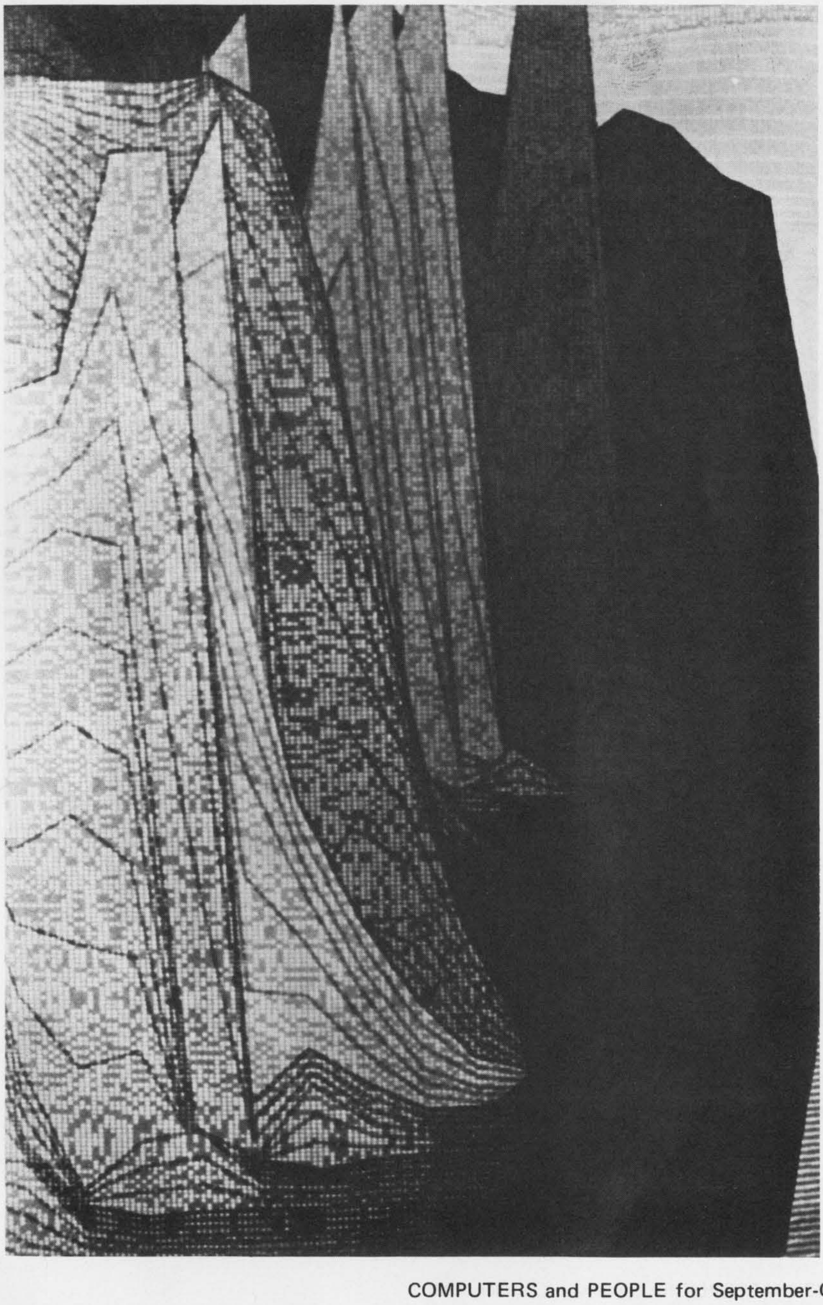
eter Stampfli
llmendstr 37
H 2544 Bettlach
witzerland

ur New World I appears on the ont cover of this issue.

"I'm using an 8080-Microcomputer with a Matrox-graphics-interface (Resolution: 256 x 256 points) and programming it in Palo-Alto-Tiny-Basic. Subroutines are drawing the different elements like trees, the sun, water waves, using simple recursion and iteration techniques. It is possible to select some elements and appropriate parameter values directly or by writing small programs (for example, combining waves into the sea). I'm awfully limited due to the coarse resolution of my graphics, my slow slow processor, and an inadequate programming languag



