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August, 1969
Vol. 18, No. 9

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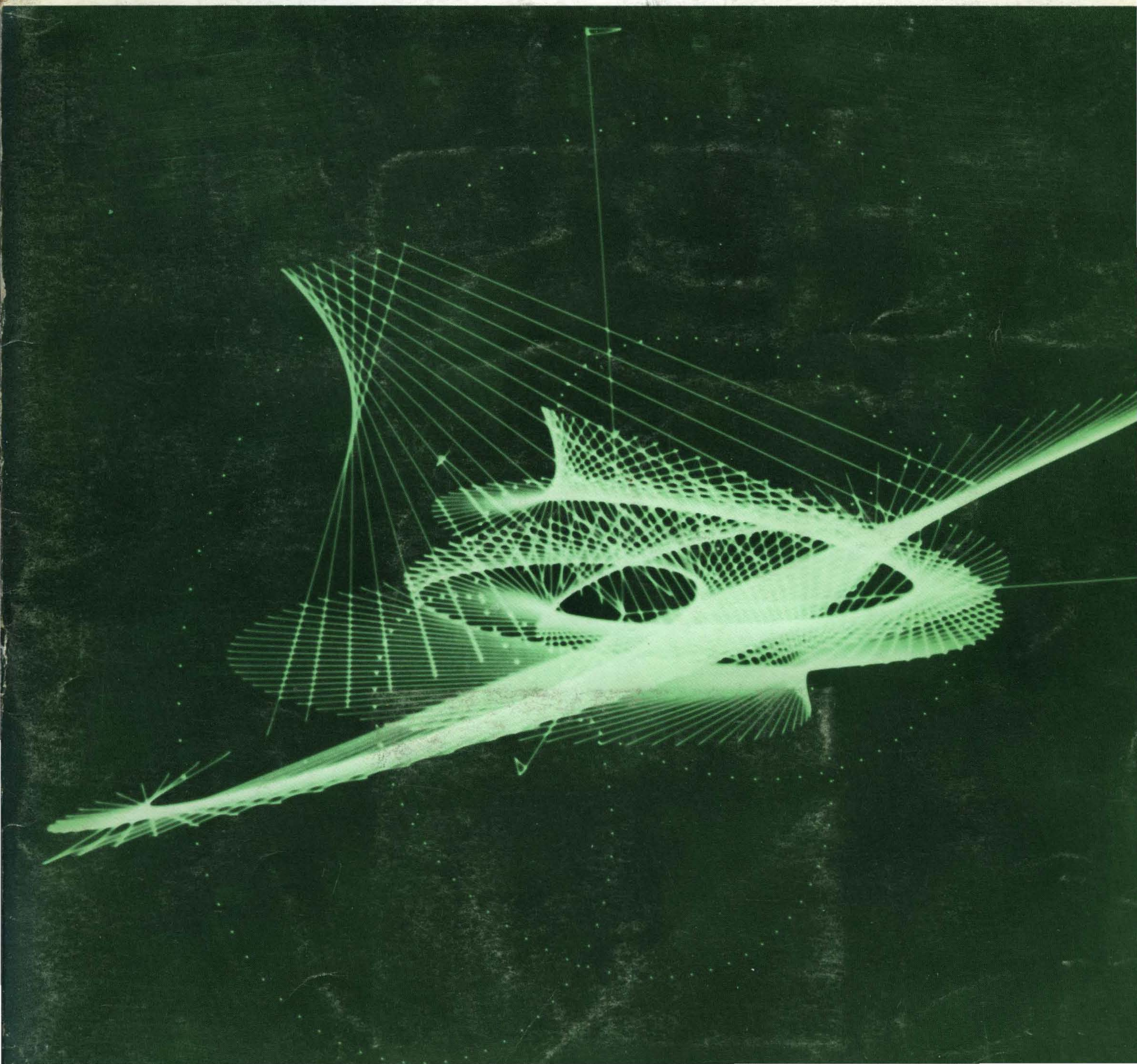
computers and automation

7th Annual Computer Art Contest — First Prize: "Circus"



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And it does your big batch jobs in its spare time.
The Octoputer does a real armload of work for a handful of change. Check the bills from your time-sharing services. See if it's not more efficient to do the same work on your own Octoputer. And get batch processing, too. One more thing. The Octoputer concentrates on remote computing because that's what you're going to need—that's where the industry is going. We got there first because communications is what RCA is famous for. It'll keep us ahead of our competition. It can keep you ahead of yours. Step up to the Octoputer and shake hands hands hands hands hands hands...

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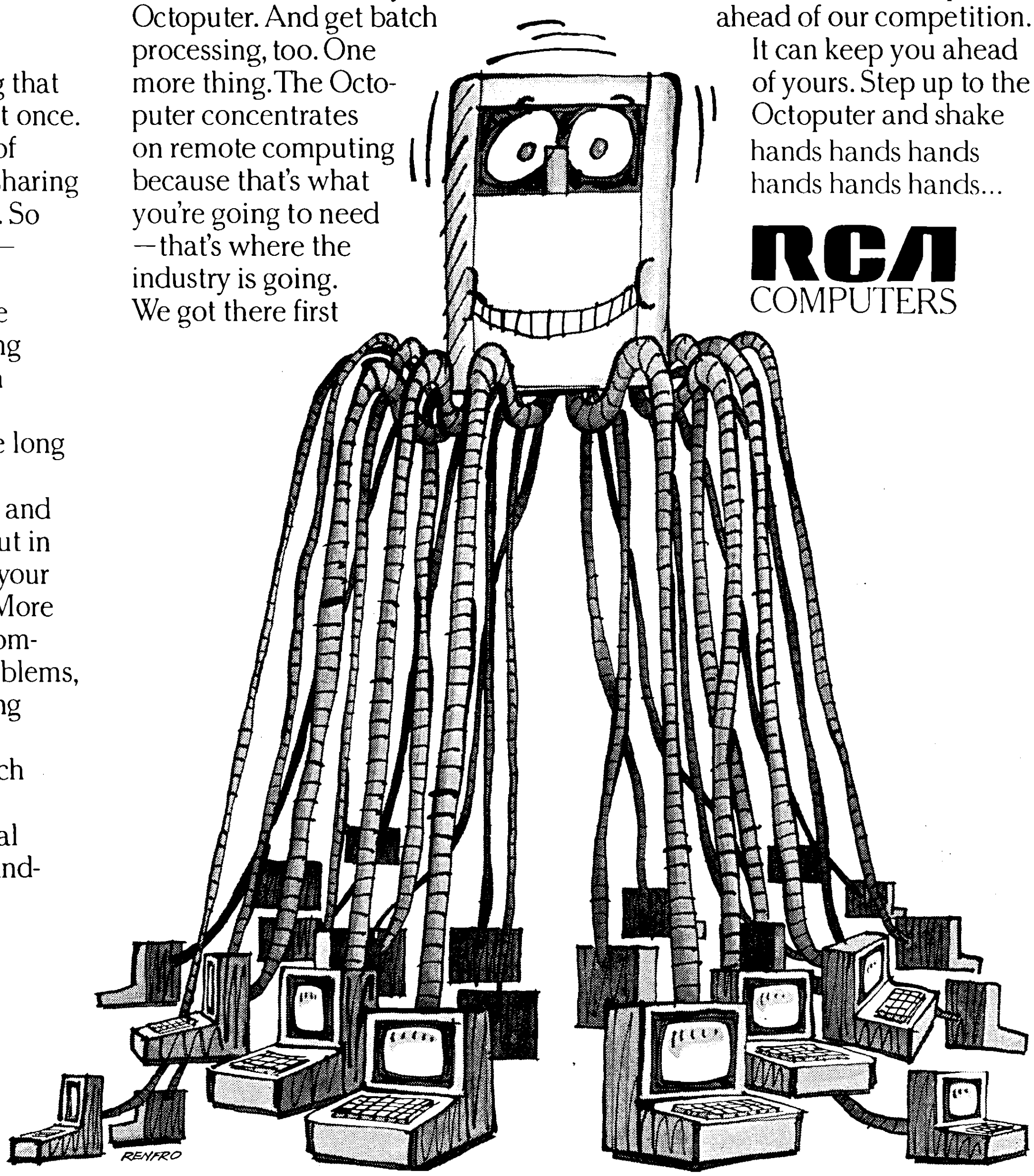
COMPUTERS



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AUG. 1969
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Letters To The Editor

"The Misdirection of Defense" — Comment

I have just now had the opportunity to read the editorial in your April issue ["The Misdirection of Defense — and the Social Responsibilities of Computer People"], which you so kindly sent me.

I found it persuasive, particularly in light of your knowledge and experience. I hope you keep up your scrutiny of the "MIC" (Military Industrial Complex).

Senator EDWARD M. KENNEDY
United States Senate
Washington, D.C.

Social Responsibility

It is most refreshing to read your penetrating editorials and your commentary on social problems subject to alleviation or multiplication by data processing techniques.

To claim that social responsibility is outside the bounds of professionalism in any field is to view such a field so narrowly that most perspective is lost. *This* reader raises his small voice to urge you on in your present course—presenting an informative, challenging, excellent magazine for those who have the capacity to appreciate it.

JOEL BERG
Director
Data Processing Center
Newton Public Schools
430 Walnut St.
Newtonville, Mass. 02160

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(Please turn to page 11)

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computers and automation

Vol. 18, No. 9 — August, 1969

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computers and automation

Vol. 18, No. 9 — August, 1969 *The magazine of the design, applications, and implications of information processing systems.*

Special Feature: Seventh Annual Computer Art Contest

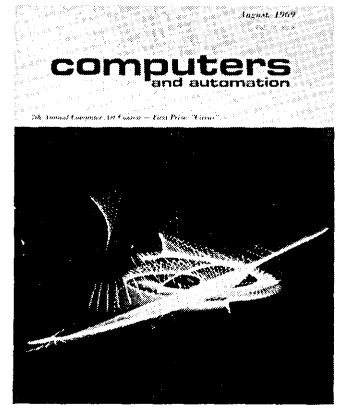
Regular Features

Editorials

Ideas: Spotlight

C&A Worldwide

Multi-Access Forum



The front cover shows the entry which won first prize in the Seventh Annual Computer Art Contest of Computers and Automation — "Circus", photographed from an Adage Graphics Terminal by Tom Childs. A description of this picture, and other entries in the contest, are in the computer art section of this issue beginning on page 12.

Departments

Edmund C. Berkeley
Editor

The Value of Computer People, and "Who's Who in the Computer Field"

In the computer field, something new has been happening:

> The value of a computer professional is beginning to exceed the value of a computing machine.

For over 20 years, the powerful computer and the large quantity of computing power which it provides, has tended to be worth far more than a computing professional. This is now changing.

The central processing unit, thanks to transistors first, then printed circuits, and currently large scale integration of circuit elements, is becoming relatively small and cheap. The peripherals are becoming less costly also. The cost of a good computer professional now is on the order of $30,000 a year (including fringe benefits needed to keep him in a job instead of having him move on to another job). A five-year capitalization of the professional's value comes to about $150,000. One can now obtain a great deal of computing power for $150,000—more than ten million million computing operations, enough to solve a large number of difficult problems.

As a result, it makes sense for the computer field to look with fresh eyes at computer people, to focus attention on them, to try to inventory the people, the professionals, in the computer field.

We, the editors of *Computers and Automation,* recognizing this fact, accordingly announce the reporting of the people in the computer profession in a new periodical publication.

Our Editions of *Who's Who in the Computer Field,* which began in 1952, will be published annually in three parts:

- Part 1 — Systems Analysts and Programmers
- Part 2 — Managers and Directors of Computer Installations
- Part 3 — Other Computer People

These issues will also contain a variety of other information and supplements, such as: "Distinguished People in the Computer Field", "Lecturers in the Computer Field", etc. Whenever a person belongs in more than one category, we plan to publish his capsule biography in each category where it belongs.

We invite our readers to subscribe to this new periodical publication *Who's Who in the Computer Field* — see the information on page 47.

If you wish to be considered for inclusion in the Who's Who, please complete the entry form on page 44 or provide us with the equivalent information. If you have previously sent us an entry form, but some of the information that you sent us has changed substantially (such as your company connection or your address), please send us a corrected entry form. Please do not delay—deadlines are close at hand: the closing date for Part 1 is September 5, 1969. All aboard!

Computer Art — The Annual Contest

This year our 7th annual contest for computer art has set a new record: 165 pieces of computer art have been entered. With this profusion, we cannot print in one issue all that is worth printing.

So we plan to publish in later issues of *Computers and Automation* throughout the year, more examples of computer art.

The front cover of this issue shows the art to which we have awarded first prize. Also, in 25 pages of this issue we present what seem to be many of the most interesting, artistic, and significant pieces of art that we have found among the entries.

The computer and its associated graphic plotter make it possible to produce about half a dozen classes of interesting and beautiful art. These classes at present appear to include:

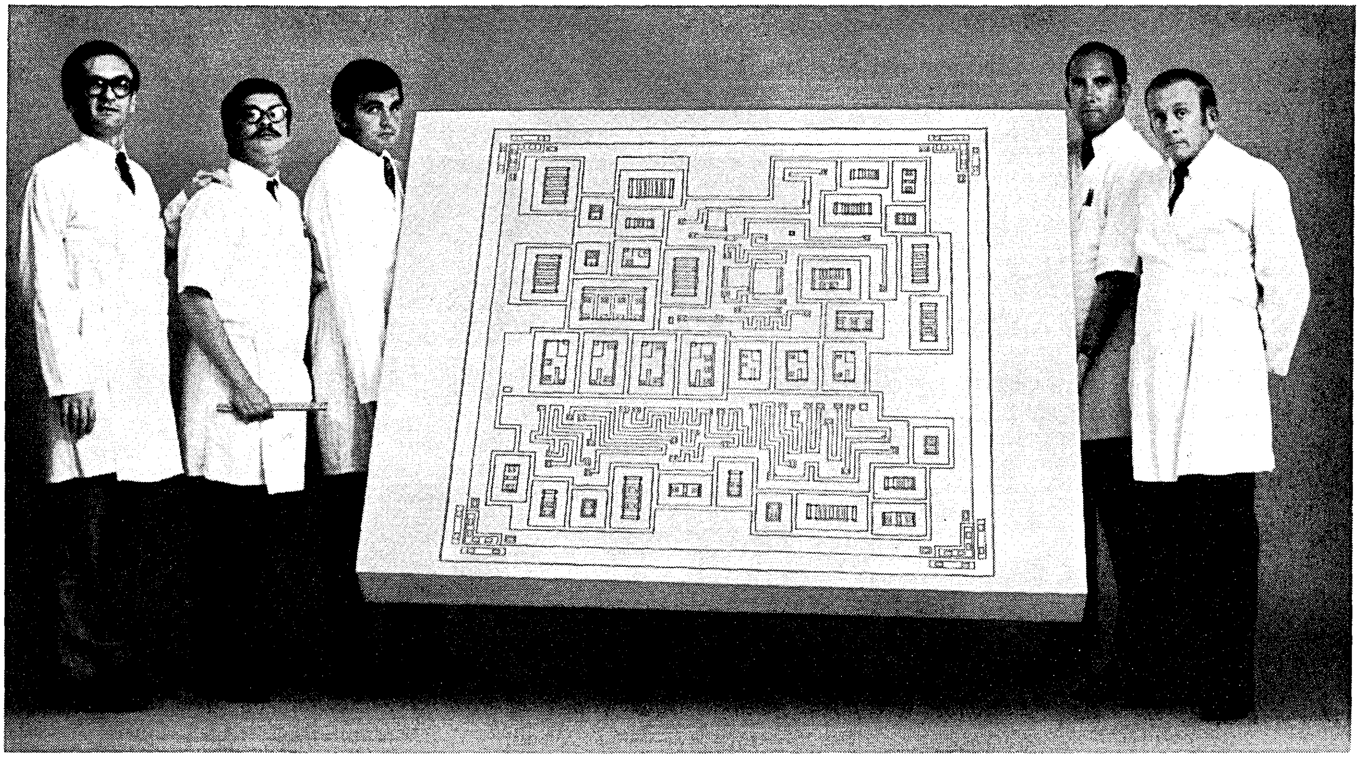
- Lines associated in patterns varying in angle and length;
- Areas bounded by contours;
- Mixtures of controlled and random elements repeated with variations;
- Copies of pictures (of persons, etc.), composed by lines of varying qualities or letters of varying density;
- Successive transformations of a single design by varying its elements (length, width, size, etc.).

Many of these designs are beautiful and striking. But very little so far in computer art seems to have the profound interest and emotional appeal of the best paintings or photography.

Why not?

The degree to which art impresses a human being is, I suppose, closely related to the familiarity of the objects portrayed. Leonardo da Vinci's painting of Mona Lisa is famous because of the enigmatic expression in the face of a woman, something all of us often see and wonder about. Another example I think of is a picture of flowers in a vase, done in bright pastelle colors, by a French artist about 1914, on exhibit in the Museum of Modern Art in New York. The various kinds of flowers are recognizable; the colors placed there in imperishable colored chalk fifty years ago are still brilliant and gorgeous; the entire bouquet, skillfully arranged and balanced, is a lovely example of something I have often seen and enjoyed in the real world. I can't imagine a computer originating a picture like either one of these two without an enormously large amount of programming, which in these days is still impractical.

Yet computer art is one of the new kinds of art that we human beings will now become used to—and perhaps, in time, often find as pleasing as many examples of human art.



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Time was when alphanumeric computer outputs chugged away on the line printer, line drawings zig-zagged on the pen plotter, and creative designs flickered momentarily on the scope face. In fact they still do chug, zig-zag, and flicker.

Something better is called computergraphics, where the computer's tapes can be given to one peripheral that is fast enough, precise enough, and versatile enough to handle all kinds of outputs.

Our FR-80 Film Recorder is a computergraphics system. Give it a personnel listing with corrections to merge and record in one pass. Or a digitized engineering drawing to be recorded and blown back to E-size from 35 mm film. Or a strip chart to be continuously recorded in abutting frames, perfectly registered. Or a directory to be set up in book-quality, like this ad.

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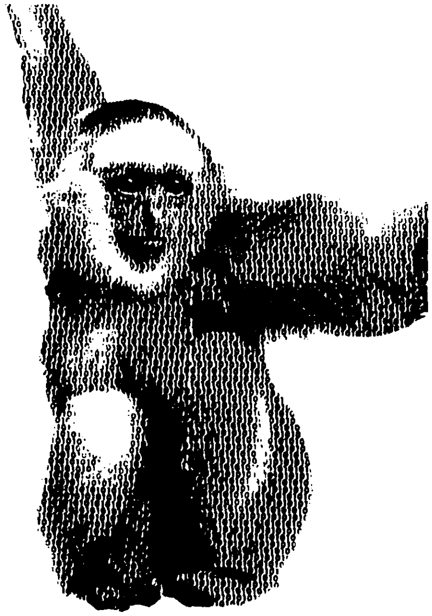
Computergraphics have come a long way



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And PFR-3 is still interpreting and extracting information from oil well logs, oceanological charts, bacterial cultures, cine-theodolite film, displayed wave forms, and many other kinds of image – all automatically. Write or call us if you'd like help on your application.

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AS WE GO TO PRESS

GRAVE DOUBTS ABOUT THE WORKABILITY OF THE COMPUTER PORTION OF THE PROPOSED SAFEGUARD ANTI-BALLISTIC MISSILE (ABM) SYSTEM have been expressed in a statement issued by a group of about 150 computer professionals. Daniel D. McCracken, author of ten books on computer programming and a national lecturer for ACM, is Chairman of the group, "Computer Professionals Against ABM". Other members of the group's executive committee include Prof. Joseph Weizenbaum, Professor of Electrical Engineering and Political Science at M.I.T. and inventor of several computer languages, and Paul Armer, director of the computation center at Stanford University and President of the American Federation of Information Processing Societies (AFIPS).

The group's statement compared the Safeguard system to a computer system which at some unspecified moment would take over the air traffic control of the entire nation without parallel operation, or testing under actual operating conditions, or evolutionary development.

Errors in such systems as air traffic control and election reporting, which were described as much less complex than the Safeguard system, were pointed to as evidence that the Safeguard computer probably could not be made to work at all. Conditions for Safeguard were described as much less favorable: (1) The computing task is more complex; (2) The precise nature of the task cannot be defined; (3) Realistic testing is impossible; and (4) Evolutionary development is out of the question.

The statement concluded: "It is important to realize that the computer would have virtually all of the decision-making power, because the warning time in a nuclear attack would be so short ... that presidential or senior military review would be almost impossible. Our experience with the failures of large computers (not to mention those that send out department store bills) makes us extremely reluctant to place so much life-and-death power in the control of a complex and untested machine.

"Worse, the ABM system could by itself initiate a firing sequence without any attack taking place. This could happen through misinterpretation of radar signals from harmless objects, or because of machine malfunction or programming error. Since the defensive missiles themselves would carry nuclear weapons, destruction of American cities might result, or the action might be interpreted by other nations as hostile.

"...the project is a dangerous mistake. Whatever other arguments may be brought to bear, for or against Safeguard, our conviction is that on technical grounds alone the project does not deserve the support of the Congress."

INTERNATIONAL BUSINESS MACHINES CORP. HAS FILED SUIT AGAINST COGAR CORP., a Herkimer, N.Y., manufacturer of computer equipment. The suit charges Cogar, its president, and 66 former IBM employees working for Cogar with misusing trade secrets. The complaint says that the former IBM workers brought IBM manuals, specifications, and other proprietary information regarding monolithic chip devices to Cogar, in spite of the fact that all of the ex-IBM employees had signed agreements not to disclose any confidential information.

The suit also charges that Cogar solicited contractors who make trade-secret equipment for IBM to make the devices for Cogar. In addition, it accuses Cogar of soliciting IBM employees working on monolithic-chip devices to work for Cogar at night and on weekends and to report on various IBM projects.

In response to the suit, Cogar stated that IBM's allegations are without basis, and described the suit as "an attempt to create and enforce servitude on IBM technical personnel". Cogar President George R. Cogar said the action will in no way affect Cogar's plans for manufacturing semiconductor memories.

The suit was filed in the New York State Supreme Court.

LEASCO DATA PROCESSING EQUIPMENT CORP. HAS SUSPENDED FURTHER ACQUISITIONS OF COMPUTERS FOR LEASE IN THE UNITED STATES. The move will not affect Leasco's European leasing business.

Saul P. Steinberg, Leasco's chairman, said the company's income was unlikely to be significantly affected by the reduction in new lease writings in view of the company's total of $234 million of lease receivables, including undelivered equipment on previously signed leases, and compensating cost reductions made

(Please turn to page 11)

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(Continued from page 9)

possible by the suspension of additional computer bases.