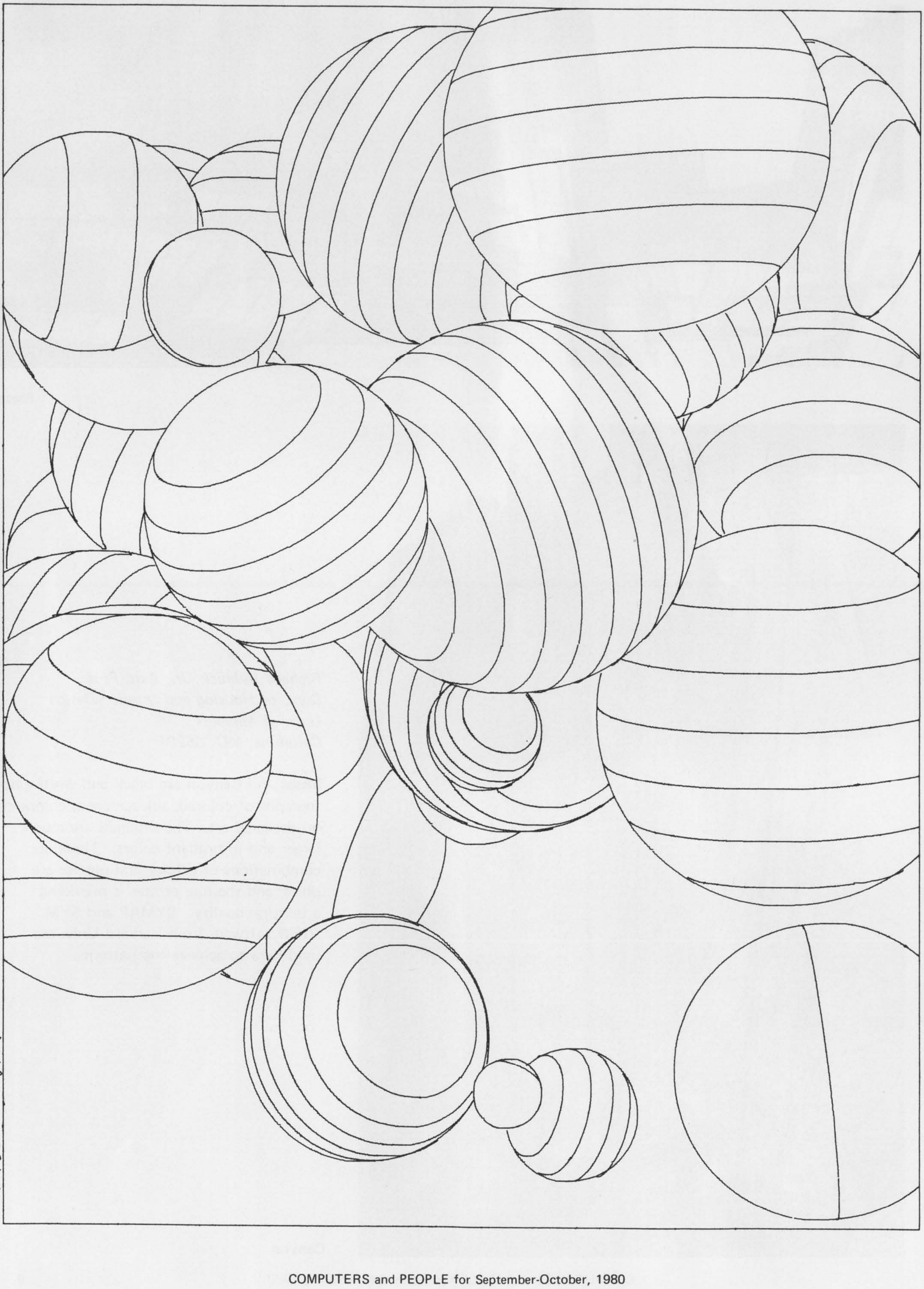
Mesas



Canyon

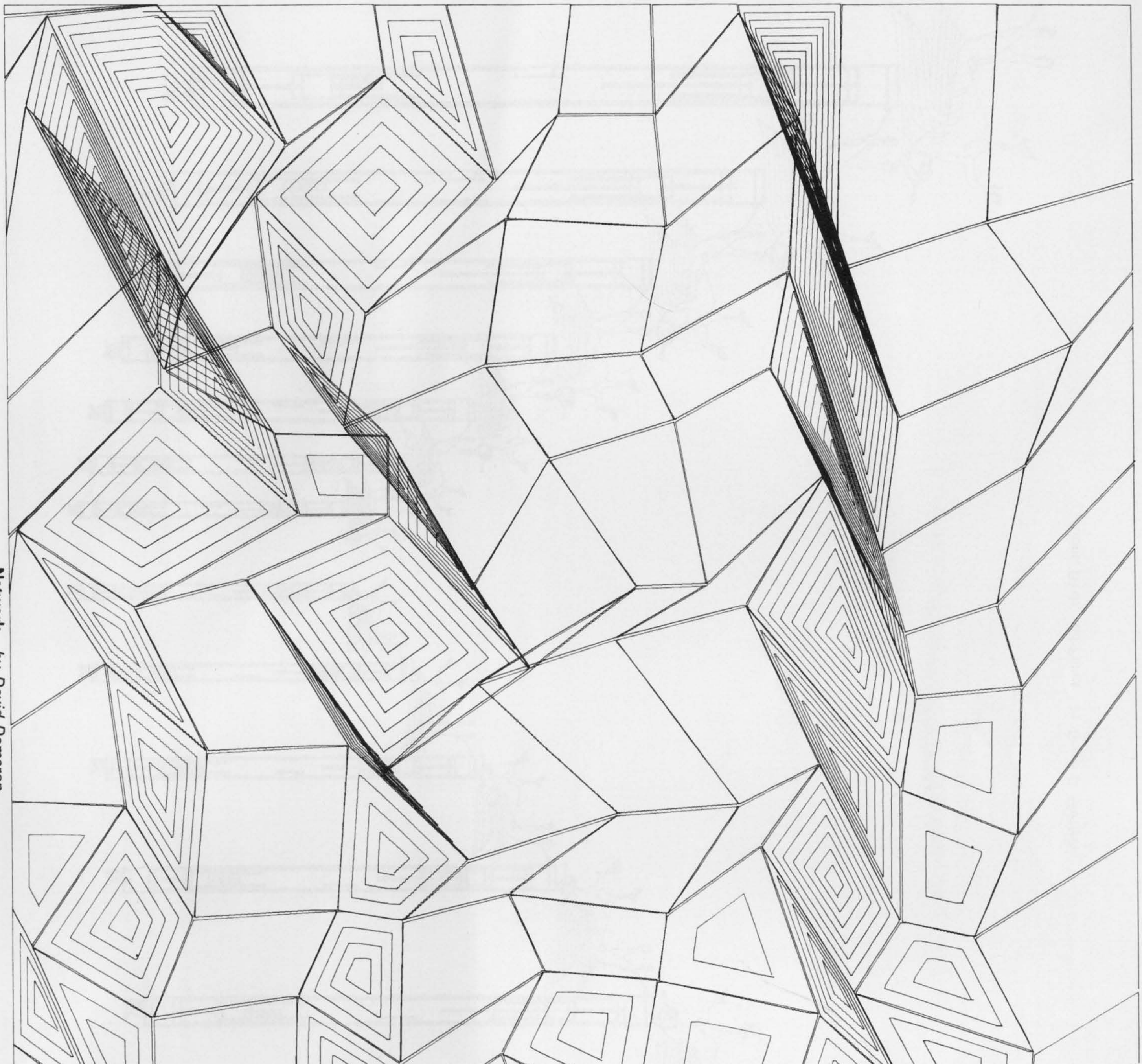
Richard Helmick, Jr., Asst. Prof.,
Dept. of Housing and Interior Design
Univ. of Missouri
Columbia, MO 65201

Mesas and **Canyon** are black and white photographs of colored, silk-screened, computer-designed art. The originals are much larger and in brilliant colors. These are combinations of printer and plotter graphics, and the line printer is providing a textural quality. SYMAP and SYMVIEW software from Harvard Univ. are used here to achieve the patterns.



Spheres *by David Dameron*

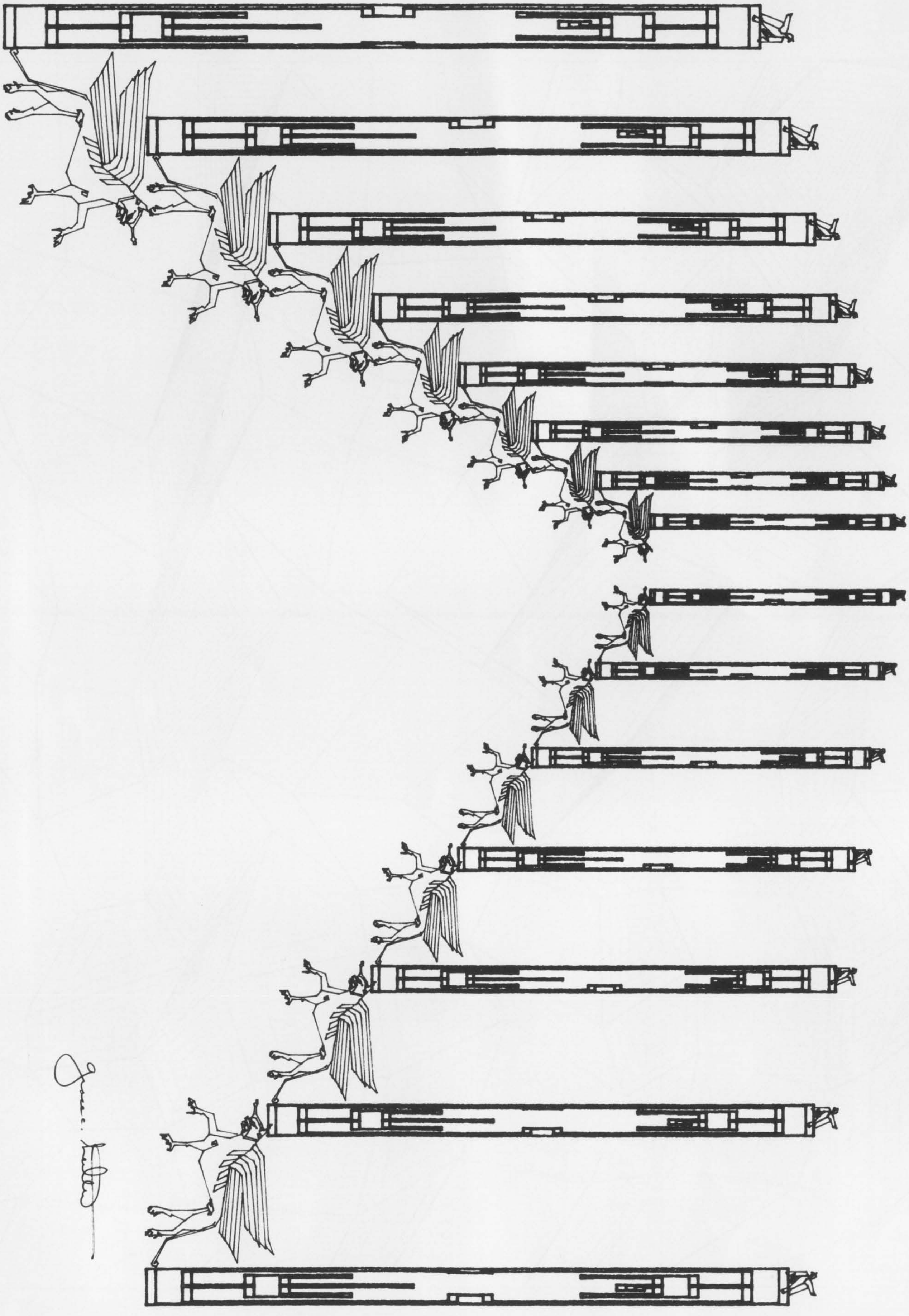
David Dameron 18 July 80

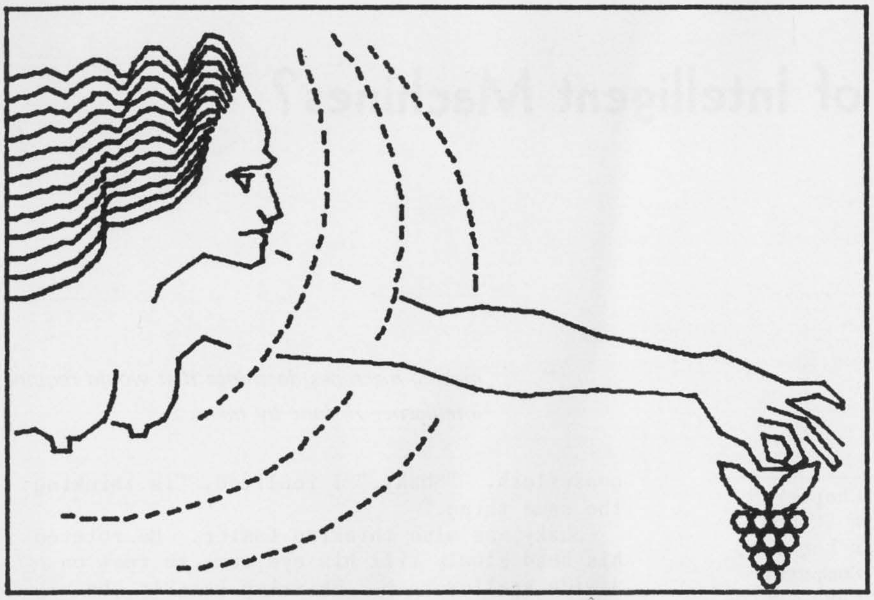


Network *by David Dameron*

David Dameron 11 June 80

Lions, Birds, and Pillars *by Grace C. Hertlein*





A Nike Reaching for a Grape

Bill Kolomyjec
Kolomputer Design
560 Pacific Pkwy.
Lansing, MI 48910

This was executed on an Apple II Personal computer driving a Houston Instrument X-Y Digital Plotter. I am experimenting with the capabilities of these small microprocessor graphic systems. The Nike was digitized by hand from a drawing originally done on graph paper. Linear interpolation was used to generate the hair from the top and bottom curves which themselves were generated by algorithms. The bunch of grapes and "aura" were produced by a subroutine for drawing arcs, with an option for dashed lines.

Spheres and Network

David Dameron
3080 Emerson Ave.
Palo Alto, CA 94306

"My computer is a Z-80 system with 48K RAM and one 5 and 1/4 inch disk drive used to store programs. Using Cromemco's BASIC and disk operating system, about 20K bytes of memory are left for programs and data. Program routines can be altered in the middle of execution to produce particular variations on the graphic output. My plotter is a modified Sylvanhills DFT-2 run from a parallel port ... Each sphere has circles at constant Z drawn on it, and is then rotated about the X and Y axes before it is drawn. Before each sphere is drawn, it is checked with all previous spheres to determine any segments which are hidden and thus should be eliminated."

Lions, Birds, and Pillars

Assoc. Prof. Grace C. Hertlein
Computer Science Dept.
Calif. State Univ. – Chico
Chico, CA 95926

The system used to create this computer art is interactive: entry of data making use of a keyboard, proofreading on a raster Hewlett-Packard display terminal, and output on an HP flatbed plotter. Files are stored on disk directly on an HP 3000 system. Modifications are made by editing text. Subroutines are also filed and stored on the HP 3000. Programming is in FORTRAN IV.

This is an example of "The Celtic Series", a group of graphics begun this summer. Patterns of forms are derived from 9th century Celtic art as illustrated in Irish history and archeology.

Hertlein – *Continued from page 7*

Some brilliant people were involved in computer art in the 1960's. Jasia Reichardt's exhibition "Cybernetic Serendipity" revealed a rich promise for computer art as a medium of art.

I concur with the editor of "Computers and People" that many forms of computer art are essentially repetitions of computer art 15 and 20 years ago. Some that was then new and exciting is now stale, dull, unappealing. Yet with new hardware, new software, and new themes, it should be possible to produce novel, exciting, and even permanently valuable works in computer art, in the 1980's.

I have done work as an editor and curator of many computer art exhibitions, and so I have seen works of computer art from all over the world. Many of them are superior. Some of them are mediocre. Some of them are trivial.

In the capacity of an editor, I would never set specific requirements for computer artists. All artists I believe should have complete freedom to explore and create in highly individual styles, abstract or nonabstract, representational or nonrepresentational.

But "Computers and People" may have performed a good service to computer art by setting some new criteria for the 1980 art exposition, a new focus on what has not yet been attained.

Computer artists should be thoroughly familiar with what has often been done previously. Computer artists should assess the communication power of their works: they should ask themselves "Am I creating for myself? or am I communicating to others? or both?" In the past computer artists may even have had too much of a tendency towards treating themselves as high priests in computer art. □

The Era of Intelligent Machines?

Thomas Logsdon
c/o Computer Science Press, Inc.
9125 Fall River Lane
Potomac, MD 20854

". . . making machines do things that would require intelligence if done by men . . ."

Note: This article is excerpted from Chapter 9, "The Era of Intelligent Machines?", in "Computers and Social Controversy" by Thomas Logsdon, copyright © 1980 by and published by Computer Science Press, Inc., 9125 Fall River Lane, Potomac, MD, 20854, and reprinted with permission. The book is available from the publisher. Price, $17.95.

Editorial Note: This book is one of the most interesting, informative, lively, and fascinating discussions of computers and society that I have come across in a long time. The whole book in my opinion is well worth reading. - Edmund C. Berkeley, Editor, "Computers and People."

For a decade or more America's popular periodicals have carried a series of stories documenting the exploits of technology's cleverest, most intelligent, digital computers. In November of 1970, for example, "Life" magazine featured these rousing paragraphs explaining how a curious, goal-directed robot named "Shaky" spends his time creeping through the empty halls at the Stanford Research Institute like some impulsive mechanical lapdog exploring his own private world:

It looked at first glance like a Good Humor wagon sadly in need of a spring paint job. But instead of a tinkly little bell on top if its box-shaped body there was this big metallic whangdoodle that came rearing up, full of lenses and cables, like a junk-sculpture gargoyle.

"Meet Shaky," said the young scientist who was showing me through the Stanford Research Institute. "The first electronic person."

I looked for a twinkle in the scientist's eye. There wasn't any. Sober as an equation, he sat down at an input terminal and typed out a terse instruction which was fed into Shaky's "brain", a computer set up in a nearby room: PUSH THE BLOCK OFF THE PLATFORM.

"Guides himself by watching the baseboards," the scientist explained as we hurried to keep up. At every open door Shaky stopped, turned his head, inspected the room, turned away and rolled on to the next open door. In the fourth room he saw what he was looking for: a platform one foot high and eight feet long with a large wooden block sitting on it.

"He'll never make it." I found myself thinking. "His wheels are too small." All at once I got gooseflesh. "Shaky," I realized, "is thinking the same thing."

Shaky was also thinking faster. He rotated his head slowly till his eye came to rest on a wide shallow ramp. Whirring briskly, he crossed to the ramp and then pushed it straight across the floor till the high end hit the platform. Rolling back a few feet, he cased the situation again and discovered that only one corner of the ramp was touching the platform. Rolling quickly to the far side of the ramp, he nudged it till the gap closed. Then he swung around, charged up the slope, located the block and gently pushed it off the platform.

Did Brad Darrach, who provided us with this stimulating reenactment of "Shaky's" impressive exploits, actually witness clearcut evidence of intelligent machine behavior? He certainly thought he did. Indeed, in the remainder of his article he expressed the opinion that Shaky can "see", "understand", "learn", and, in general, has demonstrated "that a machine can think". Moreover, he quoted the predictions of a distinguished computer scientist who stated that in "three to fifteen years we will have a machine with the general intelligence of an average human being...and in a few months (thereafter) it will be at genius level..."

A chilling possibility, indeed, but by no means an isolated account of what some highly-respected experts believe to be the future of machine intelligence. In 1968 Marvin Minsky, director of the Artificial Intelligence group at Mass. Inst. of Technology wrote an article for the Science Journal in which he gave this optimistic evaluation of the progress that had been made up to that point in making machines intelligent:

"At first machines had simple claws. Soon they will have fantastically graceful articulations. Computers' eyes once could sense only a hole in a card. Now they recognize shapes on simple backgrounds. Soon they will rival man's analysis of his environment. Computer programs once merely added columns of figures. Now they play games well, understand simple conversations, weigh many factors in decisions. What next?"

"Today, machines solve problems mainly according to the principles we build into them. Before long, we may learn how to set them to work upon the very special problem of improving their capacity to solve problems. Once a certain threshhold is passed, this could lead to a spiral of acceleration and it may be hard to perfect a reliable 'governor' to restrain it."

In other words, computers are already impressively smart-and they're getting smarter at a frightening rate.

Another talented researcher, Herbert Simon is convinced that computers can do anything people can do, only better. Right after he developed a highly acclaimed program called the "General Problem Solver", in 1957, he wrote these words describing what he believed would be the ultimate capabilities of intelligent machines:

> "It is not my aim to surprise or shock you ...But the simplest way I can summarize is to say that there are now in the world machines that think,...learn, and...create. Moreover, their ability to do these things is going to increase quickly until (in the visible future) the range of problems they can handle will be coextensive with the range to which the human mind has been applied."

Are these enthusiastic experts on the right track? Are we, indeed, on the threshold of a new era in which computers will duplicate human thought processes and behave in intelligent ways? In this chapter we shall attempt to find out what has happened in the field of artificial intelligence over the past decade or so and what is likely to happen throughout the next few years.

What Is Intelligence?

"Intelligence" is not easy to define; but even if we can't formulate a workable definition, most of us are convinced that we can recognize an intelligent person by the way he behaves. For example, you would probably be inclined to agree that my 17-year old cousin in Tennessee is "intelligent" once I have explained to you that he speaks halting French, makes good grades in college calculus, and has learned to beat most of the people in his home town at checkers and chess. What convinces you that he is intelligent? Most of the characteristics he displays are imbedded in the following definition which has been adapted for our purposes from a more abstract version that appeared in the 1976 edition of the Encyclopedia of Computer Science:

> "An intelligent person is able to understand relationships between facts, discover meanings, and recognize truth. He also adapts himself to novel situations and exhibits the ability to learn; i.e., to improve his level of performance on the basis of his past experiences."

The key words are "understand", "adapt" and "improve".

Colliers Encyclopedia echoes the same fundamental concepts in a slightly different definition. Here are the characteristics they regard as being indicative of human intelligence:

1. The ability to deal with abstract symbols, concepts, and relationships.
2. Learning, or the ability to profit from experience.
3. The ability to adapt to new situations, or problem solving in the broadest sense.

Of course, in practice, we don't usually go through this checklist in deciding if a specific person is intelligent. Instead, we tend to base our judgment on how well he scores on a particular I.Q. test. Accordingly, one sarcastic critic of the I.Q. concept has proposed that we should define intelligence as "Whatever an I.Q. test measures".