Steinberg said the company was unwilling to accept reduced profit margins on new leases — largely attributable to increased borrowing costs — in view of competing demands for its resources in the computer service field. He noted that the move will free highly-specialized sales and technical personnel for Leasco's nationwide time-sharing system.

IBM CORP. HAS REDUCED ITS EDUCATIONAL ALLOWANCES ON DATA PROCESSING EQUIPMENT. All new orders for data processing equipment received after June 30, 1969, will carry a maximum allowance of 10%. Allowances had previously ranged from 10% to a maximum of 30%.

Eligibility has been limited to 4-year institutions of higher education and junior colleges — and clinics, hospitals and laboratories that are "part of the corporate structure" of eligible schools. The company also announced that effective Nov. 1, 1969, maintenance agreements will no longer qualify for an educational allowance.

The cutback is believed, in part, to be a reaction from pressure on IBM from within the industry against what is termed "discriminatory pricing". (See "ADAPSO Position Paper on Discriminatory Pricing" on page 43.) It may also be in reaction to the Justice Dept. antitrust suit against IBM which charges the company with domination of the educational market because of its "exceptional discriminatory allowances in favor of universities and other educational institutions".

THE ASSOCIATION FOR COMPUTING MACHINERY (ACM) SEES NEW MEMBERS AS A PARTIAL ANSWER TO ITS FINANCIAL PROBLEMS. These problems include a deficit of about $150,000 in the 1968-69 budget which predicted a surplus of $95,000. A surplus of $151,000 is predicted in the 1969-70 budget; its operation will be "monitored" far more closely than in the past.

"RIGHT ANSWERS — A SHORT GUIDE FOR OBTAINING THEM": This publication, mentioned in the May editorial ("The Cult of the Expert"), has drawn over 600 requests from readers. Accordingly, we plan to publish it in full in the September issue.

LETTERS TO THE EDITOR *(Continued from page 4)*

computer programs that solve such problems. I would sincerely appreciate a bibliography of such work, and I would appreciate being put on your mailing list of publications dealing with this subject.

ROBERT P. BANAUGH
Prof. & Chrmn. of Computer Science
Univ. of Montana
Missoula, Mont. 59801

Ed. Note—*We shall be glad to send you a copy of our booklet on Numbles (price $1.20 including postage). We are putting together a bibliography relating to Numbles and cryptarithms.*

The Role of the Abacus

We were delighted to see the abacus used as the subject for your May cover. The abacus is enjoying a new wave of popularity, and not only just in the Orient. The soroban, or high speed abacus, was designed in Japan in the 1930's. While it appears similar to the ancient abacus, it uses a "shorthand" number system which permits easy and extremely fast operation. This has caused it to be used by thousands of Westerners. An average soroban operator can beat an average calculating machine operator with ridiculous ease. In addition and subtraction the soroban can handle figures of any length twice as fast as a clerk with an electric calculator.

As a computer, an abacus is not primitive. In the course of marketing sorobans throughout the United States we have sold many to computer engineers. We were fascinated to discover that several accounting machines and computers use the same calculating scheme in their arithmetic/logic units as the soroban.

You are quite correct in stating that the abacus is useful in teaching "modern mathematics" in schools. As time goes by, we expect to see the abacus used increasingly in the schools.

ROSS W. MURPHY
Marketing Mgr.
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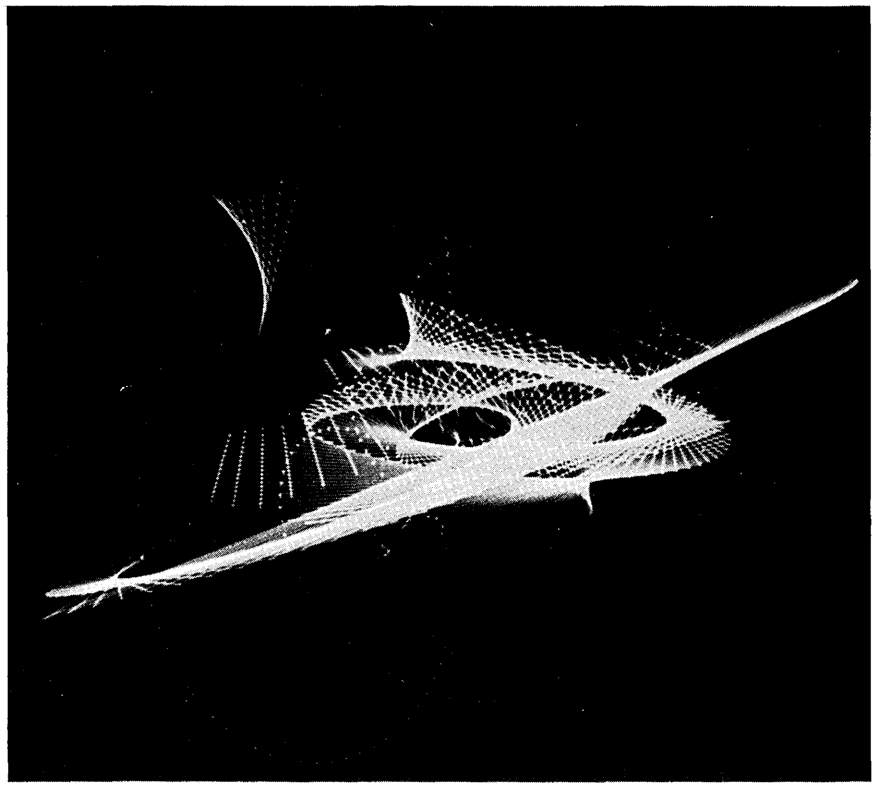
7th annual COMPUTER ART CONTEST



CIRCUS
— Tom Childs

The first prize in our 1969 Computer Art Contest has been awarded to the picture entitled "Circus", which was submitted by Adage, Inc. of Boston, Mass. The winning entry appears in color on the front cover of this issue. It was generated on the Adage Graphics Terminal and photographed by Tom Childs.

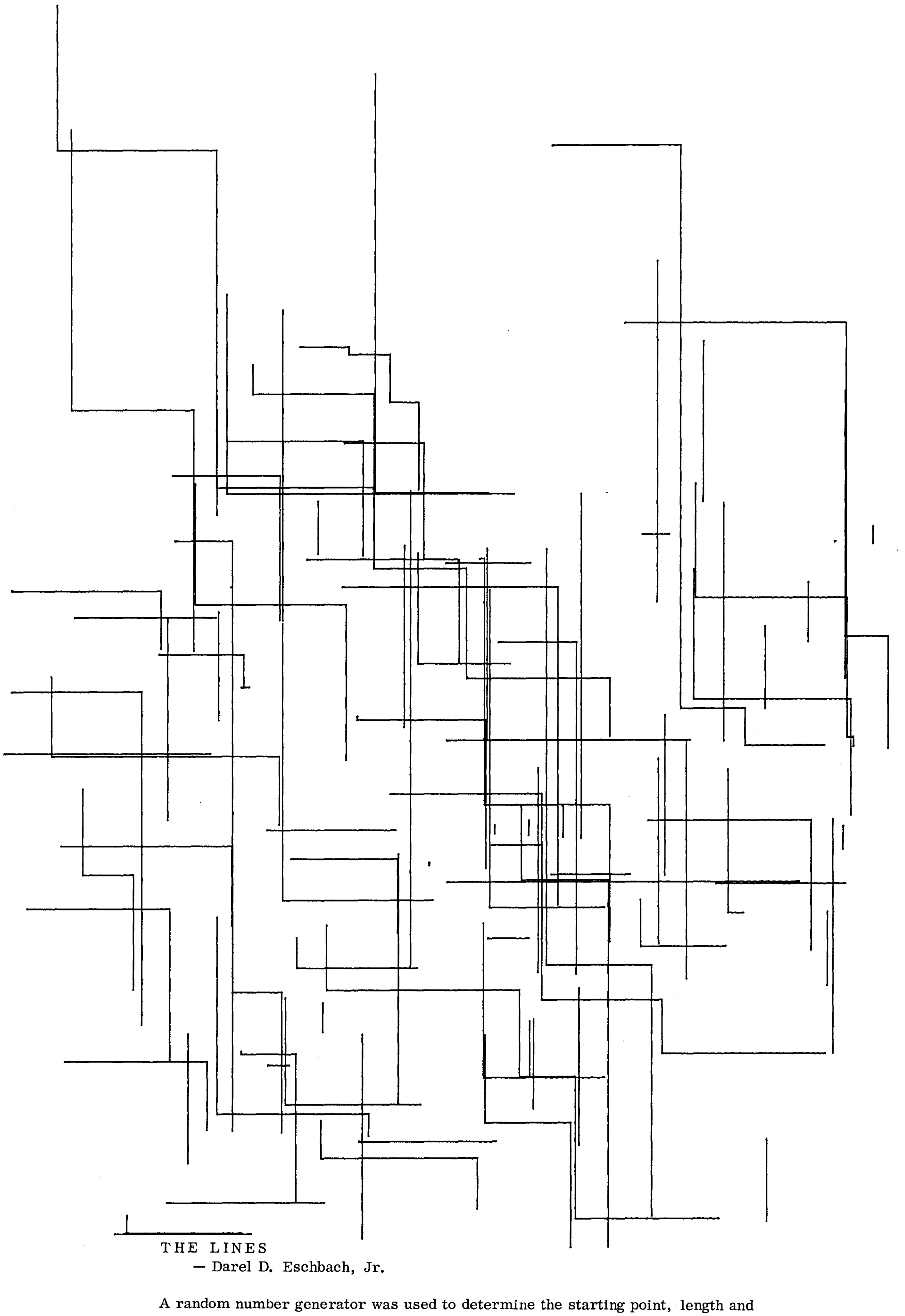
The line end points in the drawing were computed as various frequencies and phases of sine and cosine functions. In some cases, a dot was drawn at the computed point, and in other cases, lines were drawn between pairs of points.

The other computer art published in this issue receives honorable mention. For some of the drawings, the explanation is obvious or can be inferred easily; for others, explanations are given. In a number of cases, the computer and the peripheral equipment which produced the computer art have not been specified as much as we would like because the information did not reach us by the close of the contest, July 3. We would, of course, like to identify the equipment that produced the art. Supplementary information of this kind should be sent to us for publication in a future issue.

The responses to our Seventh Annual Computer Art Contest have been splendid. We are grateful to all those persons who sent us entries.

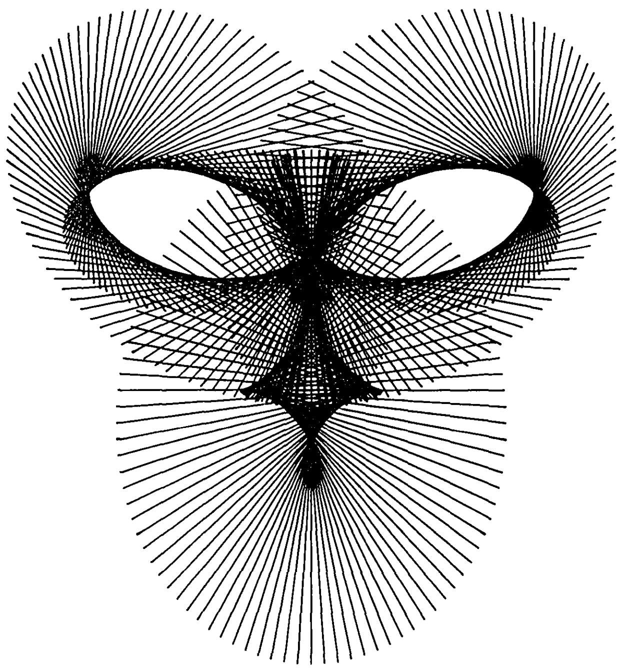
For August, 1970, we plan our Eighth Annual Computer Art Contest, and we cordially invite contributions of computer art from all our readers and others who are interested in computer art.

A complete alphabetical listing of the names and addresses of all persons whose art is published in this issue appears on page 32.



THE LINES
— Darel D. Eschbach, Jr.

A random number generator was used to determine the starting point, length and direction of each line segment. Drawn on an IBM 1620-1627 system.



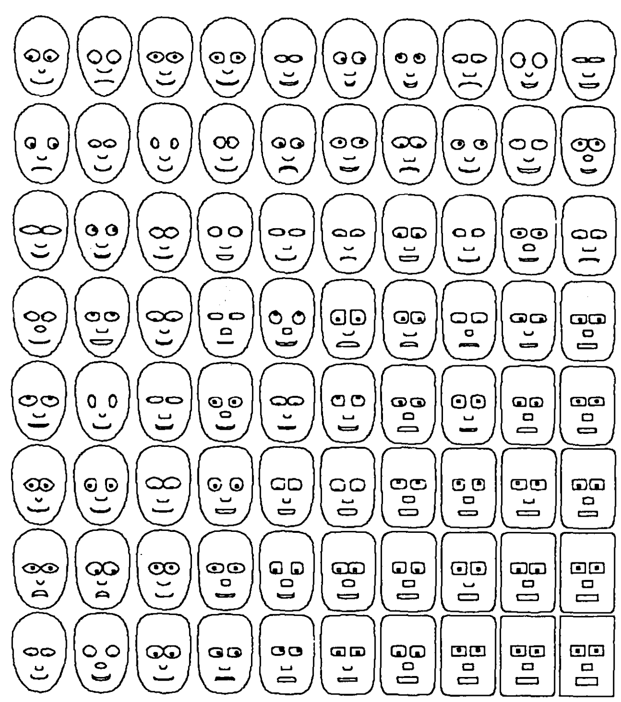
Copyright 1969 by CalComp

MASK
— Kerry Strand

The figure shows the pattern formed by a rod spinning about a closed looping curve. As the stick progresses along the curve, the stick's axis of rotation shifts in and out along its length. Drawn on a CalComp 718 flatbed plotter.

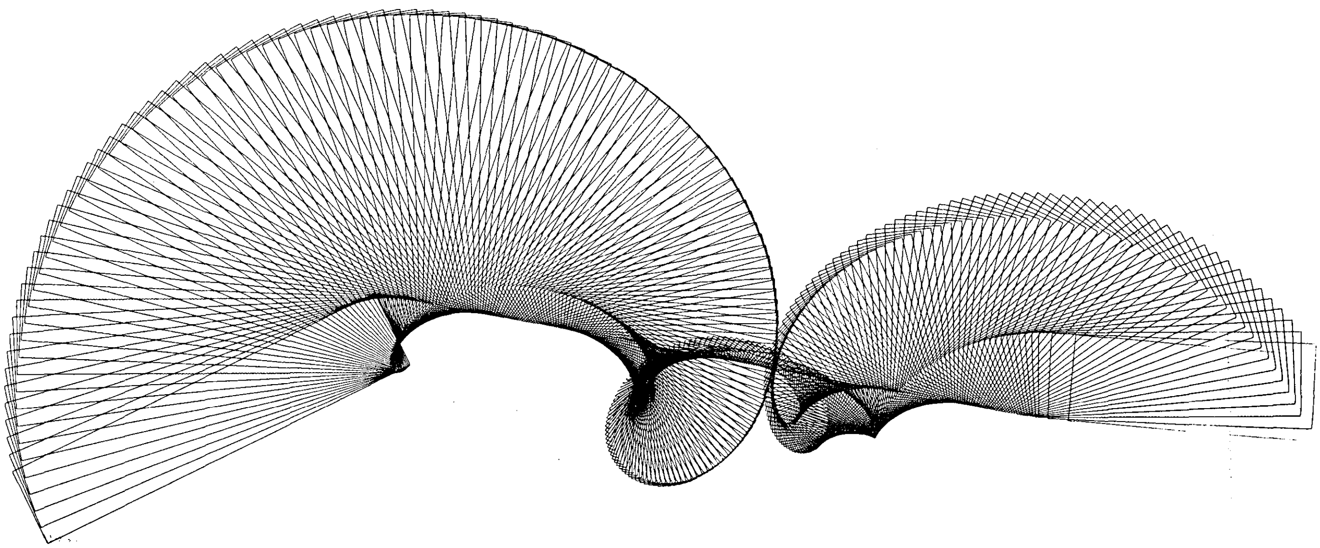
PROGRESS?
— George H. Meyfarth III and Philip F. Meyfarth

Each face is a composite of super-ellipse quadrants with exponents ranging from slightly less than 2 to about 400. The variations in location, size, and shape of the features are controlled by a Gaussian random number generator. The trend toward squareness and conformity in the lower right corner results from predetermined changes in the statistical properties. The mouth expression is correlated with eye position to suggest apprehension in those who see that they themselves are not far from total mechanization. Programmed in FORTRAN and plotted on-line on an IBM 1627 driven by an IBM 1130.



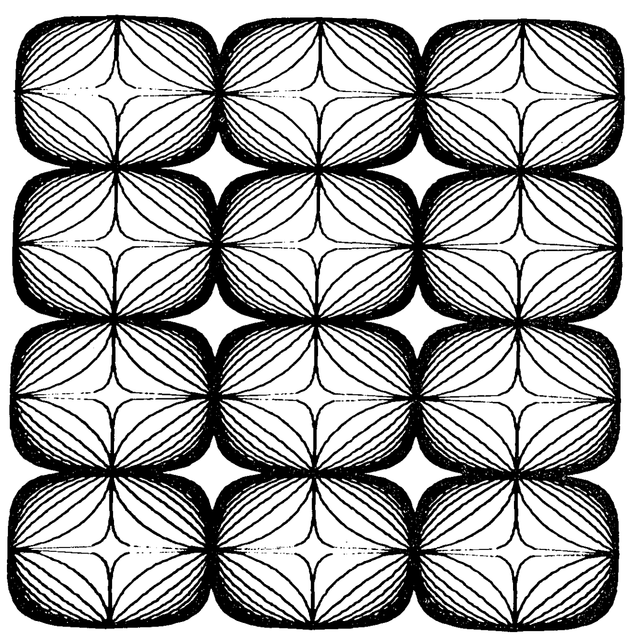
SKETCH FOR A MURAL
— A. M. France

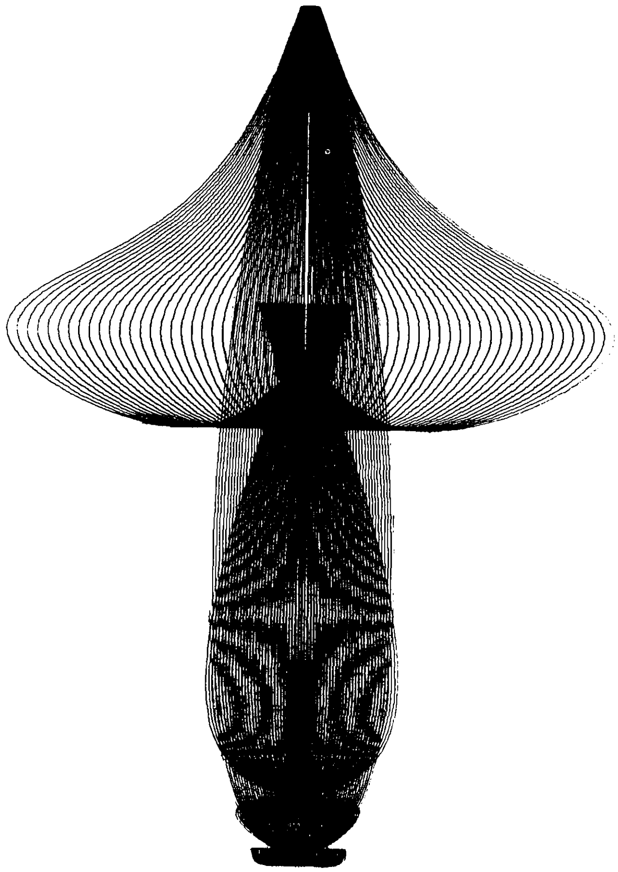
A basic shape was repeated while dimensions, angle, points of origin, etc. were altered by small, interrelated increments. Programmed in FORTRAN on an ICL 1905 computer; drawn on a CalComp 563 plotter.



ELLIPSES
— (Mrs.) Leigh Hendricks

A variation of sub and super ellipses, plotted on a Stromberg Datagraphics S-C 4020 plotter.



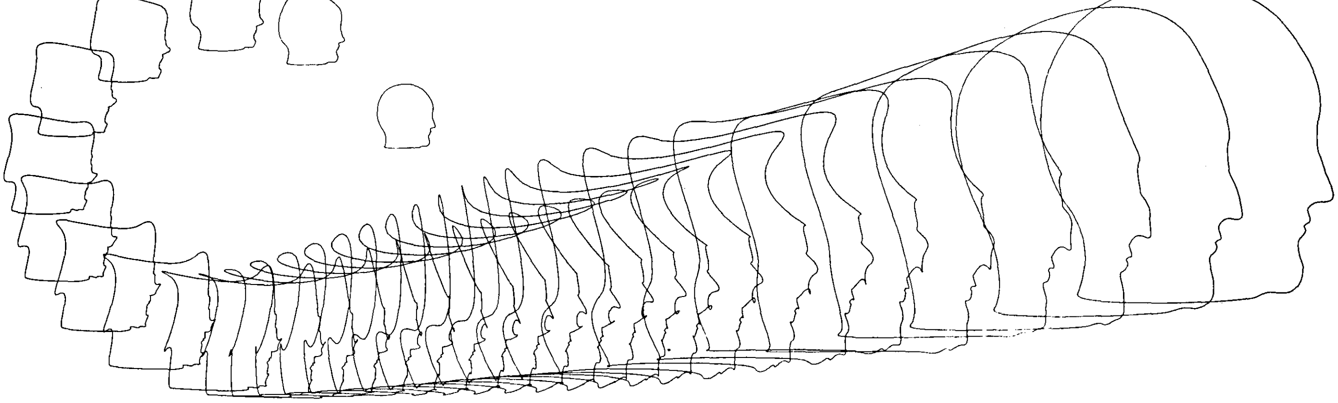


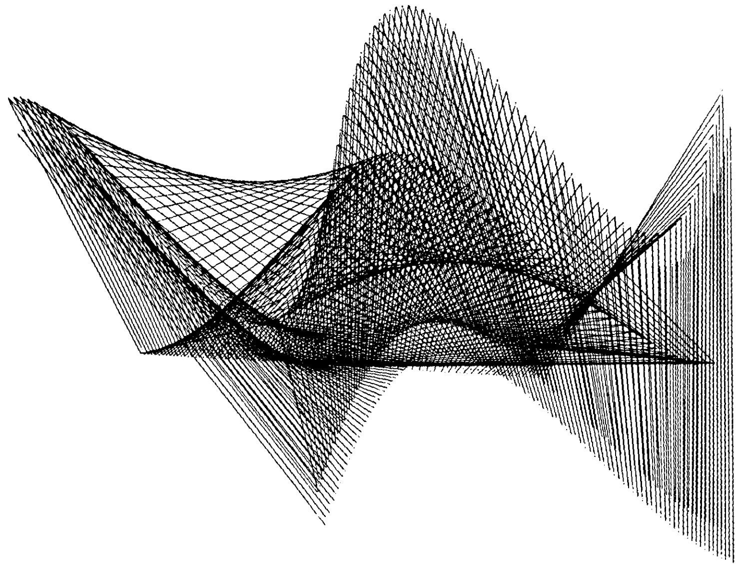
THE LITELY LIT LAMP
— William A. Carpenter

The figure was created by distorting a four-leafed rose with a complex transcendental function. This distorted rose was then made symmetrical by modifying the X coordinates with the sine of another variable, and again with the negative sine while the Y coordinates were modified with the variable itself. The resulting X and Y coordinates were then used to define a Z coordinate. Finally the X and Y coordinates were plotted on the surface described by the X, Y and Z coordinates. Programmed in ALGOL on a Burroughs 5500 computer; drawn on a CalComp 570 plotter.