We can administer a test to a person, but how can we measure the intèlligence of an animal or a machine? Indeed, should they be regarded as intelligent entities? Or is intelligence an exclusively human trait?

In a broad-ranging discussion of animal intelligence "Van Nostrand's Scientific Encyclopedia" proposes this simple definition: "The ability to adapt to changes in environmental conditions through changes in behavior." By this yardstick, it is clear that all animals exhibit at least some degree of intelligence. However, even highly-evolved primates such as chimpanzees seldom rise above the performance level of a three year old child. Thus, if they were adult human beings we would be forced to classify them as idiots.

On occasion, however, specific animals have exhibited spontaneous behavior patterns that would suggest that they are reasonably intelligent even in comparison with mature adults. In 1925 W. Kohler published a landmark study in which he attempted to estimate the intelligence levels of anthropoid apes and other advanced primates. When fruit was suspended beyond his reach one enterprising ape fetched a box upon which he could stand upright as a means of gaining access to the tempting morsels. One of his blood relatives, who spotted a tantalizing bunch of bananas suspended outside his cage, managed to snag them — after signs of much difficulty and frustration — by inserting one bamboo shaft inside another to make a pole long enough to reach.

Cornell University Professor Carl Sagan in his book "The Dragons of Eden" describes far more complex adaptive behavior as displayed by a family of chimps living on Tenerife in the Canary Islands. On one occasion two chimpanzees were observed maltreating a chicken: one would extend some food encouraging the fowl to approach whereupon the other would thrash it with a piece of wire concealed behind his back. The chicken would retreat but soon allow itself to approach again, only to receive another beating. According to Sagan "Here is a fine combination of behavior sometimes thought to be uniquely human: cooperation, planning a future course of action, deception, and cruelty."

Chimpanzees have also been taught to use language in reasonably effective ways. Because their jaw and tongue structure is not conducive to pronouncing words, and because they miss the natural "babbling" stage of human infants, the best approach is to teach them either sign language or a "push-button" language using a computer console. By applying these two imaginative techniques, two psychologists at the University of Nevada, Beatrise and Robert Gardner, have been able to teach certain selected chimps to use and understand more than 100 vocabulary words. The chimps construct full sentences such as "Please machine give Lana juice." Occasionally, they have been observed to invent new compound nouns in novel situations. After tasting watermelon for the first time, a feisty young chimp named "Lucy" described it as "candy drink" and, after she burned her mouth on her first radish, she described radishes forever after as "cry hurt fruit".

In these limited experiments the chimps were taught to communicate only with human beings or with machines. But in a more recent test series, conducted at the Yerkes Regional Primate Research Center in Atlanta, a few chimpanzees have been taught to communicate with one another.

In one experiment the researchers alternately selected either of two chimps to be led off into another room where he or she was allowed to watch as an opaque container was filled with any of eleven different kinds of food such as bananas, bean cake, or candy. Led back into the original room, the chimp was encourage to press the buttons on a computer console in an attempt to communicate to his or her roommate what the container held. If the other chimp understood, and correctly identified the food item by punching out the correct sentence on his own console, the chimps were allowed to share the food. In one series of trials two chimpanzees named Sherman and Austin got the message (and snack) 60 times out of 62 attempts.

In another series of trials the two chimps were separated by a transparent plastic barrier only one of them being supplied with food. Spontaneously, without prodding by the experimenters, the unfed chimp would punch out a request for a mouth-watering morsel. More often than not, his or her companion would comply. At first, as reported in a 1978 article in "Time" magazine, "Sherman, an older and apparently more quick-witted chimp, seemed to make 'errors'. When asked to share an especially tasty item (say, chocolate) he occasionally ignored the request, seemed to feign ignorance, or proffered something less desirable."

Upon being exposed to accounts of this type, we find it relatively easy to accept the fact that animals can be regarded as intelligent creatures. But for some reason, we tend to be more resistant if a colleague attempts to attribute the same intellectual powers to an inanimate machine. Are we merely exhibiting what NASA engineer Robert Jastrow has characterized as "carbon chemistry chauvinism"? Or is there more to it than that? Perhaps we develop those uneasy feelings because we need to reserve some uniquely human characteristic for ourselves? Or is it that machines really can't think and our best instincts are protecting us from a gross misinterpretation?

Perhaps the easiest way out of this dilemma is to avoid the issue altogether and talk not about the "intelligence" of our machines but about their "artificial intelligence". Thus, many researchers have adopted a convention first proposed by Marvin Minsky who defined "artificial intelligence" as follows: "the science of making machines do things that would require intelligence if done by men." Incidentally, if you find this definition acceptable, you have already inadvertently attributed "artificial intelligence" to an inanimate machine. You see, my cousin in Tennessee is not a person: he is a computer built by IBM. As will be explained elsewhere in this chapter, skillful programmers have already managed to teach him to speak halting French, score well on college calculus exams, and beat most local enthusiasts at checkers and chess.

The Computer and the Brain

A few years ago digital computers were often described in glowing terms as "giant brains" by excited journalists looking for a flashy headline. If the computer was, indeed, a giant brain, it seemed to follow naturally that it was an intelligent entity. Proponents of the giant brain theory of computer operation never seemed to pass up an opportunity to point out that the interconnections in the human brain resemble the electronic circuits in a digital computer. Specifically, the brain's dendrites, like the computer's logic gates, are believed to transmit electrical pulses in a binary format.

However, it is easy to get too carried away with the superficial similarities between brain function and computer processing. In fact, even if the computer does not resemble the human brain in every respect, it could eventually turn out to be a thinking machine. After all a Cheyenne helicopter doesn't look or act like a bald eagle or a California Condor but, nevertheless, almost everyone would agree that a Cheyenne helicopter is able to fly at least as well as any of nature's free-flying creatures.

Artificial Intelligence

Much of the original work in artificial intelligence has been carried out at Stanford University and the Massachusetts Institute of Technolosy. In general, the researchers at these two locations attack their problems by using either the "simulation" mode or the "performance" mode. Those who use the "simulation mode" attempt to duplicate, in some sense or other, the way we use our brains in thinking. Those who use the "performance mode" attempt to duplicate some of the end results of our thought processes but no attempt is made to duplicate the way we actually think. In general, the "simulation mode" has not been notably successful; the "performance mode" seems to be far more practical.

Using a different type of classification system, we can divide the efforts devoted to artificial intelligence into four major areas:

1. Game Playing
2. Language Translation
3. Problem Solving
4. Pattern Recognition

In the next few subsections we shall discuss these major areas one by one. We start with game playing machines which have a surprisingly long history.

(to be continued in the next issue)

The Surface of Venus

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"Venus' crust apparently comprises one huge tectonic plate, compared with Earth's six major plates and several minor ones."

Extensive radar data has been returned by NASA's Pioneer Venus spacecraft, and so scientists for the first time have mapped nearly the entire cloud-shrouded planet, and have identified huge continent-sized features — including mountains as high as Everest and deep rift valleys.

Pioneer Venus has mapped more than 93 per cent of the planet's surface. Prior to Pioneer, less than one percent of Venus' topography had been measured by ground-based radar. Venus' surface has never been seen because of the clouds which permanently cover the planet.

The data suggest that Venus' terrain and geology have both strong similarities to and major differences from those of any known planet. According to Dr. Harold Masursky, Venus' surface is gently rolling, with local dramatic highs like the North American continent. However, not counting Earth's oceans, Venus' range of elevations is somewhat greater than Earth's, ranging from 2.9 kilometers (9500 feet) above that level.

Venus' Topography

Pioneer's radar-mapper measures Venus surface deviations in topography from 75 degrees North latitude to 63 degrees South latitude. This covers 83 per cent of the planet's surface, missing relatively small circular regions at each pole.

Typical "footprint" size for altimetry measurements of topography is 25 by 50 km, on a grid with spacing of 100 km.

Sixty per cent of Venus' surface is relatively flat, rolling plains, varying in height by only about 1000 meters (300 ft.) between high and low points. This huge, planet-encompassing plain lies at a 6050-km radius from the center of the planet. (This 6050 km radius describes a reference sphere, much as sea level does on Earth.)

About 16 per cent of Venus' surface lies below the 6050-km mean radius. Such low-lying regions are far more common on Earth (they are the ocean basins) than on Venus, occupying nearly two-thirds of Earth's surface compared to the one-sixth of Venus.

Based on a paper prepared by Dr. Harold Masursky of the U.S. Geological Survey, Flagstaff, Ariz., Dr. G.H. Pettengill of Massachusetts Institute of Technology, and others, for a Fall issue of the Journal of Geophysical Research. Drs. Masursky and Pettengill are members of the Pioneer Venus radar altimeter team.

Most of the remaining 24 per cent of surface are only a few thousand feet higher than the plain. Only eight per cent of the planet is "true highlands," ranging in height to maximum altitudes 10.8 km (35,400 ft.) above Venus' rolling plains. These true highlands may resemble similar areas on Earth. They may be made of very light rock, and hence "float" much higher than other features.

The largest of the highland regions is half as large as Africa. This region has been named Terra Aphrodite. Venusian features have been tentatively named by scientists, pending action by the Working Group on Planetary Nomenclature of the International Astronomical Union.

The smaller highland region, Terra Ishtar, is the size of the continental United States. Both Ishtar and Aphrodite are rough, apparently fractured and faulted. Two other notable highland areas are Beta Regio, site of what seem to be two giant shield-shaped volcanoes, and Alpha Regio, a region of rough, probably geologically old, terrain.

Venus Crust and Crustal Movements

The crust of Venus is not as thick as those of Mars and the Moon; but it appears that Venus' crust is thicker than Earth's — so thick that it has choked off most crustal movement or plate tectonics. The lower layer of this crust apparently consists of heavier basalt-type rocks and wraps the entire planet. On top of this is a layer of light, granitic-type continental rock. The Soviet Union's probe Venera 8 found the radioactivity of rocks in one area of Venus' plains to be like that of granite. This ancient layer of lighter rocks may form a single huge planet-girdling continent, covering about 84 per cent of Venus' total surface. Perched on top of this giant Venusian continent are the smaller but still continent-sized highland regions.

Venus' crust apparently comprises one huge tectonic plate, compared with Earth's six major plates and several minor ones. Due to continuous formation of new plate material, Earth's plates constantly expand and grind together. Plates which adjoin are forced over and under each other — as with the collision of the Indian and Asian plates, pushing up the Himalayas.

On Venus, only about 16 per cent of the surface consists of low-lying basins comparable to Earth's ocean basins. There is no evidence of features similar to Earth's mid-ocean ridges, where molten basalt wells up to form new crust. On Earth, old crust is carried back into the hot interior by the submergence of a tectonic plate beneath its adjoining plate. Most of Earth's plate boundaries are at the edges of continents, but some are in mid-ocean.

By evolving much more crust than Earth and producing a thick top layer of buoyant material, Venus has squelched plate tectonics, says Dr. William Kaula of the University of California, Los Angeles.

Ancient Terrain and Highlands

There appear to be abundant primordial impact craters like those on Mars and the Moon scattered over the surface of Venus. These craters have diameters above 75 km (45 mi.), large enough for Pioneer to observe. Most of Venus' surface (and hence crust) appears to be ancient terrain. Atmospheric heating, water loss and crust formation apparently took place in the first 1 to 2 billion years of the planet's history.

Venus' two continent-sized highland areas, Ishtar and Aphrodite, may be remnants of the last plate tectonic collisional zones, before crust formation choked off tectonics completely. Alternatively, they may result from local lifting forces (like those that created California's Sierra Nevada range.)

Ishtar Terra

The highest and most dramatic conitnent-sized highland region on Venus is the northern highland or Ishtar Terra. It is a high plateau, carrying several mountain ranges. It is about the size of Australia or the continental United States.

The western part of Ishtar (named for the Assyrian goddess of love and war) appears to be a smooth plateau. It is called Lakshmi Planum and is about 3300 m (10,000 ft.) above sea level. Lakshmi Planum is bounded on the west and north by mountains ranging upward from 2300 to 3300 m (7000 to 10,000 ft.) above the plateau, and 5700 to 7000 m (17,000 to 20,000 ft.) above "sea level". The western mountains have been tentatively named Akna Montes and the northern range, Freyja Montes. The Ishtar plateau is about as high as the Tibetan plateau, but twice as large. The central area of the plateau is smooth in the radar images and may be covered with relatively young lavas. The huge escarpments around the plateau's edge are quite steep.

Maxwell Montes

The highest point yet found on Venus, a mountain massif higher than Everest, has been named Maxwell Montes. This huge area of uplifted terrain occupies the entire east end of the Ishtar Terra highlands. Its highest point is 11,800 m (35,300 ft.) above "sea level" and 9000 m (27,000 ft.) above the adjoining Lakshmi plain. The highest parts of the massif run northwest-southeast with lower projections extending both east and west. Observations from both Earth and Pioneer suggest that the mountain region itself is the roughest part of the planet — jumbled terrain, changing abruptly from the smooth plateau west of it. The brightness of this feature indicates that the steep slopes of this Mount Everest of Venus are covered with rocks larger than 10 cm (2.5 in.). On the east flank of Maxwell, Pioneer data show a circular 100-km (60 mi.)-diameter dark feature more than 1000 m (3000 ft.) deep. This may be a volcanic crater. East of Maxwell, extending for 100 degrees of longitude, is a complex topography of ridges and troughs, including many closed basins.

Aphrodite Terra

The largest continent-sized highland region on Venus has been tentatively named Aphrodite. It is as large as the northern half of Africa, and consists of two mountainous areas separated by a somewhat lower region. Situated almost on Venus' equator, Aphrodite Terra runs almost directly east and west for 9600 km (6000 mi.).

Unlike Ishtar, a relatively level plateau carrying high mountains, the Aphrodite highland region rises to various heights above the mean planet surface. The western mountainous area rises 8000 m (23,000 ft.) above the surrounding terrain, 9000 m (26,000 ft.) above Venus mean surface. The eastern mountains of Aphrodite rise 3300m (10,000 ft) above the surrounding terrain, 4300 m (13,000 ft.) above the mean surface. Like Ishtar, the terrain of these Aphrodite mountains appears to be quite rough. Because Aphrodite does not appear to contain uplifted plateaus or volcanic mountains, Aphrodite may be older and more degraded than Ishtar Terra.

Beta Regio

Centered at about 30 degrees north latitude on Venus is Beta Regio, apparently consisting of two huge shield-shaped volcanoes, larger than the Hawaii-Midway chain. Beta Regio appears to be situated on a fault line running north and south, from 40 degrees north latitude to 50 degrees south latitude. This long fault zone connects several other highland features, which may be volcanic, south of Beta Regio. The two huge, adjoining mountains (smooth on the surface and shaped like the very wide-based Hawaiian volcanoes) cover a north-south distance of about 2100 km (1300 mi.). Aside from their appearance, rocks making up the twin Beta mountains appear to be basaltic and hence very likely of volcanic origin. (The Soviet spacecraft Veneras 9 and 10 landed just east of Beta, and found the rocks there to have radioactive element concentrations similar to basalts.)

The two shield-shaped mountains making up the Beta region have been named Theia Mons (the northerly mountain) and the Rhea Mons (the southerly mountain). Both rise out of Venus' great planet-spanning plains, and both are about 4000 m (13,000 ft.) above the plain, i.e., above Venus' mean surface.

Alpha Regio

The fourth notable highland feature on Venus is Alpha Regio, a rough region lying about 1800 m (6000 ft.) above the Venusian great plain. Alpha Regio is about 25 degrees south of the equator and 6400 km (4000 mi.) west of Aphrodite. Radar imaging shows that it has extremely rough terrain with parallel fractures through the whole feature. It may combine old and new geologic forms and resembles the basin and range structure of the western United States.

Venus' Great Plain

As noted, a relatively flat, rolling plain covers 60 per cent of Venus' surface. Radar imaging shows many circular, dark features with bright central spots on this rolling plain.

These apparent craters with diameters of 400 to 600 km (250 to 320 mi.) characteristically have depths of only 200 to 700 km (650 to 2300 ft.). The bright, central areas could be the central peaks, typical of impact craters.

The very small depths and the very large diameters of these apparent craters, compared with the Moon and Mars, can be explained by "surface rebound" like that found on Jupiter's planet-sized moons. (The apparent wide-spread cratering suggests that Venus' heavily-cratered ancient crust is preserved over much of the planet.)

Lowlands

The largest low area so far found on Venus is centered west of Ishtar at 70 degrees north. At its deepest point, this great basin is about 3000 m (9000 ft.) below Venus' great plain region. This low area, like others on the planet, is smooth, and lacks large crater forms. Like Earth's ocean basins it may be relatively young geologically and filled in by basaltic lava flows. It is about the same size as the North Atlantic ocean basin.

The lowest point on the planet appears to be in the rift valley just east of Aphrodite, slightly lower than the northern hemisphere basin at about 2.9 km (9500 ft.) below Venus' mean surface. This trench is deeper than the Dead Sea rift, but only one-fifth the depth of the Marianas trench in the western Pacific. It is roughly the same depth as Vallis Marineris, the great canyon on Mars. While Venus apparently has no plate tectonics, this rift valley and another parallel to it, both in the region east of Aphrodite, seem comparable to tectonic rifts on Earth. On Earth, in the rifts, new rock material wells up out of the molten interior.

In general, the jumbled region east of Aphrodite is characterized by high ridges and deep valleys. There is a similar region east of Ishtar. □

Writing a Novel by Computer — Part 4: Events

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"The events that happen in a novel consist of actions, conversations, and thoughts. The writer tells his story in the form of what actions occur, what the characters say to each other, and what they think. Plus descriptions."

Outline

38. Synopsis of the First Three Parts
39. Events
40. Actions, Conversations, Thoughts
41. Descriptions
42. Details in Chess
43. Details in Fiction
44. Moves and Chance
45. A Chief Character: "Nature,..."
46. Algorithms

38. Synopsis of the First Three Parts

This Part 4 of "Writing a Novel by Computer" considers some more of the aspects of writing a good novel, making use of the resources of a computer to the extent that is "probably" possible or "reasonably" conceivable.