SCORPION
— Sidney Robertson

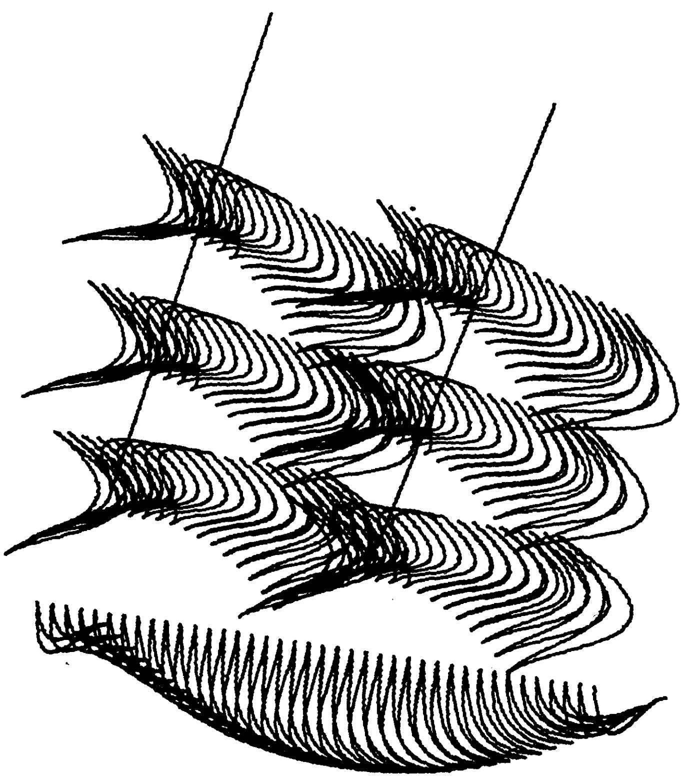
The face profile at the tail of Scorpian is defined with 17 points and direction vectors. Each successive profile results by linearly transforming the 17 points and direction vectors of the face in such a way that the final profile has the same shape as the original. Produced by a CDC 3600 computer and a CalComp 564 plotter.





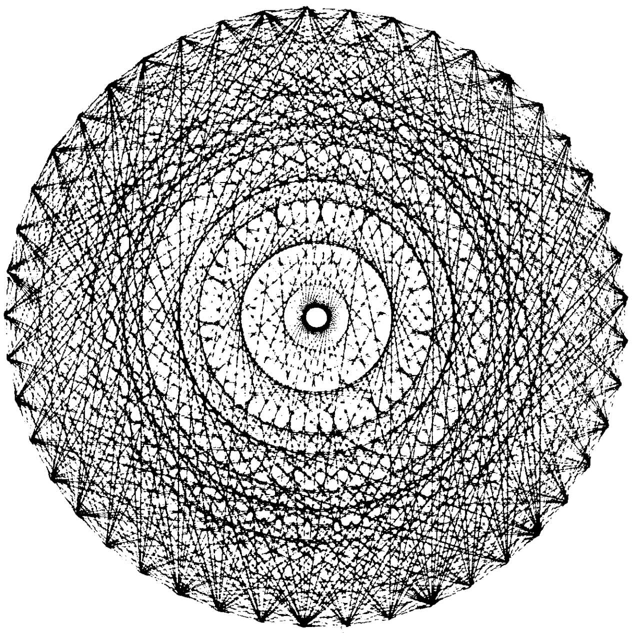
BILLOWS
— David Caulkins

Matrices were filled with arrays of points which represent various curves or lines. The points were then connected with straight lines to produce textures and moire patterns. Produced with a Univac 1108 computer and a CalComp plotter.



FLYING DUTCHMAN
— Michael Davis

Plotted on a CalComp plotter at Stanford University.

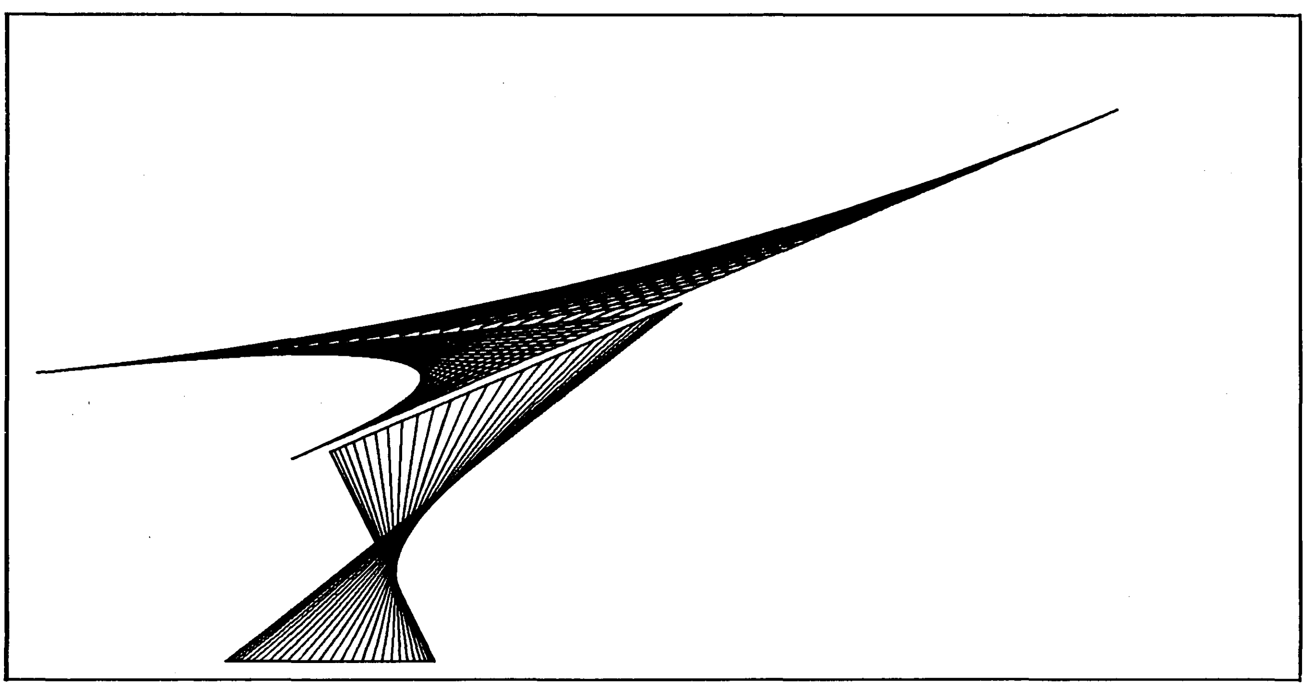


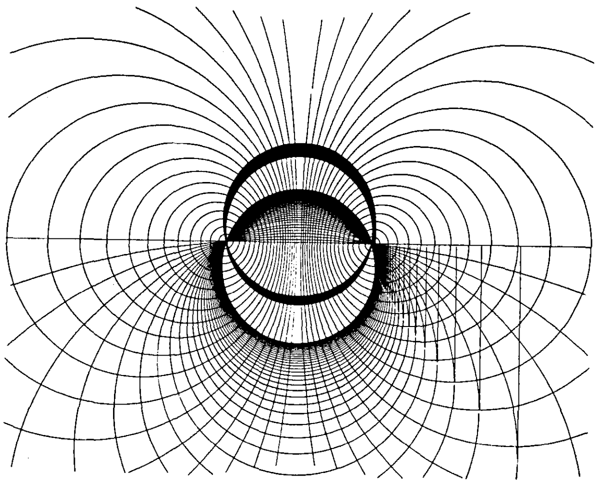
CONNECTIONS #3
— A. M. France

A series of vertices of a polygon are generated, and then linked. Programmed in FORTRAN on an ICL 1905 computer; drawn on a CalComp 563 plotter.

ASPIRATIONS
— James S. Lipscomb

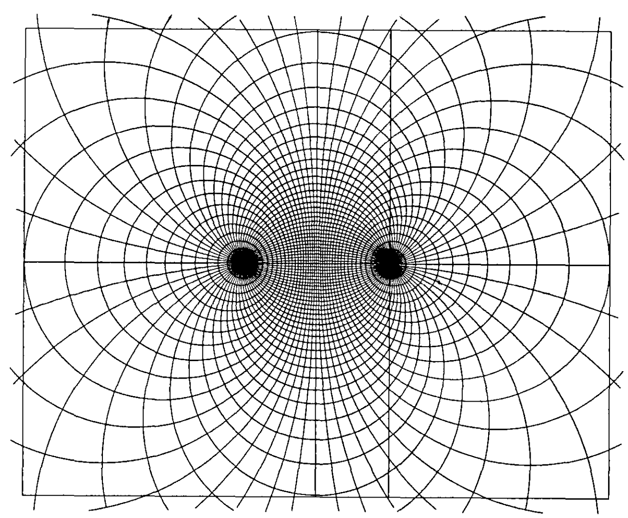
Programmed in FORTRAN on an IBM 1620 computer and drawn on-line by a CalComp 565 plotter.

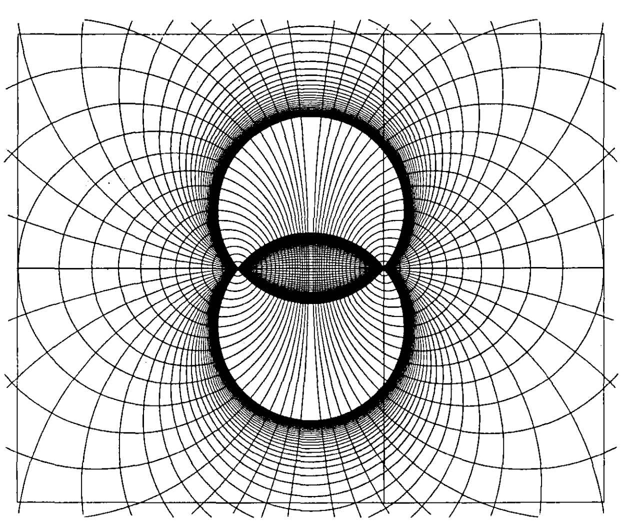


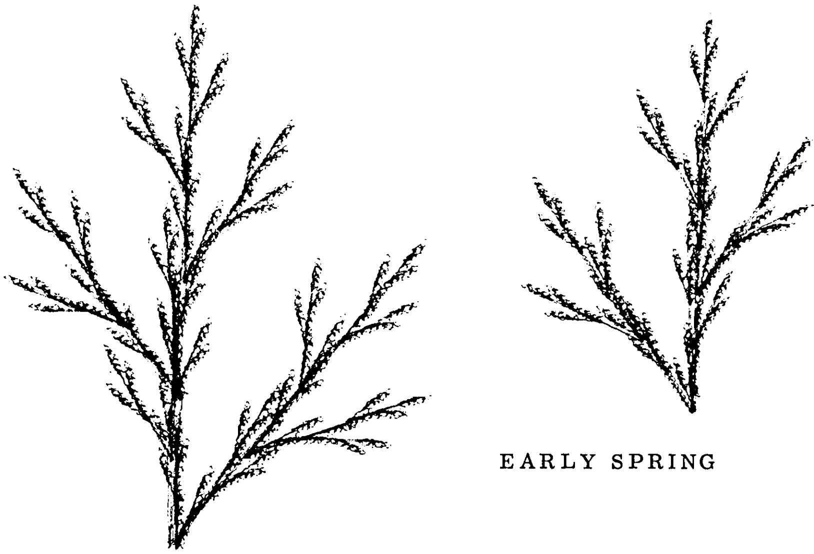


CONTROL THEORY
— E. M. Pass

The pictures above and below resulted from bugs in the program which eventually produced the picture below. Programmed on a Univac 1108 computer and drawn on a CalComp 770/763 offline incremental plotter with a stepsize of .005 inches.





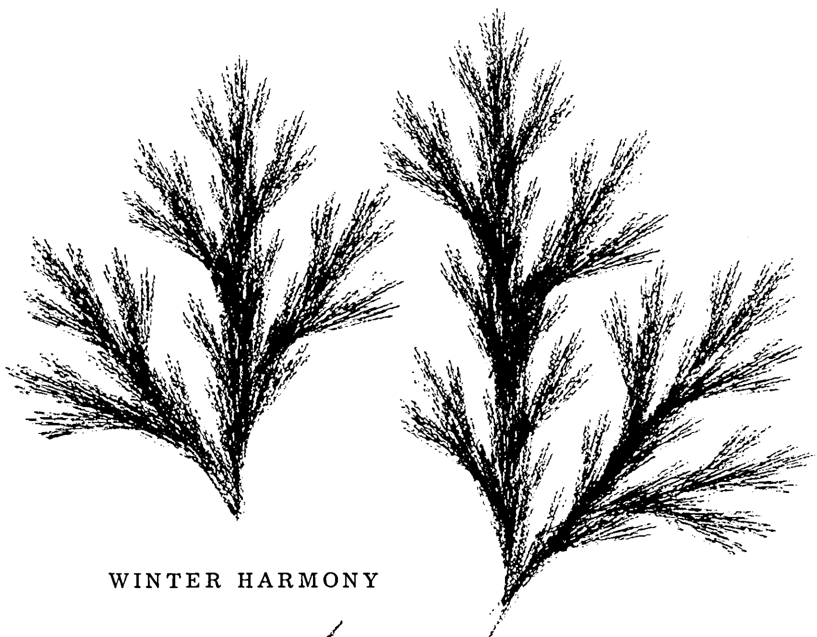


EARLY SPRING

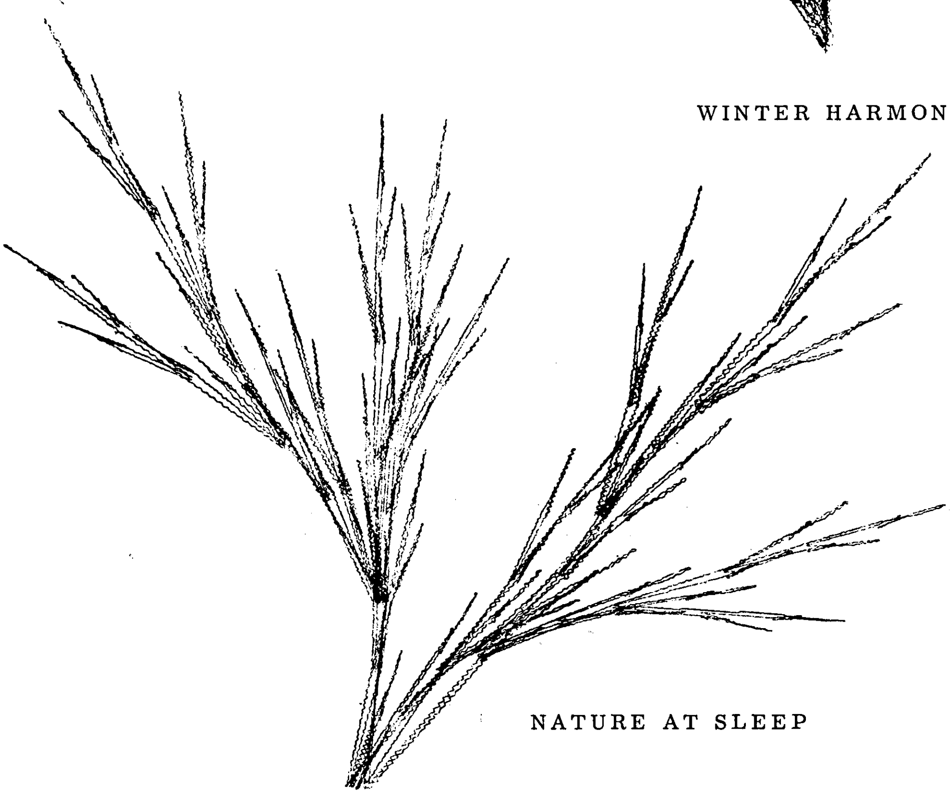
SEASONS

— Petar Milojevic

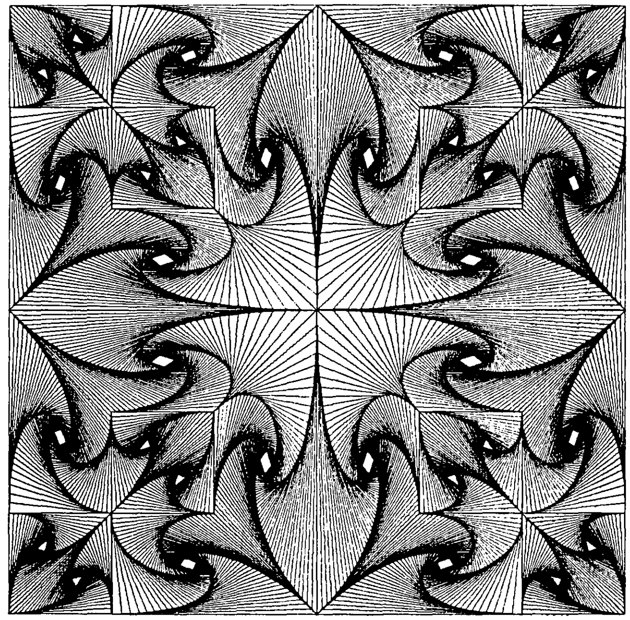
These three drawings are based on a pattern which reminds one of floral forms. The program is written in FORTRAN using random generators and with various parameters can produce unlimited floral designs. Drawn on a CalComp 565 plotter.



WINTER HARMONY

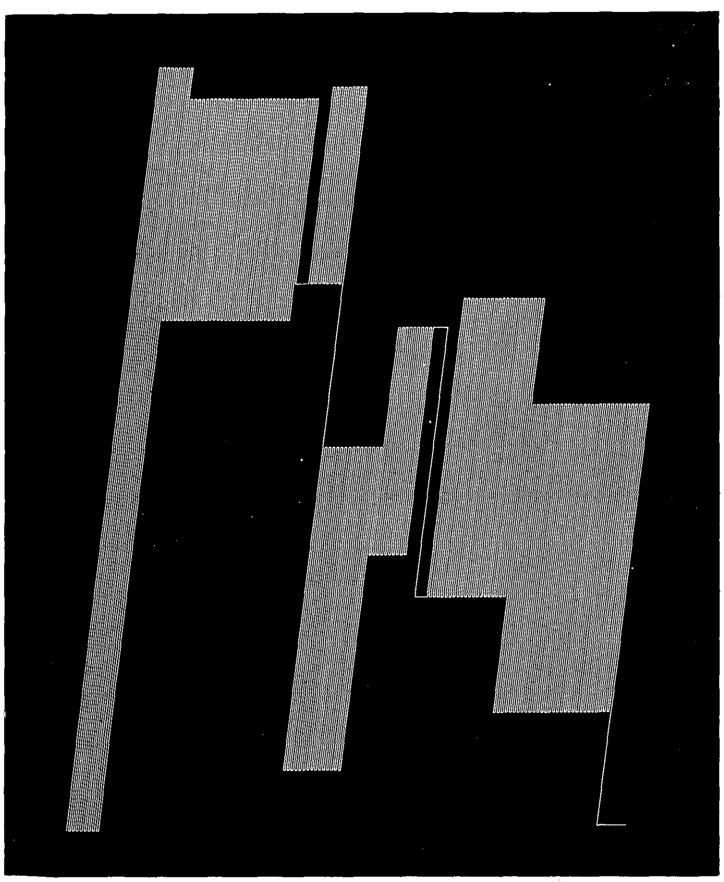


NATURE AT SLEEP



SPEARS
— Steve Derby

The algorithm for this drawing used spirals of a geometric figure inside itself. Produced with a CDC 3600 computer and a CalComp plotter.

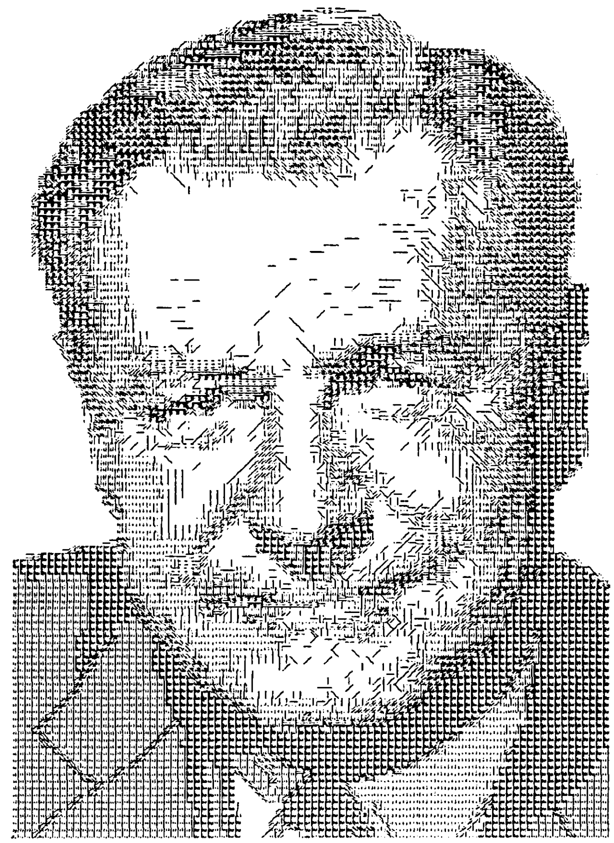


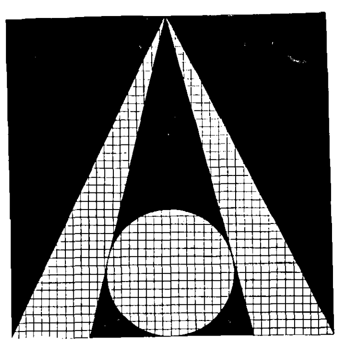
SLANT NO. 1
— Auro Lecci

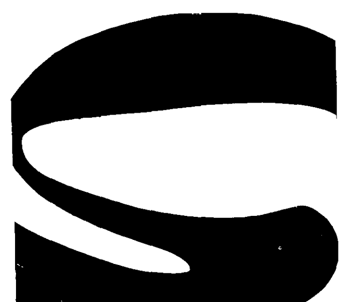
A subroutine provides random numbers that are used to influence decisions concerning all factors except the slope and the distance between neighboring lines inside blocks, which are pre-determined. Three decision levels are to be found in the program. The first is concerned with predetermining the length of the entire drawing along the X-axis. The second is concerned with decisions related to the length of the lines along the Y-axis and the number of times each line is to be repeated to form a block. The third controls connections between blocks and decides on the length of jumps, if any. All these decisions are taken at random, and each run through the computer gives a remarkably different pattern. Produced with an IBM 7090 computer and a CalComp plotter.