Our main thesis is that just as a computer can play a good game of chess, it should be possible for a computer to write a good novel, i.e., one that is interesting and worth reading.

In Table 1 is a synopsis (based on centered headings, in some cases amplified) of the prior subjects discussed in this series of articles. The centered headings in this Part 4 are numbered in a continued sequence with those in prior parts.

39. Events

The events that happen in a novel are the fabric out of which the story is sewn together. In the same way, the moves that are made in a game of chess are the fabric out of which the game is sewn together.

Some of the aspects of events are shown in Table 2. There are three kinds of actions: happenings, conversations, thoughts. Some events constitute "moves" as in the chess sense: a character selects a choice and acts. Other events are not "moves"; they can be changed. A character can think something, but then change his mind.

All of the events regularly require descriptions.

A story told without descriptions is "bare bones". It does not supply a reader with satisfying images for his mind's eye, or imagined sounds for his mind's ear, or other recalled or imagined sense impressions.

All of these events are subject to the accidents and circumstances of the "real world" as represented in fiction, and the chaining or connectivity of the stream of events which together and in appropriate sequence constitute a story.

40. Actions, Conversations, Thoughts

The events that happen in a novel consist of actions, conversations, and thoughts. The writer tells his story in the form of what actions occur, what the characters say to each other, and what they think. Plus descriptions.

In Shakespeare's "Macbeth" for example, the first scene shows the witches in a desert place: three old women, a cauldron, a fire, dancing. Shakespeare devotes the largest number of his words to what the witches say. He devotes few words to the action, for action is shown by what the audience sees on stage. Finally there are the three thoughts implanted by the witches in Macbeth's mind: the three doom-bringing prophecies: Thane of Glamis, Thane of Cawdor, and King of Scotland.

41. Descriptions

All the aspects of events invite descriptions, the supplying of details which stimulate the imagination and the senses of the reader. Robert Somerlott in "The Technique of Modern Fiction" speaks of "magnificent trifles", and quotes Michelangelo "Trifles make perfection but perfection is no trifle". These are little details that "set a scene, reveal a character, lend reality to a situation, or make a subtle comment". For illustration, he quotes an example from Suetonius, a Roman historian of the first century A.D., who wrote in regard to the assassination of Julius Caesar:

> All the conspirators made off, and he lay there lifeless for some time, until finally three common slaves put him on a litter and carried him home, with one arm hanging down.

Somerlott notes that "with one arm hanging down" is of no significance historically. But it conveys implications of great importance:

Table 1

WRITING A NOVEL BY COMPUTER

Part 1

(March-April, 1979, p. 28 ...)

1. Writing a Novel Compared with Playing a Good Game of Chess
2. The Definition of a Novel
3. The Length of a Novel
4. The Elements of a Novel: A Story
5. Programming a Computer to Tell a Story
6. Some More Elements of a Novel (Characters; Problem; Solution; Complications and Plot; Suspense; Setting; Details)
7. The Mathematical Structure of a Novel
8. Ideas
9. Events
10. Scenes, and Chapters, and Novel (counting words, ideas, events, scenes, chapters, etc.)
11. Tempo
12. Programming a Computer to Tell a Story: Verifying details against a knowledge data bank.
13. Vocabularies (choice of words and ideas for describing characters, events, and scenes in the novel)
14. Consistency of the Characters (verifying details of behavior against the nature or personality of the character)

Part 2

(May-June, 1979, p. 18 ...)

15. Synopsis of Part 1
16. Creation of Life-Like Characters
17. A Theory of Personality
18. Real Persons and Imaginary Persons
19. Personality Inside a Computer: Eliza
20. Personality Inside a Computer: A Pattern of Behavior
21. A Computer Program to Write Good Novels
22. Computer Games from "Space War" to "Dungeon"
23. An Actual Example of "First Draft to be Revised"
24. First Draft: Input
25. Second Draft: Output
26. Modifications from First Draft, and Algorithms to Produce Them: TOPICS
27. Topic 1: Conflict
28. Conflict, in the Second Draft
29. Algorithm for Revising, in Regard to Conflict
30. From Words and Phrases into Ideas

Part 3

(Jan-Feb, 1980, p. 22 ...)

31. Synopsis of the First Two Parts
32. Topic 2: Suspense
33. Suspense and Conflict
34. Suspense and the Storyteller's Art
35. The Measurement of Suspense: Suspense in the First Draft (of a passage from "Gurnard Castle")
36. Suspense in the Second Draft
37. Algorithm for Revising, in Regard to Suspense

- Suetonius saw it;
- with his eyes we look into the Roman Forum at the aftermath of the assassination;
- the most powerful leader Rome has yet seen is reduced to a mere mortal.

Was Suetonius there? No, he wrote a hundred years later; he might even have invented the detail -- but the symbolism is magnificent.

Somerlott adds that "Too many 'good' details are as bad as too few". How many is too few? How many is too many? What is a good detail? And what is a bad detail?

As usual, the meaning given to these terms is the vague meaning of prescientific observers. But the meaning of "details" is subject to mathematical analysis, and sifts down into "the specification of the values of variables". What variables? What values?

Let us now explain just what that remark is intended to assert, and show first the explanation in the context of chess.

42. Details in Chess

In the recording of a game of chess, the details of the chess events (the moves) are those which are just sufficient to specify precisely what happens in the game, according to some scheme of notation. There are two regular notations, called the English and the continental. In Table 3, some examples of the recording of chess events in English notation are shown, together with some translation of the abbreviations contained in the notation. Whenever the chess piece referred to may be ambiguous, additional specification is needed; but in the chess event "pawn to king four", there is only one pawn which is in a position such that it can move to the chessboard square called king 4.

Table 2

ASPECTS OF EVENTS IN A NOVEL

1. Actions	Happenings; what characters actually do
2. Conversations	What characters say, including dialogs and arguments; words spoken or reported
3. Thoughts	What characters think; but usually only the thoughts of the hero or heroine
4. Descriptions	Details, atmosphere, culture
5. Moves	What characters plan to do, and do
6. Chance	Circumstances, accidents, luck, fate, Nature, Destiny, Acts of God
7. Connectivity	The ways in which events connect to one another

Table 3

DETAILS FOR CHESS EVENTS – SPECIFICATION IN ENGLISH NOTATION

Summary of Chess Event: Example:	Piece Moving / Place to Which Moved / Color of Piece Moving / Number of Move / Capturing? / Castling?
1. P-K4 ...	pawn / King 4 / white / 1st move / no capturing / no castling
2. ... N-Q3	knight / Queen 3 / black / 2nd move / no capturing / no castling
10. Q x Q ...	queen / the place occupied by the black queen / white / 10th move / capture, yes / no castling
8. 0 - 0 ...	king and rook / king moving two spaces to the right, king's rook placed next to the king on the left / white / 8th move / no capturing / castling, yes

Table 4

CHESS EVENTS – VARIABLES AND VALUES

Variable	Values
kind of piece	king, queen, bishop, knight, rook, pawn
player	white, black
square on chessboard	64 values (systematically named)
number of move	usually, up to 50; sometimes, up to 100; rarely, over 100
capturing?	yes, no
castling?	yes, no

In Table 4, some of the variables that are included in chess are shown, together with the values that they may have.

The details of telling the story of a game of chess (without saying anything about the reasoning behind the player's moves, the atmosphere or occasion in which they played, etc.) are equivalent to:

1) Specification of the series of moves
2) Specification for each move of the values of the significant variables

43. Details in Fiction

In the telling of a story in fiction, the details of the fiction events are those which are sufficient (considering the audience and the occasion) to specify what is significant to the story.

Table 5

DETAILS FOR FICTION EVENTS – POSSIBLE CATEGORIES OF VARIABLES

Category of Variable	What is Included
Place	where the event happens, geography, ...
Time	when the event happens, calendar date, time of day, ...
Scenery	outdoors or indoors, furnishings, backdrops, ...
Activities	what they are doing, how they are moving, ...
Dialog	what they are saying to each, how they are speaking, ...
Mental state	what they are thinking and feeling, ...
Clothes	what they are wearing, fabric, quality, colors, shoes, jewelry, ...
Stage properties	books, chairs, fire in fireplace or not, pistols, ...
Weather	clear, rainy, sunshine, moonlight, ...
Sensations	sights, sounds, smells, tastes, touchings, ...
Miscellaneous	...

There are two main requirements, the telling of the assertions or events of the story, and the telling of the painted pictures, the sensory images, of the story. Neither by itself is enough. Furthermore, both have to be adapted to the audience, to the degree of its interest, and the quality of its attention, something that may be called "tempo", the rate at which the story is told.

Tempo varies with the audience. Aesop telling fables had to make his stories brief: he was telling them to an audience not much interested and unaccustomed to paying much attention. At the opposite pole, Marcel Proust writing his novel "The Remembrance of Things Past" wrote for an audience greatly interested in psychological details, and willing to read a vast number of them. Proust's kind of audience, nowadays, however, may be tiny. Barbara Cartland has written over 200 romantic novels set in English history and 100 million copies of her books are in print: her audience is vast.

Ordinarily the assertion of happenings takes few details, and the painting of pictures and sensory images take many details.

The categories of details that are often presented or implied in the successive events of a novel or a story are shown in Table 5.

For example, in "Gurnard Castle" (see Part 2 of this series of articles, "Computers and People", May-June 1979, p 22), the passage occurs:

> She and Lord Carburton ... were standing side by side in a bay window of the ballroom, looking out at the summer night. The moon almost full painted all the shrubbery of the formal garden in silver, while all the shadows were stark black. It made her think of the squares of a great chess game — in which she was much smaller than a pawn.

What are the details that are expressed or implied? These are shown in Table 6.

In this short passage from "Gurnard Castle" what are the words and ideas that assert happenings and that paint sensory images? These are shown in Table 7.

The two ideas that assert happenings are only a small part of the story line, the thread of narrative. The nine ideas that paint sensory images are not a part of the story line. But they stir the reader, make him think thoughts appropriate to a romantic novel (which "Gurnard Castle" aims to be) and help to convey to the reader a feeling of "being there".

What is missing? If there were room for more words in this scene (a question that cannot be settled on the basis available here), one improvement could be more sensations and more vivid sensations, such as: the smell of roses or jasmine or honeysuckle coming through the open window; Rowena's sensation of the night wind on her cheeks; the song of a nightingale. Such details would be more appropriate if Lord Carburton were young, attractive, romantic, instead of old, repulsive, and troublesome.

44. Moves and Chance

Moves in a chess game lead from one to another, because of reasons and chance. In the same way events in a story lead or connect from some events to other events, because of reasons and chance.

Chess is an unusual game; it is always open to be looked at and assessed. A player examines the board, weighs the strength and locations of the pieces, makes a decision, and then makes his move. But of two moves that seem to be equally good, a player must select only one; at this point chance enters. Or the player may fail to see some aspect of the position, and therefore makes a move worse than he could have made, so chance enters. "Pièce touchée, pièce jouée"; once he has touched a piece, he must move it.

In a novel and in life, the "board" is not regularly open and in full view to be looked at, with every move assessable. Instead it is much concealed. Also it is characters (and not the author) who must examine the situation and the problems, weigh the strength and the location of the forces, make (or do not make) judgements and decisions, and then make (or do not make) moves.

Table 6

DETAILS FOR FICTION EVENTS IN THE SAMPLE PASSAGE

Variable	Values
Place	London, the Frothinghams' mansion
Time	1681, June, evening, rather late
Scenery	ballroom, bay window, looking out on a formal garden
Characters Present	Rowena Redruth, heroine; Lord Carburton, suitor
Activities	standing side by side during a short intermission between dances
Dialog	about to begin
Mental state	Rowena, bothered, insecure, unhappy; Carburton, much in love, confident, inebriated
Costumes	formal evening clothes, elegant
Stage Properties	goblet of champagne
Weather	fine evening, moon almost full
Sensations	sights

Table 7

DETAILS OF IDEAS IN THE SAMPLE PASSAGE

Variable	Value
I. Ideas that Assert Happenings	
looking	out of the bay window
thinking	that she was more insignificant than a pawn in chess
II. Ideas that Paint Images	
night	summer
the moon	almost full
the illumination	silvery, and stark black
the shrubbery	impression of squares in a great chess game

Each fictional person has to act at all times in accordance with his character as it is or as it develops, unless he asks another character what to do, and then accepts the advice. He uses his own brand of personality, his own configuration of virtues and vices, as endowed by the author. Some characters will be crafty and scheming; others will be guileless and direct; a few characters will be too placid to depart from the obviously easiest course of action. A reader enjoys sizing up a character and guessing what he will do, based on the reader's knowledge of that type of human nature.

45. A Chief Character: "Nature ..."

In a story there is always a chief character whose mind is not fully knowable and whose moves are not fully predictable. This character has many names, including: happenstance, chance, accident, luck, Fate, Nature, Nemesis, God, Destiny, the "real world". But the "real world" in fiction is different from and more restricted than the "real world" in life. "Truth is stranger than fiction," says an old proverb. Readers reject as unacceptable a fictional world in which too many strange things happen.

This chief character has nevertheless tremendous power over all the other characters in the story. He (or it) controls time; he ages all the other characters uniformly: "Time like an ever rolling stream bears all its sons away." He controls space. Two characters in a novel who at one moment are a thousand miles apart cannot in the next moment be next to each other. He controls sequence: once something has happened, it can never unhappen. Splashed water will never pick itself up, coalesce, return in a parabola through the air, and enter the fountain jet that it issued from (except in movies run backward): he conforms to time's arrow. This chief character is represented in many games far more than in chess; his representation is dice thrown from a cup, or cards dealt and cut, or in other ways. This leads to much philosophy, like for example, the famous cowboy's: "Life ain't in holdin' a good hand, but in playin' a poor hand well."

46. Algorithms

Now, how do we proceed to tell a computer by means of one (or more) algorithms how to:

- Create an event in fiction
- Fit it into a series of events composing a story line for a novel
- Clothe it with interesting actions of interesting characters, and other interesting happenings
- Decorate it with plausible details, sensory images

As usual we seek guidance to the answer to this question by looking at the analog in chess. The construction of a good computer chess-playing program or algorithm has involved many investigators for more than 20 years. Currently the best chess-playing programs can defeat more than 95 percent of human players in chess clubs. An interesting sidelight is that the world champion of backgammon, according to the article, "Computer Backgammon" in the "Scientific American" for June 1980, is the program BKG 9.8 designed by Hans Berliner. This computer program won a world championship backgammon tournament in July 1980 in Monte Carlo, against Luigi Villa, the the world champion in backgammon.

The evidence that a computer program to write a good novel can eventually be constructed is that a human being using only the contents of his or her brain can write a good novel. For it is true that every defined (and many undefined) intellectual operations that a human being can perform can also be performed by a computer.

That word "defined" needs some attention. If I walk up to a traffic intersection, look each way at the traffic, wait for a green light plus a stopping of the traffic, and cross without being run over by a car, I have performed an intellectual operation. But it is not fully "defined" for a computer because the computer needs to be programmed to recognize which light at an intersection is a traffic light that has become green; so far as I know, this intellectual operation is still "undefined" for the computer.

Such an algorithm, may contain many thousands of instructions and many hundreds of modules. But even though it is at present out of reach, parts of it are in reach and can be expressed in computer programs.

For example, readers like to know the place and time of the events that are contained in a novel. So here is an algorithm (effective calculating rule) no. 1:

1. Make sure that each event in the novel has a place and time, either specified or implied.

Some more rules are evident, for producing a good novel:

2. Numbers of more than one significant digit, like 2.49 and -1.335, should not appear in a novel.

For example, a sentence like "John walked 2.45 feet into the room and turned 85.6 degrees clockwise to confront Dick," is ridiculous. It should be turned into: "John walked a few feet into the room and turned to confront Dick." This is bare bones but not ridiculous.

Many of the standard rules contained in textbooks for teaching the writing of fiction could be rather easily translated into algorithms for the computer to write a good novel. For example,

3. Technical vocabulary should not be used.

4. The connection from one event to a subsequent event should be possible and realistic.

5. Anachronisms must be avoided.

For example, to refer to the telephone in a novel dealing with 1681 is anachronistic: no telephone existed then. But telepathy may have existed, and was used to produce a striking effect in "Jane Eyre" by Charlotte Bronte. □

(to be continued)

Computing and Data Processing Newsletter

HOME CONFINED FORMER EMPLOYEES COMING BACK INTO PRODUCTIVE WORK

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At home, behind doors, an untapped and until recently ignored, reservoir of skills has been discovered by Control Data Corp. These talents lie in persons with years of experience and expertness.

Under a new arrangement entitled "Homework", persons who have had to leave their jobs in the company because of medical disability, now are being retrained and reemployed in a variety of capacities. The employees use the PLATO computer-based education system to learn programming and related skills, and then use those skills in new application software and new educational courseware.

Joanne Saladin was an administrative assistant for the company in Dayton, Ohio, when in 1974 she suffered a ruptured blood vessel in the brain and concurrent stroke. Her speech was badly slurred, and she had to learn to walk once more. Now she has completed her training and works as a data entry clerk. "I was a vegetable. But now I can do something of value again." The PLATO terminal automatically logs the hours she puts in and is paid for.

If this system of "Homework" becomes widespread, it could greatly reduce the social costs of maintaining incomes for the 4.7 million (estimated) unemployed and disabled Americans between ages 16 and 64. And of course it could apply to able-bodied persons as well.

COMPUTER CRIME: DETECTION, PROSECUTION, DETERRENCE

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Losses due to computer-related crime are estimated to be between $100 million and $300 million per year, according to the U.S. Chamber of Commerce and SRI International. "No one knows the actual extent of the losses," states Donn Parker, senior management systems consultant at SRI and a leading expert on computer crime. "The 700 cases that SRI has studied probably represent only the tip of the iceberg."

SRI has produced a definitive document to aid investigators and prosecutors dealing with computer-related crimes. The title is the "The Criminal Justice Resource Manual on Computer Crime." The auspices were the Law Enforcement Assistance Administration of the U.S. Dept. of Justice.