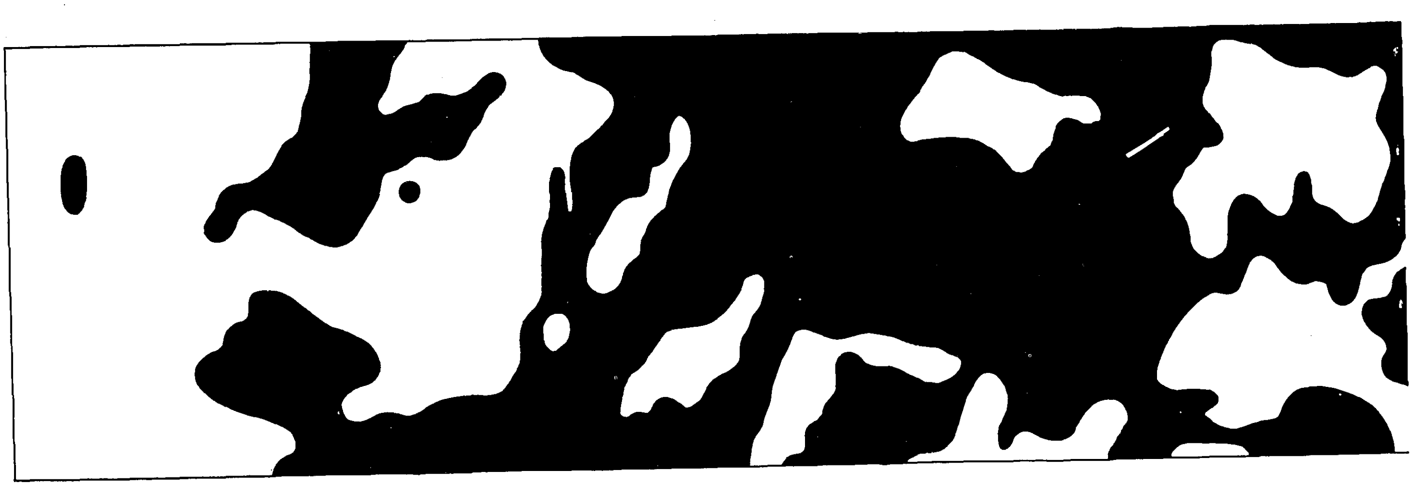
PORTRAIT (NELSON ROCKEFELLER)
— Anton G. Salecker

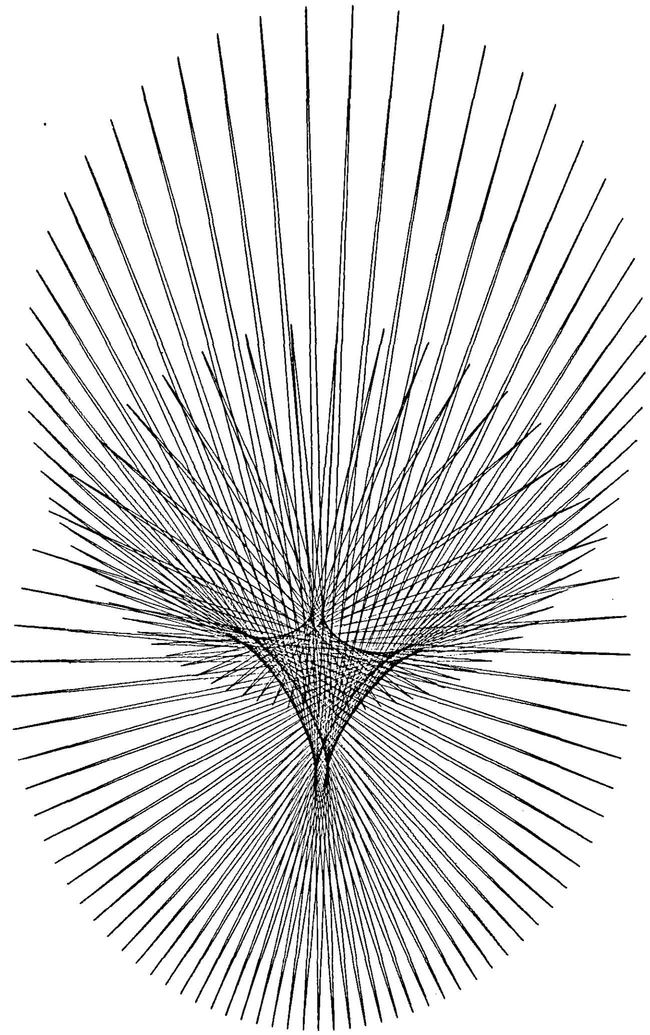
Input consisted of simple control data and thousands of pieces of digitized information. One of 16 preset patterns was plotted in each square of a large rectangular grid layout, according to the digitized input, to produce the final result. Programmed in ALGOL. Produced by a Burroughs 5500 computer and a CalComp 563 plotter.









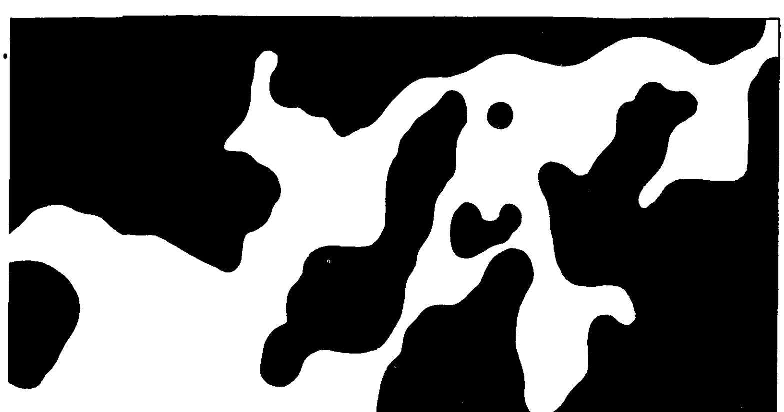


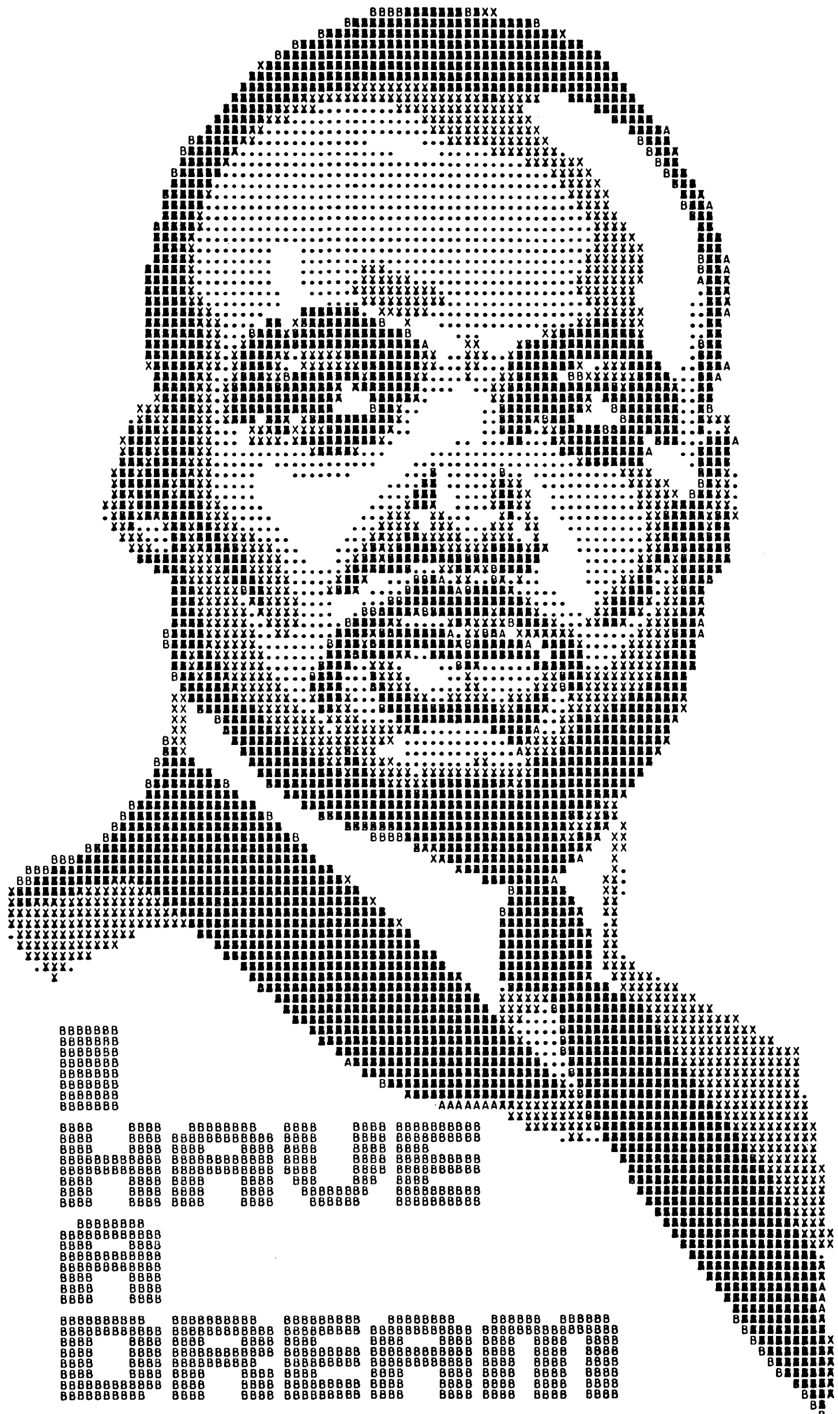
RESURRECTION
— William S. Maloney, S. J.

Circle and ellipse coordinates were calculated at various polar angles, and points were connected in several different ways. Programmed on a CDC 3300 computer; drawn on a CalComp plotter.

PATTERN OF FLOW
— Hiroshi Kawano

This work (below) consists of 8000 random number series arranged into a 40 x 200 format of two picture elements (white and black), which are generated from the transition probability matrix about all possible combinations of nine picture elements in the three pictures at the left, by means of the Monte Carlo method. Programmed in FORTRAN 4 on a HITAC 5020 computer. A line printer was used as an output device, and the final work was coded by human hand.

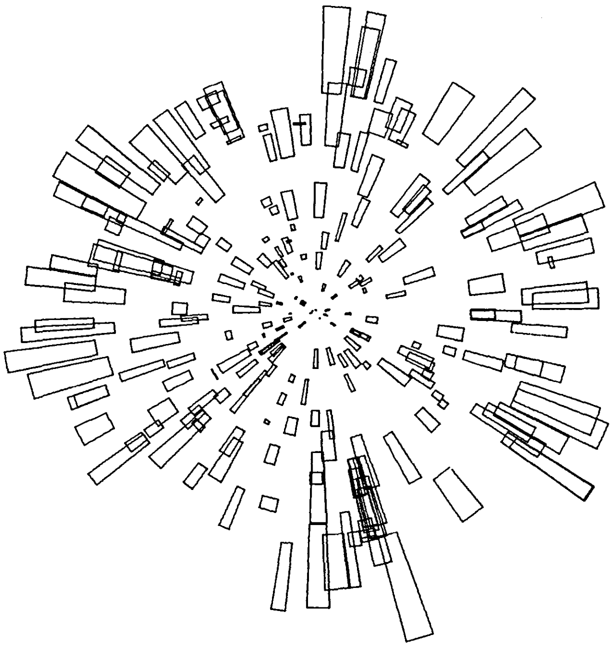




© COMPUTER PORTRAITS 1969

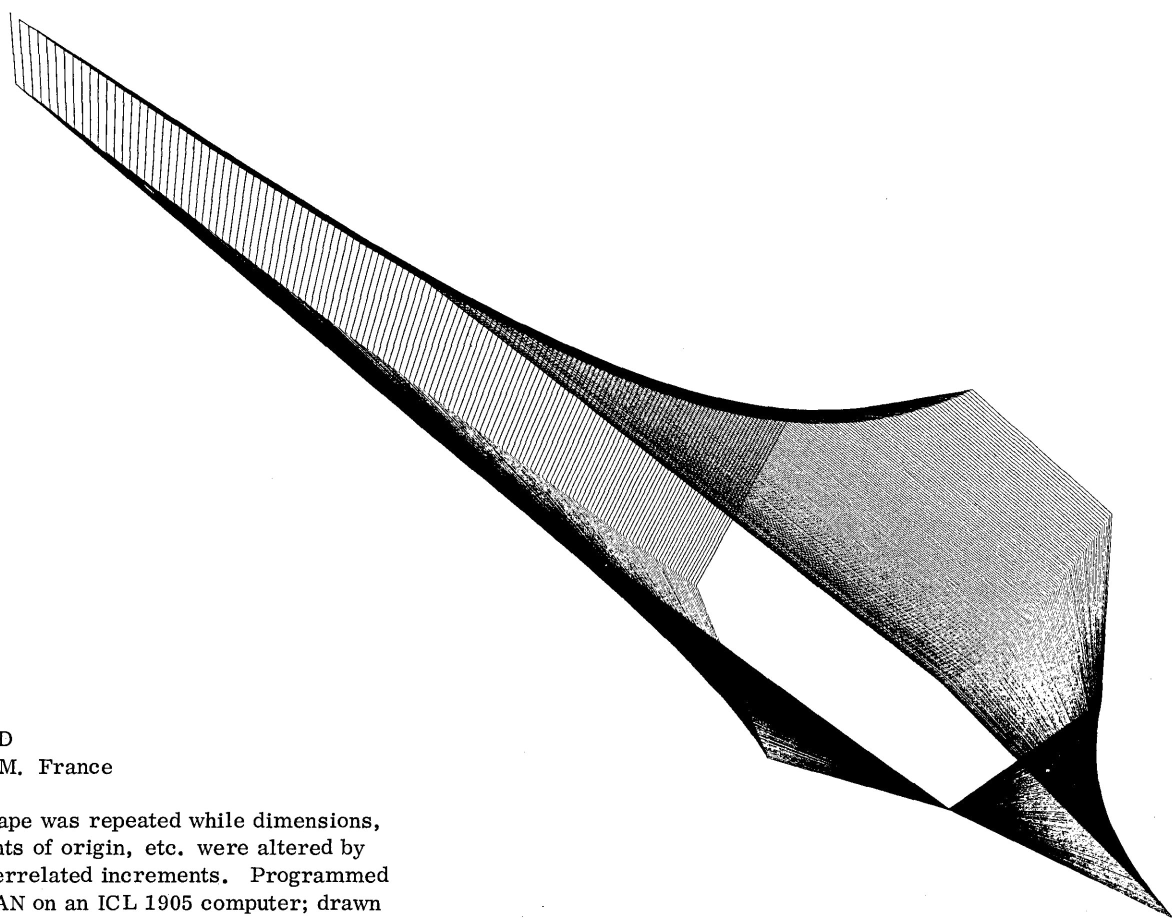
PORTRAIT (MARTIN LUTHER KING, JR.)
— Hendrikus J. Nolle and Emilio D. Rodriguez

Programmed and run on an IBM 1401 system.



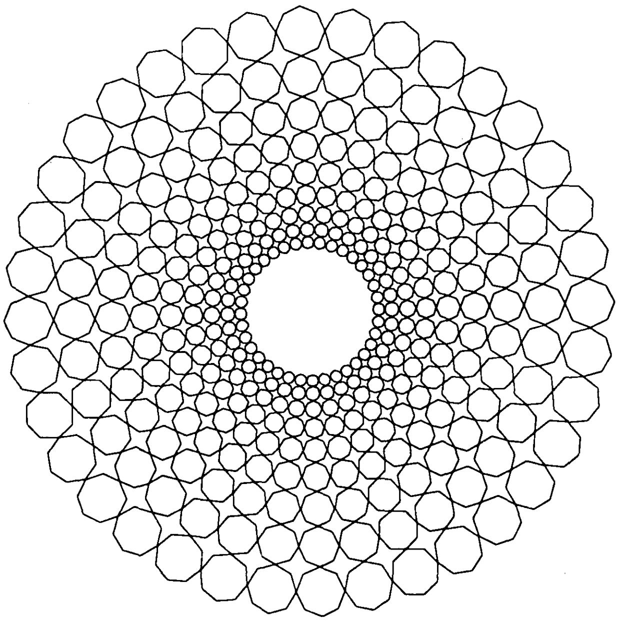
EXPANDING UNIVERSE
— Darel D. Eschbach, Jr.

Random numbers controlled the parameters of location, size of base, and ratio of height to base. Drawn on an IBM 1620-1627 system.



HOT ROD
— A. M. France

A basic shape was repeated while dimensions, angle, points of origin, etc. were altered by small, interrelated increments. Programmed in FORTRAN on an ICL 1905 computer; drawn on a CalComp 563 plotter.

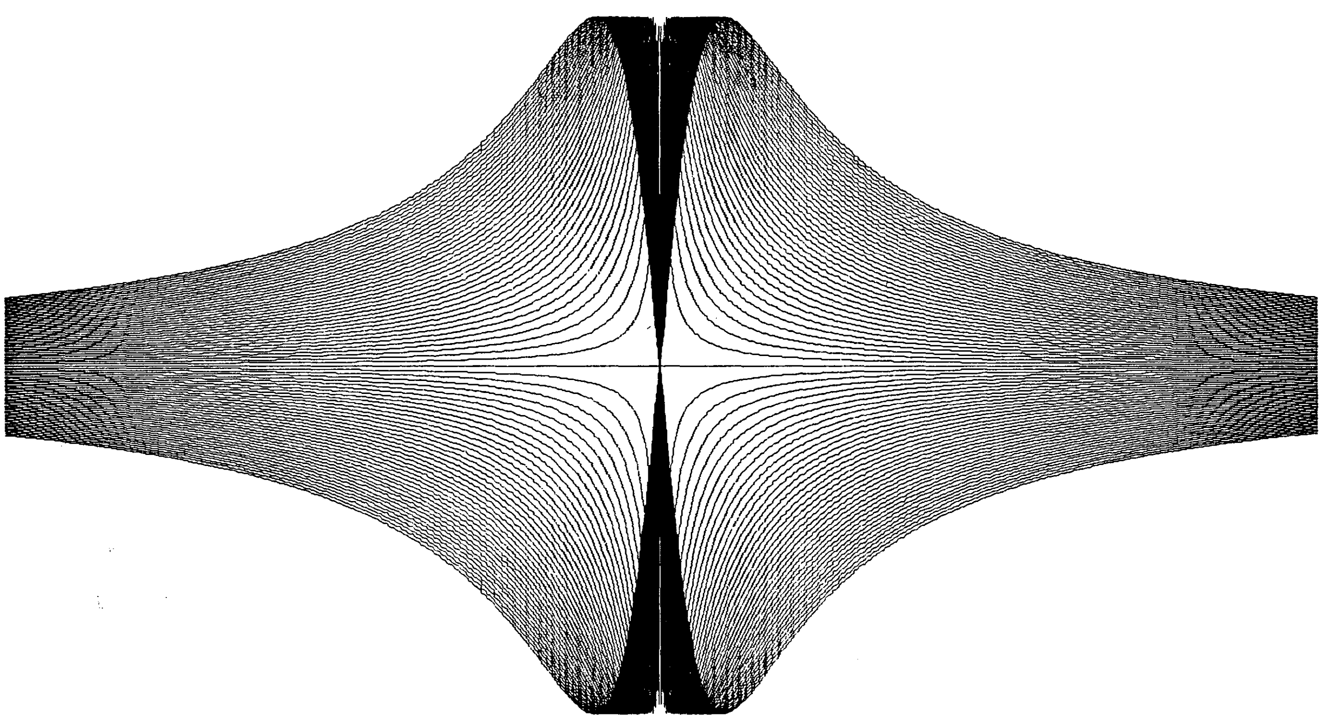


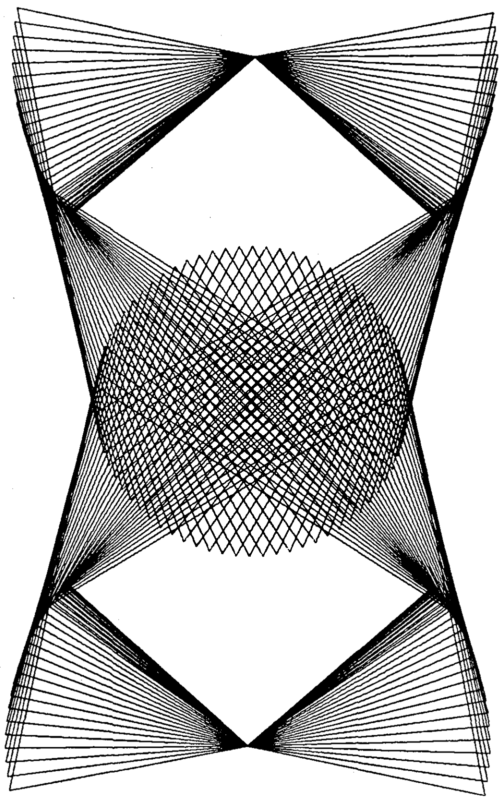
OCTAGONAL WELL
— Donald Robbins

A study of three-dimensional effects without use of the three-dimensional transformation. Programmed on a Univac 1108 computer; drawn on a Stromberg Datagraphics S-C 4020 plotter.

IMPACT
— J. A. Elenbaas

A series of serpentine curves programmed on an IBM 1130 computer and drawn on a CalComp 565 plotter.