Criminals may be found among computer operators, programmers, tape librarians, electronic engineers, and others. Their methods are new. A jargon has arisen to describe them:

- salami techniques (small amounts of money sliced from large accounts)
- Trojan horses (hiding secret codes in someone else's computer program)
- data diddling
- superzapping
- logic bombs

Targets of computer crime include new forms of money: electronic money, stored in electronic signals and magnetic patterns, and transmitted over telephone and other lines. A telephone with a terminal attached can be used to engage an on-line system in any part of the world. It is almost impossible to catch the performance of the criminal act: an illegal use of a credit card number could be executed on a computer in less than 3/1000 of a second. The computer is rapidly becoming the account book and vault of both individuals and organizations.

The Resource Manual is available for sale from the Superintendent of Documents, U.S. Govt. Printing Office, Washington, DC 20402, stock number 027-000-00870-4.

$100,000 PRIZE ESTABLISHED FOR THE FIRST COMPUTER WORLD CHESS CHAMPION – PART II

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(continued from C&P, July-August, 1980, p. 26)

Dr. Hans Berliner said "We want to insure that any human competitor who is playing against a computer can have the right to place a qualified observer at some point to guarantee that the computer is actually making the moves and not a group of consulting chess experts at the end of the wire," he explains.

There is no chance that a computer will become World Chess Champion in the next five years, Berliner believes. "It will take more than five years and probably much longer," he says. "By 1990, I think there is a 50-50 chance that it will happen. From that point, the odds will gradually get better and twenty years from now it is almost a certainty."

Winning the championship is a long process that takes four years for a human, and the computer will likewise have to work its way up the ladder in tournament play. "Even getting to the first rung of that ladder is three or four years away," Berliner continues, "but I think that a computer will be playing in the U.S. Invitational Championship within the next five years."

In the interim, a set of incentive prizes will be offered each year for computer-versus-human competition. "Two human players of a specified skill level will be selected randomly from among chess players at that level," Berliner explains. "These players will engage the best and second-best computer programs as determined by that year's competition. Each contest will consist of a pair of games with the players, human or machine, with the best score in the two games receiving the prize. In case of a tie, the prize money will be split evenly."

In each succeeding year, the skill level of the human players will be increased as will the amount of the prize. The first competition will be held this November at CMU and the prizes will be $1,500 and $1,000 respectively.

The first major progress in computer chess dates back to 1965, when Richard Greenblatt of MIT developed a program which became the first ever to win a game against a tournament level player. Within a year, Greenblatt had improved the program to a point where it was able to achieve a rating of Class C in human competition. The best program available today is one at Northwestern University which plays at low expert level.

THE INCREDIBLE SHRINKING MEMORY CHIP

George Jones
Western Electric
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New York, NY 10038

As micro-miniaturization continues to shrink the size of solid-state components, the task of manufacturing such small devices of the highest quality has grown and grown.

"In less than five years, we have gone through four generations of memory chips, going from 1000 bits to over 64,000", according to Howard Tooker, engineering department head, at the Allentown (Pa.) works of Western Electric.

The new high density 64 K semi-conductor memory chip contains actually 65,536 bits, each of which can be recalled in less than a millionth of a second. A whole range of new concerns in production and reliability has sprung up.

Three new processes have been installed; currently the metal oxide silicon (MOS) chip production line consists of 150 process steps with 50 to 60 control charts.

The first new process is a system of ion implantation: a 4 inch diameter silicon wafer containing more than 130 chips is bombarded with atoms from another element. These atoms pentrate the surface to create different electrical configurations which are the basics of integrated circuits. The silicon wafers have been processed to provide layers of oxide and metal, and have been etched with photomasks for specific circuits. So the ion implantation can be carefully pinpointed.

The second new process is the use of a plasma technique instead of wet chemicals for etching the wafer. A radio frequency discharge is produced in a gas atmosphere. This discharge acts as a catalyst that causes the desired chemical reaction to take place at lower temperatures than required by wet chemicals.

The third new process is an unusual laser repair system. The laser beam can precisely alter an electrical circuit by substituting a spare bit for one that does not work, and so save a chip from being scrapped. A test set automatically evaluates a chip, and if some of the bits are inoperative, they can be removed, spaces can be inserted, and spare bits can be connected, so that the circuit is fully operational. This repair system is only possible because the laser has been perfected to such a degree that it can be applied in this fashion.

THE EARLY DETECTION OF ARTERIOSCLEROSIS

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Arteriosclerosis is a silent disease that affects millions of Americans. Often, it goes undetected until serious complications occur, such as heart attack, stroke, or senility. Physicians are regularly rather helpless because there is no routine method for screening persons for the disease, as there is for high blood pressure: the blood pressure sleeve and the blood pressure meter.

A device developed at this university by two biomedical engineers, John G. Webster, and T. M. R. Shankar, may provide such a method. How much an artery expands as blood pulses through it is called arterial compliance. The method measures arterial compliance and compares compliance of arm and leg arteries, because leg arteries normally harden before arm arteries.

The device resembles a blood pressure sleeve It measures voltage drop from one part of a limb to another, since electrical resistance for more compliance is smaller than electrical resistance for less compliance.

If tests of the device are successful, it could become as common in doctors' offices as the blood pressure sleeve, giving early signals of arteriosclerosis, and thus helping patients and doctors treating them. □

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 programming 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"). 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 must display some kind of evident, systematic, rational order and completely remove some kind of randomness; the operation must be expressible in not more than four English words. (But Man can use more words to express the solution and still win.)

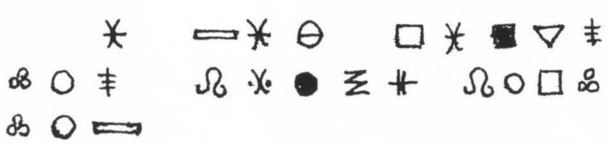
NAYMANDIJ 8009

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

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, plus a few more signs. To compress any extra letters into the set of signs, the encipherer may use puns, minor misspellings, equivalents (like CS or KS for X), etc. But the spaces between words are kept.

MAXIMDIJ 8009



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, expressed in numerical digits, is to be translated (using the same key) into letters so that it may be read; but the spelling may use puns, or deliberate (but evident) misspellings, or may be otherwise irregular, to discourage cryptanalytic methods of deciphering.

NUMBLE 8009

```
              P R A I S E
      *             T H E
          ---------------
            I D G G E P V
          I N H T A R N
      R D R N D I E
      -------------------
    = P A N I D P R P V
```

AE=YV

82229 55503 01

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

SOLUTIONS

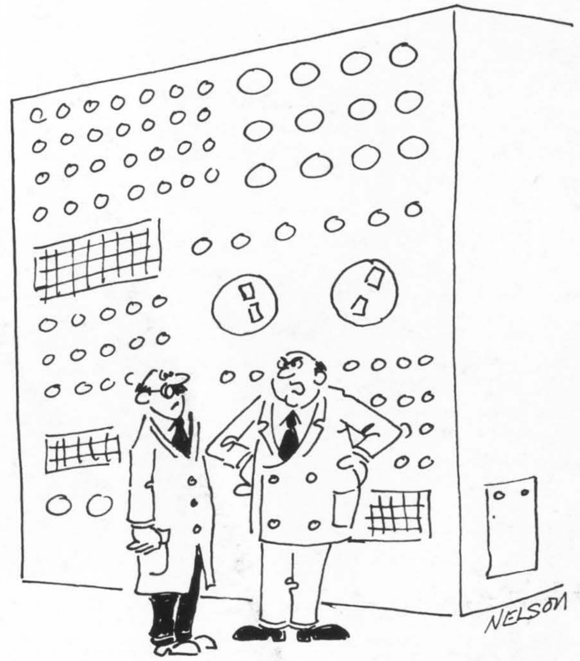
NAYMANDIJ 8007: Column 17: 3 multiples.
MAXIMDIJ 8007: Hope is as cheap as is despair.
NUMBLE 8007: Imagination gives many voyages.

Our thanks to the following people for sending us solutions: Roland Anderson, Stockholm, Sweden – Maximdij 8005, Naymandij 8005, Numble 8005; Leon Davidson, White Plains, NY – Maximdij 8007; T. P. Finn, Indianapolis, IN – Maximdij 8007, Numble 8007; Steve Werdenschlag, Livingston, NJ – Maximdij 8007, Naymandij 8007, Numble 8007.

The Frustrating World of Computers

by Harry Nelson
1135 Jonesport Court
San Jose, CA 95131

WELL, IF YOU CAN'T CORRECT YOUR COMPUTER ERROR, HOW ABOUT THROWING IT AWAY AND STARTING OVER ——?



—AND I RESENT YOUR SAYING IT KNOWS MORE ABOUT MY BUSINESS THAN I DO—

IF OUR COMPUTER BILLED YOU FOR 250,000 TEA BAGS THAT IS CORRECT; IF YOU ONLY ORDERED 25,000, THAT'S YOUR PROBLEM—

THE BOOK CLUB'S COMPUTER GOT STUCK ON MY NAME AND I'VE GOT 6,386 COPIES OF "WHAT TO DO WITH A CHICKEN, TILL A DOCTOR COMES ——"