LADY

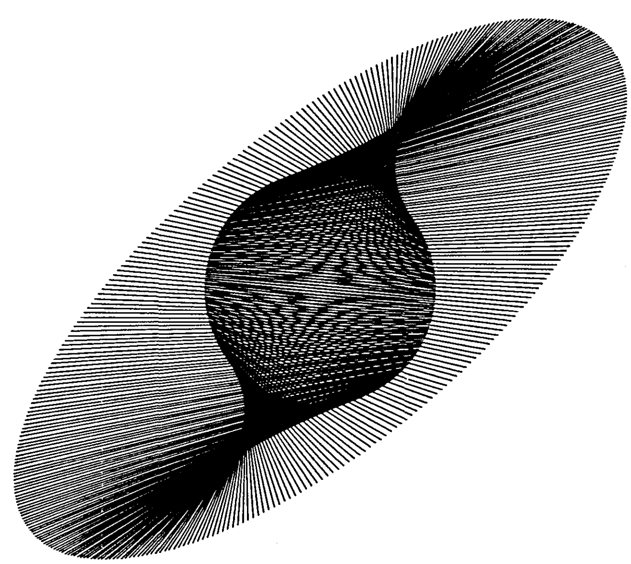
— John Cope and Ronnie Shiver

This is the motion of a four-bar mechanism that is propelled by its shortest side and then rotated in all four quadrants. Produced by an IBM 360/50 computer on a CalComp 663 plotter.

DISTORTED CIRCLE

— James Daly, S. J.

The figure consists of 360 straight lines connecting points from an inner circle to an outer circle, both circles having been distorted. Programmed in FORTRAN 4 and compiled and run on a CDC 3300 computer. Drawn on a CalComp 563 plotter.



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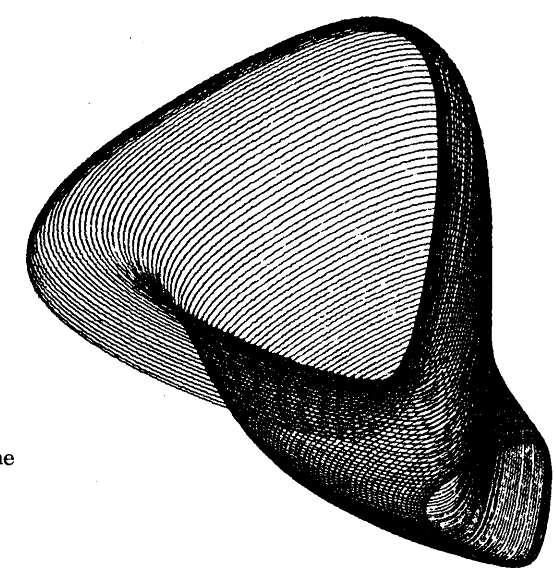
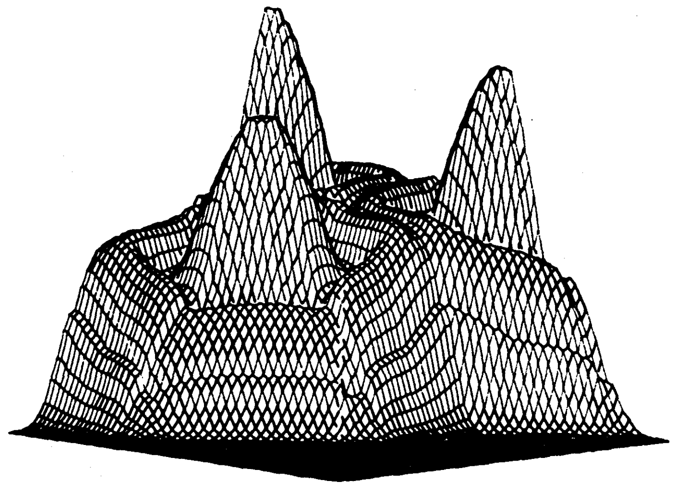
HEBREW ALPHABET
— Harold Minuskin and Bill Scott

The Hebrew alphabet was generated and recorded on the CalComp Model CRT Microfilm Digital Graphics System. The program was written in DAP. Each character was generated using a ten by twelve matrix.

MOLLUSK
— William A. Carpenter

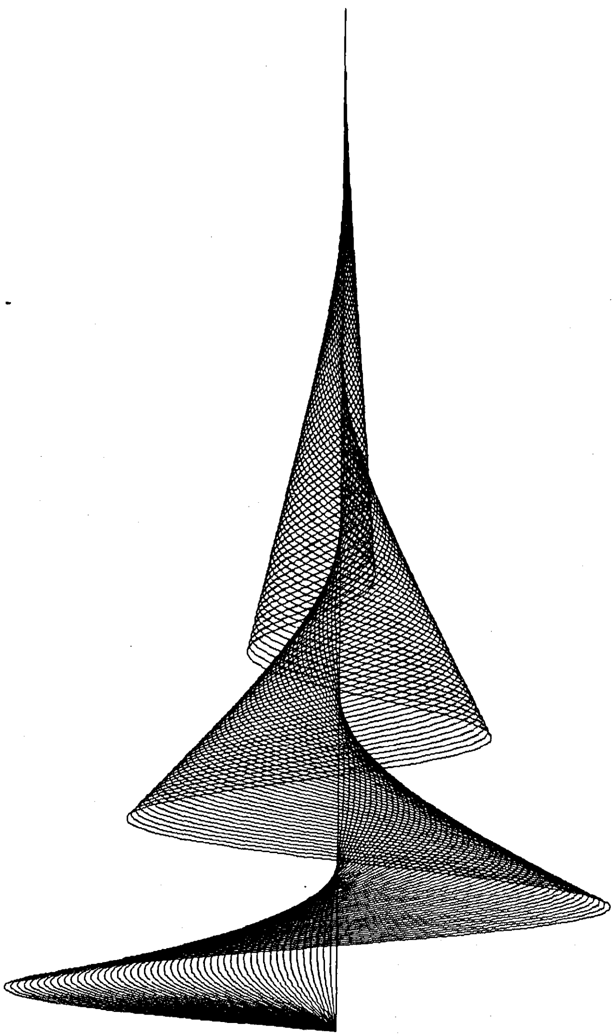
The drawing is composed of 101 figures of the form: exponential of sine of T versus the exponential of the cosine of T. Each successive figure is smaller than the last, and the centers of the individual figures fall on the curve given by: exponential of the sine of T versus the sine of T times the exponential of the cosine of T. Programmed in ALGOL on a Burroughs 5500 computer, and drawn with a CalComp 570 plotter.





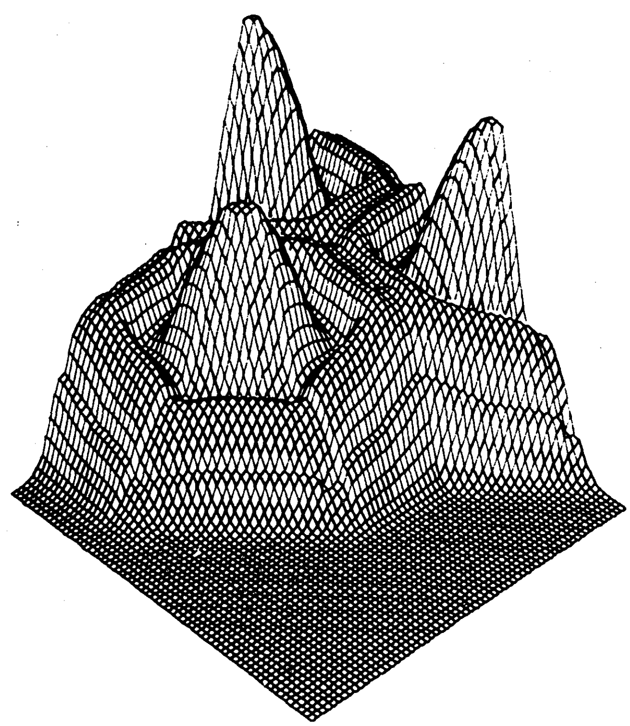
ERUPTION
— David J. DiLeonardo

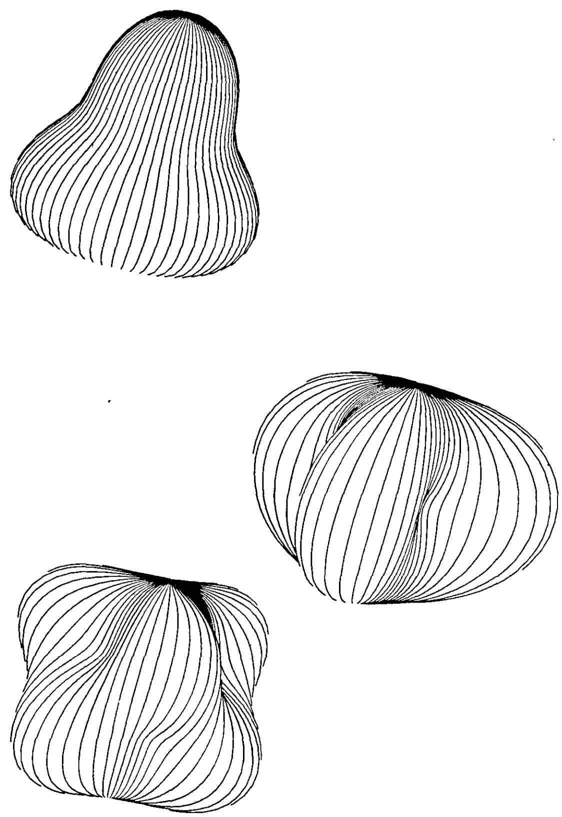
Perspective views of data arrays, produced with a CDC Model 280 Microfilm Recorder and a CDC-6600 computer.



CHRISTMAS 2001
— J. A. Elenbaas

A series of damped sine curves, programmed on an IBM 1130 computer and drawn on a CalComp 565 plotter.





LEVITATION
— Sidney Robertson

Each figure is an oblique projection of a spherical harmonic with the hidden lines removed. The upper left harmonic is the so-called "pear-shaped" zonal. The lower left figure is a 4th degree tesseral and the rightmost figure is a 3rd degree sectorial. Produced with a CalComp 564 plotter and a CDC 3600 computer.

COMPUTER ARTISTS IN THIS ISSUE

The following is a list of persons whose art is published in this issue as part of the Seventh Annual Computer Art Contest of Computers and Automation.

Carpenter, William A., 10-6 Copeley Hill, Charlottesville, Va. 22903
Caulkins, David, Los Angeles, Calif.
Childs, Tom, c/o Adage, Inc., 1079 Commonwealth Ave., Boston, Mass. 02215
Cope, John, Computer Center, Auburn Univ., Auburn, Ala. 36830
Daly, James, S. J., St. Louis University, James Henry Yalem Scientific Computer Center, 3690 W. Pine Blvd., St. Louis, Mo. 63108
Davis, Michael, 3004 Dana St., Berkeley, Calif. 94705
Derby, Steve, 607 W. Kilbuck, Tecumseh, Mich. 49286
DiLeonardo, David J., Westinghouse Electric Corp., Bettis Atomic Power Lab., Box 79, West Mifflin, Pa. 15122
Elenbaas, J. A., 1394 Rumbaugh Lane, Midland, Mich. 48640
Eschbach, Darel D. Jr., University of Toledo, Toledo, Ohio 43606
France, A. M., International Computers Ltd., Bridge House, Putney Bridge, London, SW6, England
Hendricks, Mrs. Leigh, Sandia Corp., Advanced Techniques Div., P. O. Box 5800, Albuquerque, N. M. 87115
Kawano, Hiroshi, 3-16-1-15, Aoto, Katsushika-ku, Tokyo, Japan
Lecci, Auro, Centro Ricerche Estetiche F Uno, via Pagnini 31, 50134 Firenze, Florence, Italy
Lipscomb, James S., 26 Woodfall Rd., Belmont, Mass. 02178
Maloney, William S., S. J., Jesuit Faculty Residence, 221 N. Grand Blvd., St. Louis, Mo. 63103
Meyfarth, George H. III, Tufts University Computation Center, Medford, Mass. 02155
Meyfarth, Philip F., 322 Harvard St., Cambridge, Mass. 02139
Milojevic, Petar, c/o Control Supervisor, Information Science Ind. Ltd., 1755 Woodward Dr., Ottawa 5, Ontario, Canada
Minuskin, Harold, CalComp, 305 N. Muller St., Anaheim, Calif. 92803
Nolle, Hendrikus J., 22068 Tuscany, E. Detroit, Mich. 48021
Pass, E. M., Rich Electronic Computer Center, 225 North Ave. N. W., Atlanta, Ga. 30332
Robbins, Donald, Sandia Corp., Albuquerque, N. M. 87115
Robertson, Sidney, 8241, Adenlee Ave., Fairfax, Va. 22030
Rodriguez, Emilio D., 22068 Tuscany, E. Detroit, Mich. 48021
Salecker, Anton G., State of New York, Dept. of Transportation, 1220 Washington Ave., State Campus, Albany, N. Y. 12226
Scott, Bill, CalComp, 305 N. Muller St., Anaheim, Calif. 92803
Shriver, Ronnie, Computer Center, Auburn Univ., Auburn, Ala. 36830
Strand, Kerry, CalComp, 305 N. Muller St., Anaheim, Calif. 92803

COMPUTER-AIDED SCULPTURE

Roger Ives, Vice Pres.
Brown-Wales Co.
165 Rindge Ave. Extension
Cambridge, Mass. 02140

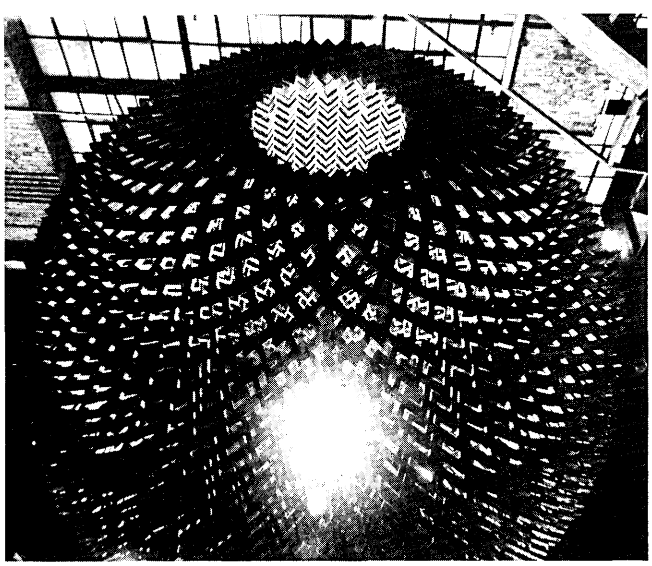
The spheroid sculpture in what will soon be a new postoffice building in Boston's Government Center is there because the computer made it a reality. It was designed by Alfred Duca, a sculptor and artist; it was created by a numerically-controlled flame cutting machine.

Mr. Duca was commissioned by the building's architects to design a sculpture to adorn the entrance to the new building. He conceived the idea of a massive steel structure made of Cor-ten steel, a product with built-in controlled rusting, which, within a year, would turn the spheroid a permanent deep red color. The shape would be like a many-sided jewel—and could be considered symbolic of that part of Boston which half a century ago was a melting pot for immigrant scholars and tradesmen alike.

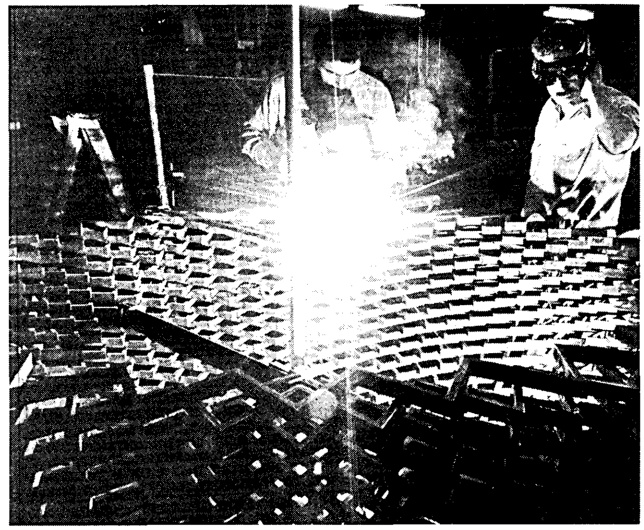
The final design for the spheroid put its diameter at seven feet; there were eighty layers of one-inch thick steel, each layer punctuated by 32 points cut in a circular saw-tooth pattern. Because of the complexity of the design, Mr. Duca became convinced that the sculpture required the aid of a computer to attain its proper three-dimensional form.

Andrew Wales, President of Brown-Wales, a steel distributing company in Cambridge, Mass., developed and wrote a computer program for the cutting of the steel. It allowed for a maximum accumulated error per segment of 3.5 thousandths of an inch. The analyzed design then became a roll of punched paper tape.

It took four torches of a flame cutting machine, controlled by the punched paper tape, four days to bite through the steel plate. Then Mr. Duca and an assistant donned protective masks and spent the next two months welding the 2,460 points of the spheroid to each other—stretching, forming, and checking to make certain of each point's contribution to the total design balance.



The interplay of light and shadows gives Alfred Duca's computer-aided steel spheroid the desired jewel-like qualities the artist strove to convey by this work of art.



Final assembly of the multi-faceted metal sculpture was carried out under the direction of the artist, Alfred Duca (right), and an assistant in the plant of Ramsay Welding Research, Cambridge, Mass.

From its assembling point, the spheroid was transported to its permanent environment, where it was placed on a three-foot pole set into an open circle of a concrete rectangle.

Mr. Duca was asked if he would use the computer again in his work. His comments follow:

> Of course! In fact, I'm working on a new design right now—it will be 40 feet tall and require a half acre site. It should be made clear that a computer cannot be *forced* to be part of a design—it must be ascertained to be *necessary* to its success. Three years ago, I did a sculpture for the Castle Square Housing Project in Boston's South End—I thought I needed computer participation, but when the design problem was analyzed, it was found that the computer would provide no time or accuracy benefits over planning it manually. The computer was not necessary for that project's success.
>
> To me, the Brown-Wales computer and the numerically controlled cutting machine were tools, employed to solve the production technicalities of *my* design. The other approach to design by computer—the sophisticated, dehumanized version in which the computer itself originates the design parameters—does not interest me for my work. In the case of the spheroid, the computer was the only way to carry it out; I appreciate its help, but I don't want a 'made by computer' label on any of my sculpture.
>
> Will the public accept computer art? The layman will accept *any* kind of process. Do you know who were the most astonished over the computer's part in the fabrication? The tradesmen! . . . the carpenters and electricians and the construction people who were working on the new buildings . . . those who understood the physical problems of handling steel.
>
> There are other applications to design by computer, tying in the areas of art, engineering, and architecture . . . everything from bridge and building design to gear design. It is a new window on the world, if designers will only look out. They must retrain themselves, and they must also be kept aware that the computer's limitations are dependent solely on the frame that *they*—people—put up. □

POETRY BY COMPUTER

Dr. Giuseppe M. Ferrero diRoccaferrera
Syracuse University
College of Business Administration
116 College Place
Syracuse, N.Y. 13210

"Is it always a good poetical approach to limit (consciously or unconsciously) the choice of words in composing a lyric? Might not a poet appreciate the possibility of having frames of words, compiled by a computer in accordance with a well-defined scheme, from which he can elaborate and extract inspirational clues for composing works of poetry?"

Among the countless uses of a digital computer, there are some which offer particular interest because of their unusual aspects. For example, a firm interested in creating a "trade name" for a new product used a computer to develop a large series of such names. The size of the desired word was established to be six characters. The twenty-six letters of the English alphabet were placed in memory. They were randomly extracted (with replacement) in groups of six letters each time. Some of the resulting words were printed in a list which would have carried more than 300 million different names[1]. This array allowed the search for a satisfactory word. Several names so obtained were compared until one was finally chosen as a label for the new product.

Composing Words

The concept of the random selection of alphabetical letters for composing words can be re-applied and used to construct phrases when the words to be placed in sequence assume a well defined frame established ***a priori.*** In one of the canonical structures of a very simple sentence, the subject precedes the transitive verb followed by a direct object as for example, in "The dog crosses the street". This phrase may appear silly, but it could have been obtained by a random composition of an article (definite or indefinite) in the first position, followed by a noun (singular or plural), by a verb (agreeing with the extracted noun), by an article and by a noun again. No adjectives have been used to modify the nouns, or adverbs to modify the verbs. Obviously, different syntax can be applied by arranging the types of words in the desired sentence structures.

Longer phrases can be formed. For instance, it is possible to compose a few lines, each of which has its own syntax. By combining these lines in a poetical frame, poems can be constructed by extracting "at random" nouns, adjectives, verbs, adverbs, articles, and prepositions, from a backlog of words standing by in the computer memory.

Relationships Between Words

This process has been applied for the purpose of creating poems by a digital computer. In order to insure a logical relationship among selected words, only a particular series of adjectives and an appropriate list of verbs were assigned to each noun. The application of this approach insured the construction of more meaningful poetical compositions. This type of restriction could have been extended to the selection of adverbs and prepositions as well, but in this experiment the choice of related words was limited to the adjectives and verbs to be used in connection with a randomly selected noun. As for the nouns, the adjectives and verbs were chosen "at random" among those having reference to that specific noun. This process has been programmed to be applied with the purpose of creating "Quatrains" (stanzas of four lines). The poetical frame was established as follows:

1. A title composed of an adjective (selected in accordance with the noun), and a noun (plural).
2. The first line of the poem: an adjective (chosen as above), a noun (plural), an adverb, a verb (plural present tense extracted from the list matching the noun), an adjective, and a noun (plural).
3. The second line: an adjective, a noun (plural), a verb (plural present tense), an adverb, an adjective, and a noun (plural).
4. The third line: an article (definite), a noun (singular), a verb (singular present tense), a preposition, an article (definite), an adjective, and a noun (singular).
5. The fourth line: a noun (plural), a verb (plural present tense), a conjunction, an article (definite) and a noun (singular).

With the aim of insuring a continuity in the meaning, or a compactness of the poem, the second adjective and noun of the first line were repeated as first adjective and noun of the second line.

[1]Using 26 letters randomly taken (with replacement) six by six, 26^6 permutations are possible, which equals 308,915,776.

Dr. diRoccaferrera is a professor of Operations Research at Syracuse University. His specialized studies are in industrial management and applied mathematics using computers. He is the author of several books, including **Operations Research Models for Business and Industry, Introduction to Linear Programming Processes,** and a book on the use of computers for solving managerial problems which he is currently writing.

Professor diRoccaferrera is a consultant to several business firms and governmental agencies. He has presented talks on operations research at the International Meetings in Vienna, Austria (1966) and in Tokyo, Japan (1967).

Number of Words Available to Computer

The computer had available in its memory supplies of 500 nouns, 300 verbs, 200 adjectives, 100 adverbs, 10 prepositions, and three articles (of which "the" had 28 times greater probability of being selected than "a" and "an"). Nouns were identified by a numerical code used to match the corresponding code carried by the adjectives and verbs. Since adjectives and verbs can be related to several names and vice versa, a programmed cross reference was established to insure the appropriate random selection of connected words. All the words stored in the computer memory were chosen according to the frequency of their occurrence in ordinary usage, from ***Webster's Third International Dictionary*** (Unabridged). Preposition usage was verified through Nelson W. Francis' text ***The Structure of Modern English.***

The computer was instructed to select "at random" (with replacement) a noun, then the corresponding adjective and verb, also at random among those which were on the matching list, then the other parts of the speech, and to put them in the above mentioned poetical frame to compose the quatrains.

Rhyming

In the computer program no provision was established for rhyming. This refinement in the composition could have been carried out by utilizing a comparison of the corresponding terminating nouns. For example, sets of rhyming nouns could be stored in the memory, and the program could provide for the selection of the endmost words in the appropriate lines (i.e., ***a b a b, a b b a,*** or ***a a b b***).

The results obtained through this experiment are quite interesting. Among the 500 quatrains created there are some which give a poetical message; others, on the other hand, do not provide too much logical sense even accepting a liberal interpretation of ultra-modern expression of mechanized art.

Evaluation

What usefulness could there be in creating poems by computers? Indeed, the mind of an inspired poet is free to wander on the green pasture of words, and to harvest those which represent for him the idea, the mood, the concept, or the poetical vein that is expressed through the construction of the verses. Splendid and renowned works of art have been created by the pure contribution of the human mind.

It is well known, however, that a writer expresses himself by showing his sensitivity, his feeling, his knowledge, and his personality. There are readers capable of recognizing an author by his style or by his way of describing facts or thoughts. Poems are the expressions of an intimate state of mind. Consequently, the selection of the words is usually not made at random. Nevertheless, is it always a good poetical approach to limit (consciously or unconsciously) the choice of words in composing a lyric?

Modern paintings show that it is not necessary physically to "represent" objects, persons, landscapes, or other visual subjects to create a piece of art. A random composition of colors on a canvas may provide to the viewer a free interpretation of an abstract concept.

To say that a pure sequence of words extracted at random from a stock may also provide a reader with a metaphysical thought is probably too hazardous and not justified. As for an abstract painting, some harmonious rules of composition being sensed by the painter are respected; so collections of words must follow a certain sequential pattern. A poetic syntactical structure is a perfect frame to put words in. By selecting them "at random", as only a mechanical device can do (e.g., a computer), poems can be created having the essential characteristic of being "free from inspirational selection".

Is this a good thing to do? Is it useful? Indeed a poet may appreciate the possibility of having frames of words, compiled in accordance with a well-defined scheme, from which he can elaborate and extract inspirational clues for composing works of poetry. When poems constructed by a computer are available, he may change only the last words of the computerized poem in order to provide rhymes, or to vary nouns and verbs with the purpose of restricting the meaning of the lyric to a specific subject.

Almost all poets use some kind of liberty in writing. For example, the well known English poet Andrew Marvell (1621–1678) in his country life lyrics "The Garden", wrote "...a green thought in a green shade...". The computer, consequently, is also permitted poetic license.

The examples of poems shown below, selected from the 500 created by the computer, are reproduced without any change from the computer printout[2]. These can stand in their own right as poems generated by a random process, or they could be used as an aid for identifying evocative combinations of words or phrases to be utilized by authors in the writing or poetry. □

GRATEFUL	VISIONS					
SOFT	CLOUDS	TERSELY	STAGGER	CREAMY	SNOWS	
CREAMY	SNOWS	WEAR	CASUALLY	BLACK	COLORS	
THE	TIME	BRINGS	AROUND	THE	FRANTIC	YEAR
RIVERS	RASP	WITH	THE	SEA		

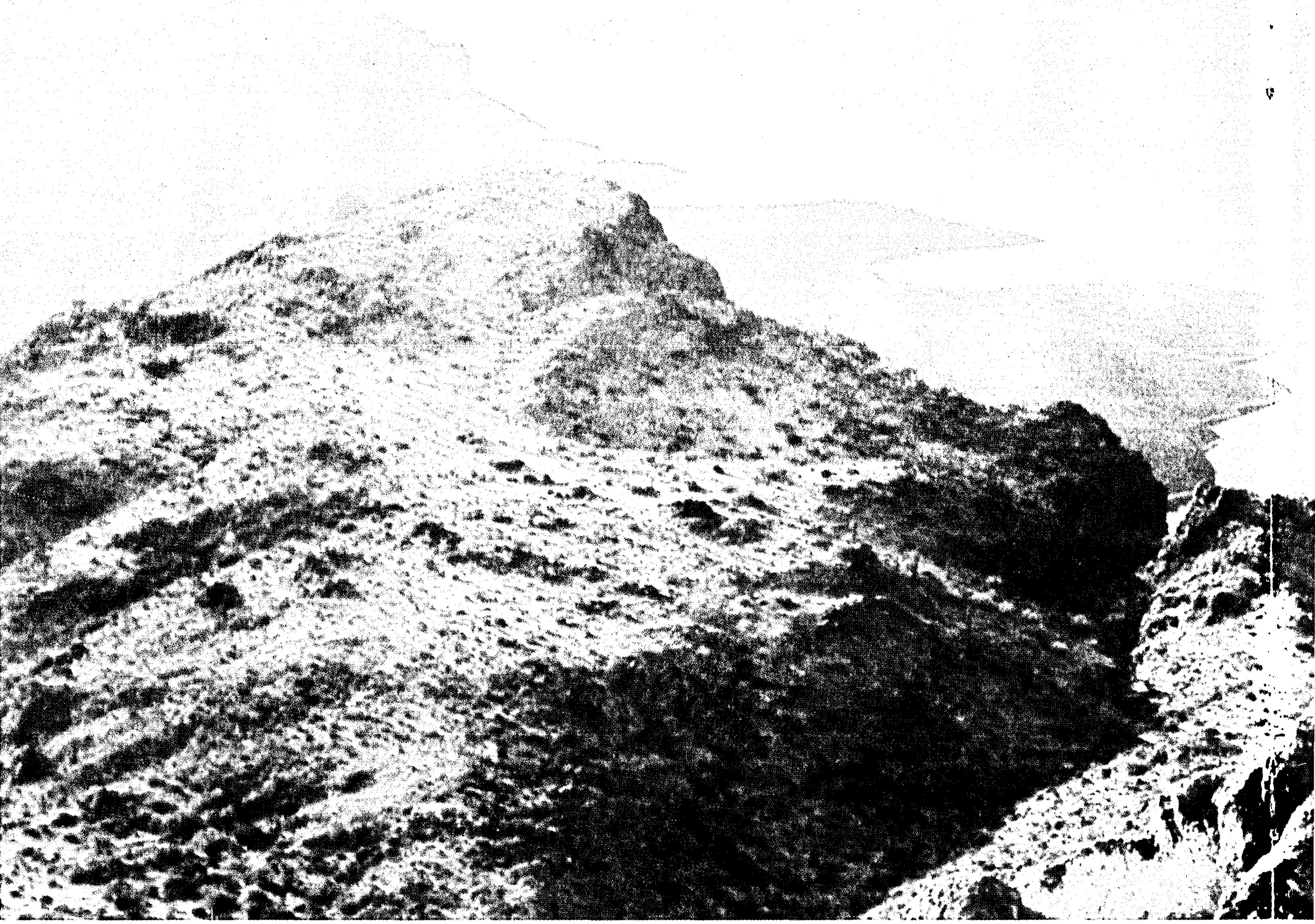
CLEAR	SPIRITS					
WARPED	TRUNKS	FRAILLY	DWELL	DELICATE	LEAVES	
DELICATE	LEAVES	SHUDDER	CUNNINGLY	INTRICATE	LINES	
THE	IMAGE	VANISHES	TO	THE	SHARP	SECOND
BEE	FLY	AGAINST	THE	CLOUD		

NOISELESS	ROOTS					
LITTLE	FLOWERS	COOLY	BREATHE	PASTORAL	WOODS	
PASTORAL	WOODS	MOLD	PATIENTLY	WHITE	BLOSSOMS	
THE	ROAD	WANDERS	FROM	THE	LITTLE	VALLEY
FIRES	TURN	AWAY	THE	ROAD		

PRECIOUS	SYSTEMS					
RED	IVIES	GENTLY	BLEND	GREEN	FIELDS	
GREEN	FIELDS	RECALL	JOYFULLY	SECRET	CLOUDS	
THE	STAR	TEASES	WITH	THE	BLACK	OCEAN
FOUNTAINS	SPRINKLE	FOR	THE	SNOW		

BLATANT	BEAUTIES					
MORTAL	CREATURES	AWKWARDLY	CURE	ANCIENT	BEAUTIES	
ANCIENT	BEAUTIES	TELL	HOPEFULLY	SILENT	VIRTUES	
THE	DAY	JUMPS	FROM	THE	STRONG	WIND
WONDERS	ENRICH	OUT	THE	WORD		

[2]IBM 360/50 level G, of the Computing Center of Syracuse University (Syracuse, New York).



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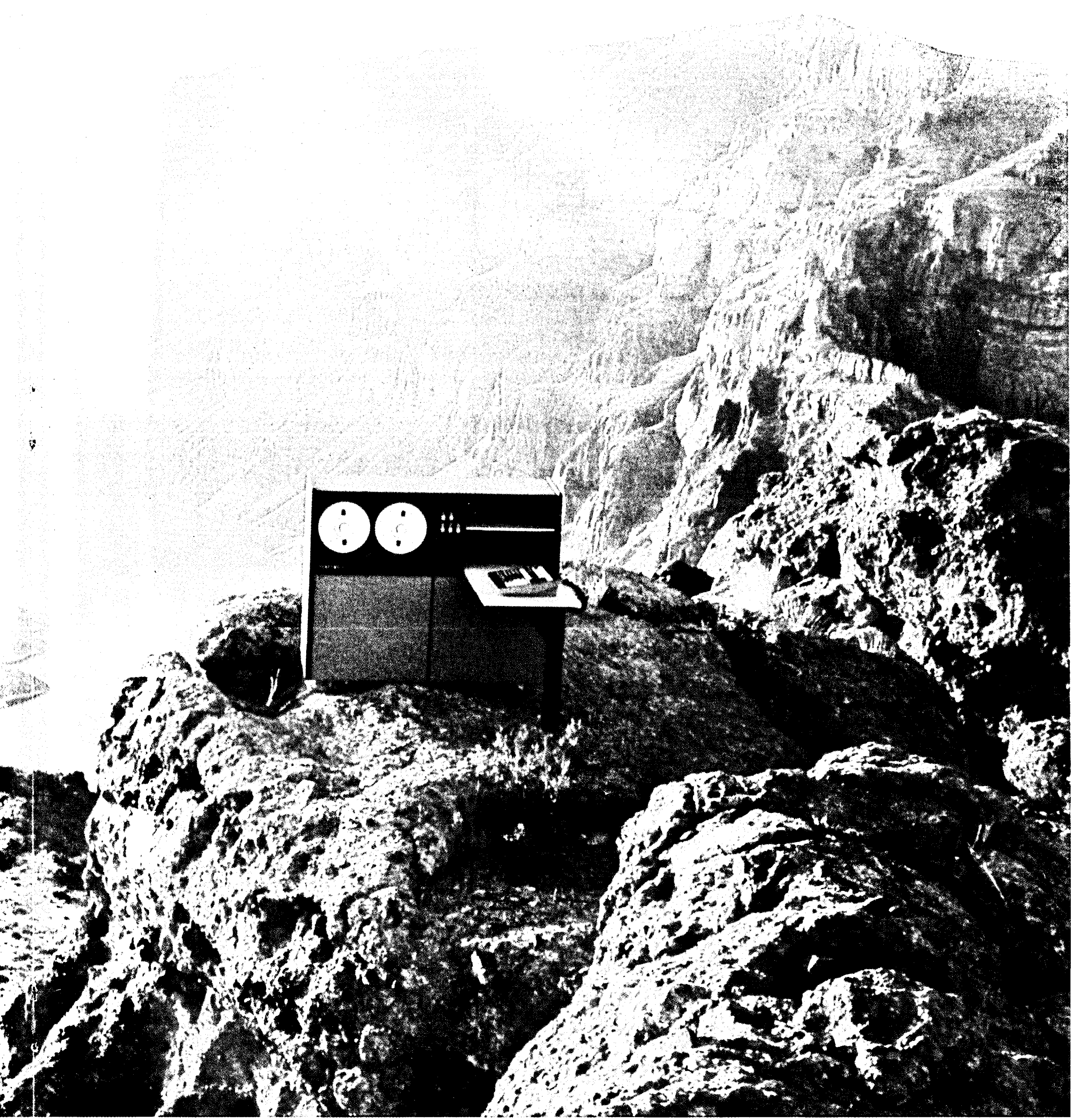
Since data preparation came of age there have been a number of keyboard to magnetic tape devices introduced or announced to the industry.

Our unit was one of the first.

We called it Keytape.

And we created a full division to make 52 different models. With



unique Honeywell features like smooth vacuum tape drives and electronic keyboards second to none.

We delivered the first of these units over a year ago. And pretty soon Keytape began showing up everywhere.

Now we find that people are using the name Keytape to describe anything that records data onto magnetic tape.

Before things get completely out of hand, we'd like to make one point.

There is only one Keytape.
Honeywell makes it.

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Designate No. 17 on Reader Service Card

The Only Keytape Company:

Honeywell

Communications and Data Products Division c.a

MULTI-ACCESS FORUM

COMPUTER CENSUSES — DISCUSSION

I. From Walter A. Magee, Management Analyst
ADP Management Staff
Executive Office of the President
Bureau of the Budget
Washington, D. C. 20503

Your monthly census of computers of U.S. manufacture has proved useful on a number of occasions in comparing statistics on computers in the Federal Government to the market as a whole. In your February, 1969 issue, your census appeared to drop to less than 30,000 from more than 60,000 in previous issues. Needless to say, this radically changed some of my carefully prepared charts and tables. Letters reprinted in your April, 1969 issue show that others shared my reactions.

On piecing together several of your tables, however, it becomes obvious that the difference is not so great after all. The following table shows what I mean:

Category of U.S. Manufacturer	Count	As Of	C & A Issue
Top ten, installed in U.S.	29,271	9-30-68	2-69
Top ten, installed overseas	15,497	12-30-68	3-69
Others, installed in U.S.	1,038	12-30-68	5-69
TOTAL	45,806	----	----
Earlier Total, All U.S. Manufacturers, U.S. and overseas	62,800	6-15-68	7-68

I hope I have interpreted and summarized these figures correctly.

I sympathize with your intention to publish only figures that are based on a verified list of installations. At the same time I feel obliged to (gently) chide you and your source, DP Data Corp., for apparently excluding from your lists some of the computers of the largest user, the U.S. Government. The "Inventory of ADP Equipment in the U.S. Government" has been published annually beginning with the 1960 edition. The latest published figures, released through the Government Printing Office, February, 1969, show 4,232 computers on hand as of June 30, 1968. (Later unpublished reports list 4,357 computers installed as of December 31, 1968.) A comparison between your published figures and the Federal inventory shows ten instances where the number of Federal computers equals or exceeds the total in your tables. The ten are:

(1) MFR. & SYSTEM	(2) C & A 9-68	(3) C & A 6-68	(4) FED. INV. 6-68
CDC 3800	8	*	10
GE 435	6	*	6
IBM 7080	13	*	34
IBM 7090	4	*	17
IBM 7094 I	10	*	47
IBM 7094 II	6	*	7
NCR 390	81	660	131
RCA 3301	24	75	24
RCA 501	22	96	25
UNIVAC 1107	8	33	9

*Not listed as a separate figure.
(2) from *Computers and Automation,* Feb. 1969.
(3) from *Computers and Automation,* July, 1968.
(4) from "Inventory of ADP Equipment in the U.S. Government," Fiscal Year 1968. (For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington, D.C. 20402; price $1.75.) (Count in (2) and (4) excludes overseas installations.)

I realize these are only ten out of well over a hundred systems. Even so, this discrepancy could indicate the omission of many others. Enclosed is a copy of the current Federal Inventory so that you can crank into your census whatever systems are not included. I hope this contains enough information on each system to suit your needs.

II. A dialogue between Jack Harvey, Vice Pres.
National Data Systems, Inc.
210 Summit Ave.
Montvale, N.J. 07645
— and the Editor of *Computers and Automation*

a) From Mr. Harvey

If the computer census published in your May, 1969 issue is an attempt to jar loose some hard data from the manufacturers, I wish you good luck. However, it is so patently ridiculous that it is useless. Since the census published in previous years was at least consistent with most other sources, it had real value to me, and was by far the most useful feature in ***Computers and Automation.*** Unless the census regains my confidence, I will not renew my subscription.

b) From the Editor

This computer census in the May issue covers a ground no other computer census that we have previously published covers: it reports information on computer installations *outside* of the United States. Was this clear to you from the description of it? Should we have included some repetitive remarks so as to emphasize this difference?

We are seeking intensely to obtain good computer census information. Even the Central Intelligence Agency office in Cambridge, Mass., telephoned us the other day, asking us for some information about the number of computers in the Soviet Union! In spite of several contacts that I have there, I have not found any good figures.

c) From Mr. Harvey

I must say that the special viewpoint of the May computer census was certainly not communicated to me. The change from the prior policy of a standard monthly census turns the feature into disconnected individual articles, each of which must receive individual evaluation to be useful. With a standardized monthly census, the reader can develop his own correction factors and have confidence in the result.

I would suggest at least a monthly directory of previous special censuses and (hopefully) a schedule of future issues. But continuity and standardization seems very desirable.

d) From the Editor

I think you make two excellent points when you object to disconnected individual articles, and ask for a standardized monthly census for which the reader can develop his own correction factors.

I think we shall try to do this. But the census may have to be published every second month instead of every month, so as to allow for more comments and more change from one publishing to the next.

Thank you for your helpful protest and suggestions.

III. From the Editor

In the Midyear Computer Directory issue of *Computers and Automation,* we have published a World Computer Census, covering four and a half pages, which represents a careful summary of all the computer census information available to us on June 15, 1969. This is in accordance with the helpful suggestion of Mr. Harvey.

Our present plans are to publish a computer census in every month, publishing either one of two parts alternately: Part 1, reporting on the computers of United States companies; Part 2, reporting on the computers of foreign companies. Each part will be updated every second month. The next computer census will be published in the September issue of *Computers and Automation.* □

REACTIONS TO IBM'S "UNBUNDLING"

On June 23, IBM announced a major change in the way it charges for and supports its data processing equipment; specifically, that certain systems engineering activities, most future computer programs, and most customer education courses previously furnished without charge, will now be offered for a charge in the United States. Coincident with this action, the company is reducing data processing equipment lease and purchase prices by approximately 3%. This "unbundling" or separation of prices by IBM has brought comments (and criticism) from all corners of the computer industry. Some of these comments follow.

Paul Williams, Jr., Pres.
Boothe Computer Corp.
1 Maritime Plaza
San Francisco, Calif. 94111

In my opinion, IBM's pricing change . . . of an overall 3% reduction is in fact the largest price increase in the history of the data processing industry. I have confirmed with several significant IBM customers that this change will raise their data processing costs by some 20% because of the additional expenses they expect to incur for program products, systems engineering and education. Companies which purchased IBM equipment in the past prepaid for the services which are now to be an added charge. This is tantamount to selling a man a house and later removing all the bathrooms.

Dr. Daniel J. McCarthy, Pres.
Computer Environments Corp.
3 Lebanon St.
Hanover, N.H. 03755

The new pricing structure announced by IBM for its computer education courses is proof that IBM now recognizes that there are private computer schools capable of doing the job in the basic training of computer programmers. This has been the most important development in the computer school field in five years.

Harvey N. Berlent, Pres.
The Computer Exchange, Inc.
30 East 42nd St.
New York, N.Y. 10017

The announcement broadens the opportunity for companies requiring data processing services to select the source and services in terms of their own needs. At the same time it places an additional responsibility on the user to clearly define his actual computing requirements, since support services will now be available to all users at the same price. The customer who hesitated to purchase previously-owned hardware because he was concerned about his ability to get support can now relax.

G. W. Woerner, Jr., Pres.
Computer Technology Inc.
Old Orchard Rd.
Skokie, Ill. 60076

Although the free and competitive environment in the [computer] industry may be somewhat improved by the unbundling of prices which took place, IBM was shockingly remiss in not similarly unbundling its organizational approach to bringing these services to the market. An even more disturbing aspect of the possible continuance of IBM's domination [of the computer industry] is the data processing division's addition of a custom contract service capability. By having the design and installation of a customer's data processing system come under the same operations as its other sales and service activities, IBM could dominate the marketplace to an even greater degree.

George S. McLaughlin, Jr., Pres.
George S. McLaughlin Assoc., Inc.
785 Springfield Ave.
Summit, N.J. 07090

IBM's unbundling will amount to cost increases of between 18 and 30% . . . for every computer user, be they IBM customers or other vendors. IBM's profits, dominance, and growth are now guaranteed.

C. W. Spangle, Vice Pres. and Gen'l Mgr.
Honeywell EDP Div.
60 Walnut St.
Wellesley Hills, Mass. 02181

Our studies indicate that with separate pricing, customers will have difficulty predicting their future full costs, and the majority will pay significantly more in the future in order to continue to get the data processing services they presently are receiving.

[Ed. Note—Honeywell announced on July 1 that it will maintain its package pricing policy.]

James E. Townsend, Pres.
Levin-Townsend Service Corp.
445 Park Ave.
New York, N.Y. 10022

The computer user will be the benefactor of this significant change in computer pricing, for now he will be able to select the best software services for his computer installation without being swayed by services offered without charge.

Robert L. Harmon, Vice Pres. and Gen'l Mgr.
McDonnell Douglas Corp.
P.O. Box 516
St. Louis, Mo. 63166

IBM's unbundling will unleash a healthy competitive struggle among computer software suppliers, and a series of secondary explosions, including overall higher operating costs to most computer users and an increased demand for experienced programmers and other data processing personnel.

Albert M. Loring, Pres.
Programming Sciences Corp.
90 Park Ave.
New York, N.Y. 10016

IBM's announcement has, in effect, given birth to the software industry as an industry. The market is going to expand enormously, but in actuality only for those companies that are in a position to take advantage of this situation through the quality of their services.

John M. Randolph, Chrmn. of the Board
Randolph Computer Corp.
537 Steamboat Rd.
Greenwich, Conn. 06830

The IBM announcement will significantly increase total data processing costs for many users. This will focus greater attention on the cost savings available through third party leasing. □

COMPUTER PROGRAMMER TRAINEES CAN'T FIND JOBS

Mrs. Helen Solem
666 E. Main, Apt. 16
Hillsboro, Oregon 97123

Recently a visiting President of a Computer Programmer School said that the number of data processing personnel is steadily slipping behind the need. While this may be true for trained and experienced personnel, it is certainly not true for computer programmer trainees.

Young people who have had no previous data processing experience find staunch employer resistance to hiring trainees—whether or not they have taken special courses which supposedly allow them to be called "trainees". The following quotes seem to represent the experience of persons in the employment field in our area:

STATE EMPLOYMENT SERVICE: "It's scandalous how these schools promise young people high salaried jobs. There is absolutely no demand for computer programmer trainees coming through this office."

ROBERT HALF EMPLOYMENT AGENCY (specializing in Accounting and EDP Placement): "There is no call whatever for computer programmer trainees. We can't even place top-ranking graduates from big name universities in this area!"

And the same sad tune is heard again and again for those making the weary round of employment agencies. There is no demand for computer programmer trainees.

Imagine the heart-breaking disillusionment faced by hundreds of young people who worked hard to get good grades and spent more than a $1,000 for tuition, only to learn that this diploma they so eagerly and industriously sought opened no door whatsoever.

There are some very sound reasons for employer resistance to hiring trainees.

1. Mistakes are extraordinarily costly; employers have learned this through bitter experience. 15,000 errors a minute can come flying out of the machine piling up fantastic amounts of special forms to say nothing of the machine's wasted time.
2. Technical proficiency is but half the knowledge required. Practical business experience, i.e., familiarity with the systems of a particular business, is a must. Without a thorough knowledge of the input and output data, some detail is bound to be overlooked. An experienced computer programmer at year end this year failed to make provision for "meals" on payroll W-2's on a 6,600 employee payroll. About 15% of the W-2's had to be corrected. This was not discovered until they were due to be mailed out and at that point machine time could not be rescheduled to re-do the W-2's so a clerical crew hand corrected them at no small additional cost.
3. Most computer users are fairly large organizations. They already have employees capable of becoming

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Our client, a diversified energy company, located in Boston, ranks among America's largest business enterprises. This company has a record of steady growth with revenues increasing by 33% since 1963 and, more significantly, net income in the same period increased 300%. They are establishing a small, elite EDP group involved in corporate computer systems applications. Systems and programming requirements are urgent and immediate for the following:

SYSTEMS PROGRAMMER

SALARY TO $20,000 FEE PAID 360/OS experience to work with subsidiaries during programming and installation of completely redesigned integrated information systems. Position will be of an internal consulting nature and will involve work on many different problems in several industries. Excellent opportunity to apply skills to the solutions of only the most difficult problems. Also will involve development of proprietary software while working with experts in other fields. Equipment will include several 360's up to Mod. 50.

SYSTEMS ANALYST

SALARY TO $20,000 FEE PAID Experienced systems analyst with strong business orientation capable of overall design work, reviewing design work to analyze and determine the most efficient use of business information, file design, and implementing standards for documentation. Work will be on a corporate level consulting with several subsidiaries. Experience with 3rd generation equipment is essential and emphasis will be placed on past achievements in projects of significance. Equipment will include 360/25, 30, 50.

SYSTEMS ANALYST

SALARY TO $13,000 FEE PAID Develop labor and material cost systems including automation of company annuity plan. Position involves accounting and management information systems. Opportunity to interface with top management. Computer communications experience highly desirable.

COBOL PROGRAMMERS

SALARY TO $12,500 FEE PAID Some BAL background with a heavy emphasis in COBOL. Random Access experience desirable but not a requirement. Opportunity to join the finest SPECTRA-70 installation on the East Coast.

Our client, situated in a prime Boston location, offers a comprehensive benefit program as well as excellent opportunity for rapid career growth.
They assume all interview and relocation expenses. For an immediate interview, please call Jeff Kurtz, Collect, at (617) 482-4720 or direct your resume to:

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80 BOYLSTON STREET, BOSTON, MASS. 02116

(617) 482-4720

programmer trainees with the built-in advantage of being familiar with the work. Therefore, hiring a new recruit for this very exacting work is a risk most employers can and do avoid.

4. Not everyone who aspires to be a computer programmer is capable of succeeding. Rigorous selection tests must be adhered to. Aptitude tests given by many schools are a farce. Anyone who can pay the tuition can take the course. A person considering going to one of those schools should have a friend take their entrance exam and deliberately fail it. If he is encouraged to enter the field anyway, BEWARE.

According to articles appearing ever more frequently in the professional journals, job placement for programmer trainees is a problem all over the country. So called "schools" have mushroomed in the wake of a real shortage for *experienced* computer people. Fortunately, professionals in the computer field are aware of the problem. Both the Association for Computing Machinery and the Data Processing Management Association are working toward setting up standards.

The best way for people to get the necessary experience to become good computer programmers seems to be to start at the bottom with a company, and work their way up. Perhaps an internship in industry could be worked out to provide practical experience, in addition to basic technical training. Such close cooperation between the schools and industry would tend to keep at a minimum the temptation to "train" persons to be "trainees", or to train persons totally unsuited for the profession. □

UNITED NATIONS TO STUDY THE TRANSFER OF COMPUTER TECHNOLOGY BETWEEN COUNTRIES

Office for Science and Technology
United Nations
UN Plaza
New York, N. Y. 10017

At the 23rd session of the United Nations General Assembly, a resolution (2458) was passed entitled "International co-operation with a view to the use of computers and computation techniques for development". The passage of this resolution marks a recognition of the special importance of computers, and the impact which the use of related technical processes may have on accelerating the progress of vital economic and social sectors, such as economic planning, programming of industry, transportation, public health, agriculture and urbanization. Noting the most satisfactory promotion of international co-operation in the fields of use of atomic energy for peaceful purposes and the exploration of outer space within the United Nations organization, it is hoped that a similar promotion of co-operation can occur in the field of computer technology.

To the above ends, the Secretary-General has been asked to prepare a report describing the results already attained, indicating the forms in which international action may be taken to intensify co-operation, and delineating the role which the United Nations can play in promoting international co-operation with emphasis on questions concerning the transfer of technology, the training of personnel, and the obtaining of equipment.

Professor Harry Huskey, Director of the Computer Center at the University of California, Santa Cruz, California and Professor C. C. Gotlieb, Director of the Computer Centre at the University of Toronto, Toronto, Canada, have been designated as consultants to advise the Office for Science and Technology of United Nations in the preparation of the Secretary-General's report. Other consultants will be named later.

In order to gather background material for the preparation of this report, the Secretary-General, through the UN Office for Science and Technology, has developed a series of questionnaires that have been sent to member states, to international professional societies, and to various United Nations organizations. The responses to these questionnaires will be reviewed and a draft report prepared in the early spring of 1970. The final report will be presented to the Economic and Social Council in July 1970 and to the General Assembly in September 1970.

It is expected that the resulting report will be a significant contribution in terms of bringing together the experience of many countries and many people in the problems of the application of computer technology for development. It is hoped that constructive recommendations can be made as a result of the study on such questions as how to develop a cadre of trained professionals in the field in the developing countries, how to install equipment and systems in such a way so as to minimize labour displacement and how to transfer technology to the developing countries from the developed countries. It is also hoped that illustrations will be presented of progress that can be made within the economic and social conditions of the developing countries. And, most important, that a mechanism will be presented which will encourage continuing co-operation of the member nations and the UN organizations with respect to the application of computer technology for development. □

COMPUTING EQUIPMENT IN THE NATIONAL ECONOMY OF THE UNION OF SOVIET SOCIALIST REPUBLICS

Norman Precoda
459 Foxen Drive
Santa Barbara, Calif. 93105

The article below, which I read in *Ekonomicheskaya Gazeta,* No. 18, May 1969, struck me as interesting from several points of view. I translated it from the Russian with the thought that others might also find it informative.

A conference of the budget-planning commission of the Supreme Soviet, RSFSR, was devoted to the use of computing equipment in the Republic's economy. V. Lisitsyn, deputy chairman of Gosplan, RSFSR, and A. Dryuchin, deputy chief of the Central Statistical Bureau, RSFSR, appeared (with reports) before the deputies.

2,435 computing centers, machine-calculating stations and bureaus, subordinate to Republic and Union Republic ministries and departments, have been formed in the

Russian Federation. They serve more than 15,000 enterprises and organizations. Volume of mechanized processing has grown 30% during the last two years. As a consequence of the centralization and mechanization of calculation, 11,500 calculators and accountants—with annual wages of 6.8 million rubles—have been freed.

Conference participants gave primary attention to questions connected with introduction, by enterprises, in branch and departmental systems of: (1) planning, calculation, control and processing of information; (2) automatized systems of control based on use of economics and mathematical methods; (3) modern computing equipment facilities; and (4) mechanization of technical, engineering and administrative work.

As noted in the presentations, ministries and departments of the RSFSR are far from fully utilizing computer equipment resources for the improvement of control, solving planning problems, and technical and material supply.

The majority of the machine-calculating installations in the Republic work one shift only; electronic computers have an average daily loading of 6.8 hours. At the same time only one-third of the computer equipment requirements of the RSFSR's ministries and departments are met.

There are not enough specialists—electronics people, mathematicians, and engineers and economists—in mechanized processing of economics information to service the computer equipment resources.

In a resolution made at the conference, the budget-planning commission of the Supreme Soviet, RSFSR, recommended to the RSFSR's ministries and departments to work out in detail and ratify (by the end of 1969) the main directions of the introduction of computing equipment in planning, in accounting and control, and in designing, having three goals in view: (1) to widen formation of automatized control systems firstly at enterprises and in the economy; (2) to introduce during the years 1969-1970 mechanization of accounting at operating machine-calculating stations and in bureaus having standard projects; and (3) to systematically correlate and disseminate experience in the use of advanced computer equipment.

The recommendation was made to the Ministry of Higher and Intermediate Special Education to expand the self-supporting activity of the computing centers of higher educational institutions by means of execution of computing work for industrial enterprises, transport and other organizations.

Chairmen of many Union and Union Republic ministries took part in the deputies' detailed discussion on introduction of computer equipment in the national economy. K. Gerasimov, deputy chairman of the RSFSR's Soviet of Ministers, addressed the conference. □

ADAPSO POSITION PAPER ON DISCRIMINATORY PRICING

ADAPSO (Association of Data Processing Service Organizations, Inc.)
420 Lexington Ave.
New York, N. Y. 10017

The following is a position paper issued by ADAPSO on discrimination in prices charged by computer hardware manufacturers to different customers.

Statement of Policy

The Association of Data Processing Service Organizations Inc., opposes any discrimination in prices charged by hardware manufacturers to different customers. It regards such discrimination as anti-competitive in effect, and harmful to the ability of the electronic data processing services industry properly to serve the public.

Discussion

Where such discriminatory pricing has the necessary effect on competition, it constitutes a violation of law, for which the guilty manufacturer will be held answerable in damages to any purchaser who has been damaged. It is the Association's intention to do all within its lawful power and financial ability to assist in bringing such manufacturers to justice and require them to account to the injured parties.

Some hardware manufacturers have sought to justify discrimination in their pricing of equipment sold to governmental organizations, universities, charities and other public or eleemosynary institutions, on the ground that the purchaser is required to agree that the equipment will not be used in competition. Such discrimination may not be unlawful; theoretically it may even be in some cases in the public interest. In practice, however, despite these agreements, such purchasers with impunity almost always employ equipment purchased at these discount prices (ranging up to 60% of list) in competition to some degree. Accordingly, even this theoretical justification fails.

THE PERFECT PROGRAM

"No program's that perfect,"
They said with a shrug.
"The client is happy—
"What's one little bug?"

But he was determined.
The others went home.
He dug out the flow chart
Deserted, alone.

Night passed into morning.
The room was cluttered
With memory dumps, punch cards,
"I'm close," he muttered.

Chain smoking, cold coffee
Logic, deduction.
"I've got it," he cried, "Just
change one instruction!"

Then change two, then three more
As year followed year,
And strangers would comment,
"Is that guy still here?"

He died at the console
Of hunger and thirst.
Next day he was buried
Face down, nine edge first.

And his wife, through her tears,
Accepting his fate,
Said, "He's not really gone—
He's just working late."

Lou Ellen Davis
97 Brook Run Lane
Stamford, Conn. 06905

WHO'S WHO IN THE COMPUTER FIELD — ENTRIES

The Fifth Edition of Who's Who in the Computer Field will be published by Computers and Automation during 1969-70. This Edition will include three separate hard-cover volumes containing upwards of 7,000 capsule biographies of computer people, as follows:

Vol. 1 — Systems Analysts and Programmers
Vol. 2 — DP Managers and Directors
Vol. 3 — Other Computer People

Following are sample capsule biographies which we shall publish in the 5th edition of Who's Who in the Computer Field.

Special Abbreviations	Main Interest Abbreviations
b: born	A Applications
ed: education	B Business
ent: entered computer field	C Construction
	D Design
m-i: main interests	L Logic
t: title	Mg Management
org: organization	Ma Mathematics
pb-h: publications, honors, memberships, and other distinctions	P Programming
	Sa Sales
	Sy Systems
h: home address	

PAGEN, Dr. John / director - CAI project / b: 1926 / ed: BS; MEd; EdD / ent: 1967 / m-i: A P Sy; computer assisted instruction / t: director - INDICOM / org: Waterford Township School District, 3101 W Walton, Pontiac, MI 48055 / pb-h: AERA; Phi Delta Kappa; MASA; AASA; reports on CAI / h: 463 Berrypatch, Pontiac, MI 48054

PALM, John N. / EDP management / b: 1938 / ed: BA, math / ent: 1957, part time; 1960, full time / m-i: P Sy; management of systems, programming, operations, etc. as applied in solving retail problems / t: vice president, information systems / org: Target Stores, Inc., 8700 W 36 St, Minneapolis, MN 55426 / pb-h: CDP, SPA / h: Route 1, Box 27, Wayzata, MN 55391

PALMER, Dennis W. / EDP mgr / b: 1937 / ed: 2 yrs college / ent: 1959 / m-i: Mg P Sy / T: EDP mgr / org: Protected Home Mutual Life Ins Co, 30 E State St, Sharon, PA 16146 / pb-h: DPMA, SPA, CDP / h: Rt 3, Box 700, Corland, OH 44410

PALMER, Fred E. / systems & programming / b: 1935 / ed: 3 years college / ent: 1960 / m-i: A B P Sy / t: manager of programming / org: Western Farmers Association, 201 Elliott Ave W, Seattle, WA 98119 / pb-h: CDP, DPMA / h: 19611 62nd NE, Seattle, WA 98155

PAN, George S. / senior technical management / b: 1939 / ed: BSEE, Illinois, MSEE, Syracuse / ent: 1960 / m-i: A Mg Ma P Sy; simulation / t: director, management sciences division / org: Interactive Sciences Corp., 170 Forbes Rd, Braintree, MA 02184 / pb-h: "Weighted File System Design Method", 1965 IBM National Systems Symposium, "Generalized File Structure and Optimum Design Considerations", 5th Nat'l Computer Conference of Canada / h: 5146 N 11th Ave, Phoenix, AZ 85013

If you wish to be considered for inclusion in the Who's Who, please complete the following form or provide us with the equivalent information. The deadline for receipt of entries in our office for Vol. 1 is Fri., Sept. 5, 1969. (If you have already sent us a form some time during the past eighteen months, it is not necessary to send us another form unless there is a change of information.)

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WHO'S WHO ENTRY FORM
(may be copied on any piece of paper)

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2. Home Address (with Zip)?__________
3. Organization?__________
4. Its Address (with Zip)?__________
5. Your Title?__________
6. Your Main Interests?

Applications	( )	Mathematics	( )
Business	( )	Programming	( )
Construction	( )	Sales	( )
Design	( )	Systems	( )
Logic	( )	Other	( )
Management	( )	(Please specify)	

7. Year of Birth?__________
8. Education and Degrees?__________
9. Year Entered Computer Field?__________
10. Occupation?__________
11. Publications, Honors, Memberships, and other Distinctions?__________
(attach paper if needed)
12. Do you have access to a computer? ( )Yes ( )No
    a. If yes, what kind of computer?
       Manufacturer?__________
       Model__________
    b. Where is it installed:
       Manufacturer?__________
       Address?__________
    c. Is your access: Batch? ( ) Time-shared? ( )
       Other? ( ) Please explain:__________
    d. Any remarks?__________
13. Associates or friends who should be sent Who's Who entry forms?
    Name and Address

(attach paper if needed)

When completed, please send to:

Who's Who Editor, Computers and Automation,
815 Washington St., Newtonville, Mass. 02160

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- Supplements, special rosters, cross-reference lists, (including biographical information), such as: Lecturers in the Computer Field .... Heads of Computer Science Departments .... Authors of Books in the Computer Field .... Authorities in Computer-Assisted Instruction ....

SAMPLE CAPSULE BIOGRAPHY
(many abbreviations expanded)

CHAPIN, Ned / consultant / born: 1927 / educ: PhD, IIT; MBA, Univ of Chicago / entered computer field: 1954 / main interests: applications, business, logic, management, programming, systems, data structures / title: data processing consultant / organization: InfoSci Inc, Box 464, Menlo Park, CA 94025 / publications, honors: 3 books, over 50 papers; member, over 12 assoc; CDP; lecturer for ACM / home address: 1190 Bellair Way, Menlo Park, CA 94025

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UNDERESTIMATES AND OVEREXPECTATIONS

Dr. J. C. R. Licklider
Professor of Electrical Engineering
Massachusetts Institute of Technology
Cambridge, Mass. 02139

During the last three decades, the military-industrial complex of this country has had dozens of major experiences in the design, development and deployment of large complex systems. These have involved radar, communication, computer and other related electronic subsystems, all of which are essential to the ABM. From these accumulated experiences, lessons have been learned by individuals and to a lesser extent by organizations. And as a result, it is now part of the "common wisdom" of many scientists, engineers and administrators of technology that—particularly for a certain class of systems—costs and times tend to be grossly underestimated and performance tends to be mercifully unmeasured.

By all rights, it would be taken for granted that lessons learned through past experience would have been applied in evaluating the probable effectiveness of the proposed anti-ballistic missile system. But the "facts of life" about other complex systems have never been incorporated adequately into the basic procedure of procurement. Thus the elaborate process of planning, proposing, awarding, funding, slipping and overrunning continues almost as though it were a chain of instinctive behavior, not modifiable by learning.

The class of systems for which costs and times are repeatedly underestimated and performance repeatedly overestimated have certain definable characteristics. These are: (a) complexity and "sophistication"; (b) several interacting technologies; (c) several or many concurrent but geographically separated instances; (d) operating conditions not mainly as envisioned by the designers or under the control of the operators; (e) the changing of the task with time; and (f) difficulties in the way of testing and practice. Some of the systems in this class are:

1. All-weather interceptors
2. Semiautomatic Ground Environment (SAGE) for air defense
3. Distant Early Warning (DEW) Line
4. Ballistic Missile Early Warning System (BMEWS)
5. Strategic Air Command Control System (SACCS)
6. Many others of the so-called "L" systems (intelligence and command-and-control systems)
7. Airlines reservation systems (e.g., SABER)
8. Electronic Switching System (ESS)

The closest things to counterexamples, we think, are Polaris and the Mercury-Gemini-Apollo series. Both are complex and sophisticated and involve several interacting technologies, and both have pretty good records. Note, however, that in both cases the operating conditions are mainly as envisioned by the designers or under the control of the operators and the basic task remains constant over time.[1] Moreover, a large fraction of an over-all Polaris system can be tested periodically, and every manned space mission is in essence a period of test and practice. And—we think a very significant factor in the case of the NASA systems—the spacecraft have been operated one at a time on a "fire when ready" basis by the original design-development-operation team; they have not been subjected to the rigors of "continual readiness" under field conditions and at the hands of nonprofessional personnel. Even relatively simple missile systems seem to run into trouble under pressure. The newspapers have reported five firings of Minuteman missiles in demonstrations to Congressmen. All five demonstrations failed.

If a wise decision is to be made about the ABM, it is necessary for high-level decision-makers to understand how the several factors work together to influence cost, time and performance—and how strong their combined influence is. Inasmuch as most of those decision-makers did not have close exposure to the technological experience provided by systems such as those listed, and inasmuch as there is no source that is both comprehensive and convenient, it may be necessary for the decision-makers to hear scientists, engineers and administrators on the subject.[2] Even with power of subpoena and much staff assistance, however, it would be difficult or impossible to develop truly authoritative data on the underestimation of cost and time or on the overestimation of performance. What could be reasonably developed, we think, is a subjective appreciation of the difficulties and uncertainties and of the distortions of perception and estimation that characterize the planning, development and deployment of complex systems even when they are in good hands. (Let us stress that the distortions of which we speak are not attributed either to stupidity or to villainy; they seem just to be characteristic of technological or organizational thinking in the complex-system field.)

"Can we design computers and their attendant programs with a reasonable expectation that they will function?"

Interceptors: The First Test

Will an ABM system work when it is used for the first time? For obvious reasons, it will not have been tested as a whole.

Although the Air Force's all-weather fighter planes have not had to intercept enemy bombers, they have been "used" in tests with airborne targets. Perhaps the earliest full-scale tests were the Engineering Suitability Tests of the F-86 (North American), F-89 (Northrop), and F-94 (Lockheed), back in the early 1950s. Those aircraft were quite complex weapons systems by then-current standards, though not by today's. This is what happened the first time each aircraft fired rockets at a towed target: the F-86 had a malfunction of the rocket launcher; no hits. The F-94's rockets disturbed the air intake of the jet engines and caused a flame-out; no hits. The F-89 fired all its 104 rockets: 103 went off at an angle of about 45 degrees from the line to the target; one rocket wobbled erratically, departed from the others, and by the sheerest of flukes scored a direct hit on the target.

A direct translation of those experiences—which were by no means the worst offered by the all-weather interceptors—into the ABM context would, of course, spell out a horrible debacle.

SAGE System: Idiosyncratic Behavior

What about the extrapolation from developmental tests of a precursor to deployment of a full-scale system? The Semi-automatic Ground Environment for air defense offered pertinent lessons.

The Cape Cod system had a few troubles, but it worked—surprisingly well—less than a year after it was undertaken. The SAGE system was to be essentially a scaled-up and replicated Cape Cod system, hence easy to estimate and schedule. Yet the number of man-years of programing required was underestimated by six thousand at a time when there were only about a thousand programers in the world. Up to a few weeks of the scheduled date of the first full installation-wide software test, the programing was "on schedule"—but then it slipped a year, and then another. Initially, it was thought that when the software was perfected for one installation, it would have only to be copied for all the others—but then it was found that each location was idiosyncratic and required time-consuming custom programing. And, of course, the computer technology advanced more rapidly than the system development. And the threat advanced more rapidly than the computer technology. SAGE was obsolete before it was completed. Although it was never subjected to a realistic test, the initial exercises made it obvious that SAGE could be brought under control, if at all, only step by step over a period of many months.

Another kind of lesson could be learned by dropping in on SAGE installations a couple of years ago—and probably still today. According to credible reports, there were makeshift plastic overlays on the cathode-ray displays, and the 'scope watchers were bypassing the elaborate electronics—operating more or less in the same "manual mode" used in World War II.[3] But perhaps we should not call that a lesson; it is part of the bottled-up knowledge in most systems engineers' heads that operational readiness simply cannot be maintained in an inactive man-machine system, in a man-machine system that is not repeatedly performing its essential function so that one can repeatedly see how well or how poorly it performs. If you try to achieve sustainable operational readiness by turning to fully automatic design, you give up human control over the crucial decisions. If you retain human control, you have to remember the sad experience of SAGE and other man-machine systems that tried to remain "ready" and "set" without ever receiving the word "go."[4]

DEW Line: Changes on the Spot

The Distant Early Warning Line was a highly amplified example of "hurry up and wait." According to a summary by Donaldson,[5] it was "conceived in 1952," "born in 1953," and "formally turned over to ITT Federal Electric Corporation by the USAF for operation and maintenance in the summer of 1957." (Five years for design, development, and deployment.) Donaldson's summary says:

> Most of the electronic equipment, because of the urgency of the situation, did not have a normal development period. Equipment was manufactured directly from the breadboard design. Because of this,

many operations and maintenance problems arose which were not normal to a technician's daily work. The problem of modifications to electronic equipment and building and outside plant equipment to meet its new environment is discussed. Reliability of the detection and communication equipment and experience on remote area operation of a complex weapons system, in the face of ever increasing military operation requirements, and their solutions are reported.

BMEWS: Moonbeams

Early in its operational life, the Ballistic Missile Early Warning System made its now-famous detection of "incoming ballistic missiles" that turned out to be the moon. Fortunately, cool wisdom in Colorado Springs—and lack of confidence in the new system—prevailed over the reflex of counterstrike, and what could have been the greatest tragedy in history became a lesson. Was the lesson merely to remember that large, distant objects can reflect as much energy as smaller, nearer ones? Or was it that men may not trust the advice of untested electronic systems enough to launch nuclear missiles? Or was it that men ***should not*** trust the advice of untested electronic systems?

SACCS: The "Bug" Problem

The development of SACCS (Strategic Air Command Control System) updated the programing experience gained in the SAGE system. It showed dramatically that, when software gets very complex, you can pour more and more men and money into it without causing it to be completed. The programs get more and more complicated but not more and more operable. You begin to understand the possibility that they may literally never be "debugged" and integrated. You lower your aspiration level and accept what there is, working or not. You hope that the military computer people can finish the task the contractor's computer people could not—but you know that is only a hope, and you are happy that they can find things to do with parts of the contractor's unfinished product.

To put SACCS-like software into an ABM system would be folly—potentially hideous folly. To put perfected software into an ABM system would be—and this is the consensus of experienced system programers—impossible. All the large software systems that exist contain "bugs." There is no prospect for wholly perfecting any large software system in the next decade.

Other "L" Systems

At one time, at least two or three dozen complex electronic systems for command, control and/or intelligence operations were being planned or developed by the military. Most were never completed. None was completed on time or within the initial budget. There should be a "History of the 'L' Systems."

SABER: The IOC Factor

One of my associates had the experience of flying from Detroit's Metropolitan to New York's LaGuardia the first day American Airlines' SABER (airline reservations) system was put into operation. He was trying to go to Boston, but the Detroit-Boston flight for which he was ticketed was oversold—and he took the New York plane as the next-best thing, a step in approximately the right direction, not realizing what he was getting into. When he reached LaGuardia, about two hundred people were milling about in the American Airlines area, and all the other airlines were flooded by American's overflow. Most of them had "reservations," but a reservation on the first day of the computer system's IOC[6] turned out to be worth just about as much as a letter of complaint to a computerized billing system.

The ESS: Double-time

The telephone company developed its Electronic Switching system carefully and deliberately. The curve of "percent programing completed" against time rose at about half the projected rate, then bent over and approached one hundred percent asymptotically.[7] Indeed, the curve looked very much like curves for other large computer-based systems and added another bit of confirmation to the rule that such systems turn out to require at least twice as long for their development and deployment as their planners think they will.

ESS was developed over a period of about three years; tested, modified and augmented over a period of six months in a pilot installation; improved; tested, modified and augmented over a period of a year in a second installation; and then put into wider service gradually. Hundreds of flaws were discovered and corrected in the process.

Although a great advance over the older electromechanical systems, ESS is actually not very far out. It switches in milliseconds, not microseconds or nanoseconds. It switches lines, not messages. It is a far cry from the switched digital network that the nation ought to have. Note that such a conservative system as ESS can be deployed successfully only with much trial and error and gradual progression. How can one expect to make the much more radical ABM electronics work the first time out?

Computer Programing: Endless Revisions

From experiences of the kind described in the preceding section, we have learned that the brash confidence of the "systems salesman" usually fades into the background soon after the development contract is let—and that the schedules slip, the costs mount and the delivered product falls short of the promise. We have learned that the misestimation of time, cost and performance are usually worst for the most complex subsystems. And we have learned that in many systems the most complex subsystem is the computer software, that is, programing. It seems worthwhile to focus attention, during the process of deciding about the ABM, upon its software subsystem. The following paragraphs deal with problems in the development and deployment of software that will probably be pertinent to the ABM software subsystem.

First, experience shows that computer programs that carry out regulatory and control functions are usually much simpler and easier to prepare than computer programs that involve target acquisition, pattern recognition, decoy discrimination, decision-making and problem-solving. If the ABM software were required only to handle clear signals and uncomplicated threats, and if it could be tested in an operational context, one might not expect more than a moderate amount of programing misestimation and trouble. On the other hand, if—as the case will actually be—the system will have to contend with weak signals and a sky full of man-made objects, some of them designed to resemble missiles or warheads, then, no matter how simple and straightforward it is expected at the outset to be, the ABM software will turn out to be very complex, continually in the process of revision and augmentation, and never free of bugs and "glitches."[8]

Fallibility: On the Research Frontier

Because the matter of errors in the programing of complex computer software is so fundamental, let us take time to make it clear that the presence of such errors in a program is not evidence of poor workmanship on the part of the programers. True, the fewer errors the better the work and the more, the worse—other things being equal. But the essential facts are that all complex programs contain programing errors, that no complex program is ever wholly debugged and that no complex program can ever be run through all its possible states or conditions in order to permit its designers to check that what they think ought to happen actually does happen.

On the frontier of computer science, research people are working to overcome the obviously unsatisfactory situation just described, but they are not yet within reach of practical solutions. In the meantime, an important part of the software art is the part that concerns the practical mastery or "containment" of complex software subsystems. The techniques that have been successful involve continual operational testing of the over-all systems within which the software runs, careful recording of all detected anomalies of system behavior, taking the system out of operation periodically to make diagnostic tests and to track down the bugs and glitches and very careful revision and retesting of the programs. The revising has to be done very carefully because a programer is likely to do more harm than good when he makes a "corrective" change. Correcting one error may expose another, which, when it gets a chance, may disrupt the whole subsystem—which may then disrupt (or conceivably even destroy) the over-all system.

To a person who has been bombarded by phrases about "the fantastic speed and accuracy of the computer," the foregoing may appear to be either a heresy or grounds for barring computers from all functions that are vital to society. Actually, it contains a trace of both, but it is substantially neither. As we said, recognition of the facts of computer life is part of the common wisdom of knowledgeable computer scientists and engineers. Just as the foregoing assertions are facts of computer life, so also is the assertion that even quite complex software subsystems can be "mastered" (which is not the same as "perfected") and made to provide useful and effective service if they can be developed progressively, with the aid of extensive testing of systems (as well as subsystems and components), and if they can be operated more or less continually in a somewhat lenient and forgiving environment. A crucial question for consideration at this time, it seems to us, is the extent to which the ABM system and its environment will offer the conditions under which the essential software subsystem can be mastered in the sense and in the way just described.

Slowness and Cost: The "Retrofit" Factor

The study referred to earlier (summarized by Nossiter in the Washington *Post*) notes that "complex electronic systems typically cost 200 to 300 percent more than the Pentagon expects and generally are turned out two years later than promised."[9] From the data presented by David[10] and from our own unsystematized observations, we have the impression that the two years is an underestimate of the typical schedule slippage, but it does not lead to a seriously distorted conclusion if one keeps in mind that a complex system may be delivered or deployed long before it is actually in fully operable condition. Indeed, complex systems ordinarily go through a long series of "retrofits" and field modifications. The F-111 swing-wing fighter-bomber leaps to mind as the example, of course, but perhaps the significant thing is that, although it seems to have been singled out for criticism, it is actually not much worse than quite a few other weapon systems.

In 1964, the rule of thumb for estimating the manpower requirement of the programing of large systems was 200 or 300 machine instructions per man-month. However, in a graph developed that year by Nanus and Farr,[11] summarizing experience gained in developing eleven complex systems, the function relating man-months to number of instructions curved upward rather sharply. It showed—on the average, though with quite a bit of variation—about 200 instructions per man-month on systems of 100,000 or 200,000 instructions, but fewer than 100 instructions per man-month on the largest of the eleven systems, which had 640,000 instructions. Such figures make it clear that the programing of large systems is governed by other factors than the capability of a typical programer to write a procedure: it would be difficult for a programer to write fewer than 100 instructions in a single morning. The governing factors have to do with the definition and organization of large programing tasks that involve several or many programers.

Many things have changed for the better in the world of software since 1964, but not the essential facts about the programing of large, complex systems. To obtain a rough check on the figures of Nanus and Farr, we made a quick calculation of the programing rate of the Multics system, a multi-access computer system developed jointly by General Electric, the Bell Telephone Laboratories, and M.I.T. For five years, it has been the focus of effort of a software group averaging about 50 people—which translates into 3,000 man-months. After having reached a size of well over a million instructions, it is now down to about half a million, and much better for having been made more compact. Thus Multics has yielded roughly 160-170 instructions per month for each of about 50 men. Perhaps one should take one instruction per hour for each of 100 men as a close-enough, easy-to-remember rule.

The instructions to which we have referred are machine instructions. To a first approximation, it may not matter how they were written—whether in a simple "assembler language" or in a high-level "compiler language." The significant thing is that the main causes of inefficiency lie outside the individual programer. If the 100 men were increased to 1,000, the hourly productivity of each would decline to one-third or one-fifth—or possibly one-twentieth. It may well be that, for any given state-of-the-art, there is an upper limit to the rate of production of complex, integrated software, and it may well be that it is now in the neighborhood of 10,000 or 20,000 instructions per month.

Significance for the ABM: The Slow Software Pace

The significance of the foregoing discussion of slowness and cost lies in the slowness much more than in the cost. If a 10-billion-dollar ABM system required a 10-million-instruction software subsystem, the cost of the software, in and of itself, would be almost negligible. The trouble would come from the interaction of the software development and the development and deployment of the other subsystems. After each partial[12] system test, there would be weeks and months of reprograming—concurrent with the argument as to whether the failure of the test was due to the software or to other subsystems. Meanwhile, the threat would be changing—and the system would be continually improved and adapted—and the software would always be adjusting to changes in other parts of the system as well as to changes within itself. Thus the whole system effort would be reduced to the software's pace and to its state of confusion. On the other hand, the sad plight of the software system might be hidden from some of the other subsystems—and from the outside world—until the arrival of the hoped-against moment of truth. Then would the bugs come out.

We have, in sum, tried to set forth some of the considerations which we think should be held in mind by the decision-makers who determine whether or not to deploy an ABM system—and, if so, where, when and how. Most of the considerations pertain to the unhappiness that lies ahead for anyone who deploys a large, complex system that involves computers and software, that faces a changing and complicating threat and that cannot be tested continually as a whole. But we doubt that a mere description will serve to convince those not already convinced. We doubt that adversary proceedings are what are called for in the decision process of an issue so crucial to the future of life on this planet. □

Acknowledgement

This article is from the book **ABM: An Evaluation of the Decision to Deploy an Antiballistic Missile System,** Copyright© 1969 by Abram Chayes and Jerome B. Wiesner. Reprinted by special permission of Harper and Row, Publishers.

References

[1]When Apollo's LEM lands on the moon, the operating conditions may cease to be mainly as envisioned by the designers or under the control of the operators, and the basic task will change considerably — and, significantly, it is precisely at that time the confidence built up through the long series of orbital missions will need the most support from success in the ongoing operations.

[2]Perhaps the closest approach to a comprehensive report is one that was circulating early this year in governmental and academic circles. See article by Bernard D. Nossiter, "Weapon Systems: A Story of Failure," Washington **Post,** Sunday, January 26, 1969. See also **Congressional Record,** February 9, 1969, p. S 1450 for the full text of this report.

[3]Frederich B. Thompson, "Fractionation of the Military Context," **AFIPS Conference Proceeding,** Vol. 25, Spring Joint Computer Conference, 1964, pp. 219-230.

[4]Of course, the interceptors "scrambled" against "unknowns," but that is nothing like going in earnest against a nuclear attack.

[5]W. G. Donaldson, "A Decade of Field Operations and Maintenance of the DEWLINE," Conf. Proc. Mil-E-Con 8 **(International Convention on Military Electronics),** p. 134, 1964.

[6]Initial operating capability, or the day on which a system is put into operation for the first time.

[7]Edward E. David, Jr., "Effects on the Professions and on the Character of Individual Contributions to Society," talk presented at the 1968 Alumni Seminar, M.I.T., November 9-11, 1968.

[8]Glitches are errors that, once they are located and understood, seem more glaring and blatant than bugs.

[9]Nossiter, B.D., **op. cit.**

[10]David, E. E., **op. cit.**

[11]Burt Nanus and Leonard Farr, "Some Cost Contributors to Large-Scale Programs," talk presented at the Spring Joint Computer Conference, M.I.T., 1964.

[12]There could not be a complete system test without exploding nuclear warheads.

c.a

NUMBLES

Number Puzzles for Nimble Minds — and Computers

Neil Macdonald
Assistant Editor

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 is otherwise irregular, to discourage cryptanalytic methods of deciphering.

We invite our readers to send us solutions, together with human programs or computer programs which will produce the solutions.

NUMBLE 698

```
  P E O P L E          W A X
 +    W I T H     + H E A D S
 =L A I E E I     = H A A L S

   P D T K = L O U X = P N U X

  18532  55539  72045  386135
```

Solution to Numble 697

In Numble 697 in the July issue, the digits 0 through 9 are represented by letters as follows:

E = 0	A = 5
O = 1	S = 6
T = 2	F = 7
N = 3	W = 8
I = 4	H = 9

The full message is: Want is the whetstone of wit.

Our thanks to the following individuals for submitting their solutions to Numble 696: A. Sanford Brown, Dallas, Tex.; T. P. Finn, Indianapolis, Ind.; Ross F. Garbig, Toronto, Ontario, Can.; Adrian Kuhs, Williamsport, Pa.; G. P. Petersen, St. Petersburg, Fla.; David Sickles, Williamsport, Pa.; D. F. Stevens, Berkeley, Calif.; and Robert R. Wedin, Edina, Minn.

THE ROLE OF EDP EQUIPMENT IN THE ACCOUNTING SYSTEM OF THE COMMONWEALTH OF PENNSYLVANIA

William J. Carlin, Director
Bureau of Program and Management
Capital Building
Harrisburg, Pa. 17102

"A new computer system will relieve each comptroller of the function of maintaining budgetary accounting records, and will enable him to concentrate his efforts on interpreting, forecasting, and advising officials of his department and the Office of Administration about the operations of the department which he serves."

The accounting systems employed by the Commonwealth of Pennsylvania are characterized by close central co-ordination and control exercised from the Office of Administration, a part of the Governor's Office. This is a direct result of legal provisions which assign responsibility for designing and maintaining uniform accounting systems to the Governor.

Background

Prior to 1955, each Department under the Governor's jurisdiction maintained its own budgetary accounting records under very limited central requirements. As a result, it was impossible to determine the financial condition of the Commonwealth as a whole on an accurate and timely basis. In fact, several conflicting financial statements were issued from different sources well after the close of the accounting period.

When the Office of Administration was formed, a Bureau of Accounts was created and given responsibility for establishing uniform accounting systems subject to central controls established and enforced by the Bureau. Realizing that each Department required timely accounting reports concerning its activities and the advice of an experienced financial manager, the accounting organization was established with a Comptroller physically located in each Department. The Departmental Comptrollers are under the supervision of the Director of Accounts in the Office of Administration.

This arrangement provides the Director of Accounts with direct and immediate control over all accounting operations and places an independent financial advisor and resident auditor in each of the departments under the Governor's jurisdiction. A system of summary daily reports at the general ledger level from the comptrollers to the Bureau of Accounts enables the Bureau to produce accurate financial statements for any of the major budgeted funds on very short notice.

Expansion

Initially, the detailed subsidiary allotment records maintained by the Comptrollers' Offices were maintained through use of bookkeeping machines. It soon became apparent that this equipment could not efficiently handle the volume of transactions occurring in the larger departments. Consideration was given at this point to maintaining all records centrally, employing unit record equipment on the Univac I which the Commonwealth acquired in 1958. It was determined that the most feasible approach would be to employ unit record equipment in those departments where volume warranted its use and to maintain the system under which a comptroller was assigned to each department.

Over the next several years, advances in data processing technology and our own growth resulted in substantial updating from bookkeeping machines to unit record equipment and finally to EDP equipment in our larger departments.

The relatively recent advances which have made large-scale, low-cost random access equipment available required that we again review the system in use. As a result, systems redesign is now under way for the formation of a system under which all accounting records will be maintained within our central computer center on its random files. In the Comptrollers' Offices, transactions will be audited and batched for transmittal to the computer center where the accounting records will be maintained. Initially, the transmission media will be created on magnetic tape through the use of a keypunch-like device now available from both Mohawk and NCR. This device permits transcription of source data directly to magnetic tape, rather than through punched cards as has been the usual practice to date. During the early phases of this system, output to the comptrollers will take the form of computer-produced reports of daily status showing the current status of each allotment account. Eventually, we hope to have direct input-output devices in each of the Comptrollers' Offices, probably in the form of cathode ray tube devices.

Central Data Bank

Essentially, the new system will result in the formation of a central data bank which will store all accounting information. It will make each comptroller's organization more efficient in that the comptroller will be relieved of the function of maintaining budgetary accounting records so that he can concentrate his efforts on interpreting, forecasting, and advising officials of his department and the Office of Administration concerning the operations of the department which he serves.

More importantly, this system will provide a Commonwealth-wide accounting data base which is readily accessible by top management. Preliminary systems work has now been completed and computer programming is in process. Several departments are scheduled to begin the new system on a test-basis soon. If no major problems are encountered during the shakedown period, we expect to have the central data bank in operation within the next year.

The system which I have outlined here has as its objective the recording of the execution of the budget. It serves to display for the public and the Legislature the financial condition of the Commonwealth as it relates to taxes, appropriations and fund balances.

Management Accounting Systems

Most of our recent work in accounting systems and EDP applications has not been in the area of budgetary or fund accounting. Efforts have been concentrated in the area of developing management accounting systems and related EDP applications for the large segment of the Commonwealth's operations which are, at least from an accounting point of view, non-governmental in nature.

Examples of these activities would include:

1. The cost accounting system accounting for manufacturing operations within Correctional Industries. These industries manufacture virtually all clothing used in State institutions, most of the wooden office furniture used in State offices, soap, printed forms and various textiles, including blankets. Annual sales are approximately $10 million.
2. The Commonwealth operates what is probably the largest retail distribution system in the State through the Pennsylvania Liquor Control Board. This system, which is also the largest buyer of liquor in the world, now includes seven hundred stores with annual sales in excess of $400 million and annual profits in excess of $110 million.
3. Within the Department of Highways, the Commonwealth has developed a computer-oriented system which is used to account for in-house construction and maintenance costs amounting to $94 million per year and to classify and process accounting records relating to construction performed by contractors at an annual rate of $208 million.
4. Finally, the Commonwealth also operates: 2 competitively oriented insurance carriers; approximately 50 general, mental and geriatric hospitals; and 13 State colleges.

In all of these endeavors, the accounting requirements are substantially the same as they would be if the organization in question were not owned and operated by the Government.

Thus, we face many of the problems faced regularly in designing and automating accounting systems for manufacturing, retail distribution, insurance, construction, and hospital functions.

Example: The Liquor Control Board

One of the more complex systems now being implemented concerns the integrated management system for the Liquor Control Board. Since I was initially rather closely associated with it, and because it clearly demonstrates application and organization problems common to automating both government and private functions, I will outline our experiences to date in some depth.

In the fall and early winter of 1965, the Liquor Control Board came to the conclusion that its EDP facility—an IBM 1401—would no longer satisfy the requirements of current applications and permit the extension of automation to other areas of operations. The Board's recommendation was that the 1401 be replaced by an IBM 1460 computer, retaining the same programs and systems, but taking advantage of the faster operating speeds of the 1460.

Computer Selection

We in the Office of Administration suggested that a complete review of the information and operating systems within the Board be performed and that new equipment, if needed, be selected on the basis of the results of that review.

To complete this review in a reasonable period of time and to insure that expert knowledge representing all appropriate disciplines was provided, a task force was formed composed of Liquor Control Board employes, consultants from the firm of Peat, Marwick, Mitchell who were engaged by the Board, and representatives of the Office of Administration.

During the next six months, this team thoroughly investigated the Liquor Control Board's operations. It concluded that:

1. Methods then used fell into two broad groups—those formulated at the Board's inception in 1933 and those developed with the installation of the 1401 computer in 1961 and thereafter.
2. The system was characterized by massive paper processing activities, repetitive entries from single transactions, duplicate records, and excessive layers of control. The system was highly accurate, but very slow to produce the needed data and very expensive.
3. The applications which had been computerized were efficiently designed as discrete applications. However, the concept of multi-use files had not been employed to the extent necessary to reduce repetitive entries and duplicate files.
4. The IBM 1401 was, in fact, not capable of handling the Board's current and anticipated applications.
5. High and middle levels of management were relatively competent and aware of their responsibilities. However, the impending retirement of a large number of these managers created a substantial problem in that lower level workers generally had

no concept of the system outside of the narrow duties of their own jobs. This level of employee also feared automation. Even when automation was accepted, there existed a tendency to favor conversion of current practices to identical methods employing the computer, thus negating the major reasons for automating.

Based on the data revealed during the review, the team developed computer specifications which resulted in the selection of an NCR 315 Rod-Memory Computer as the Board's future EDP facility.

The development of detailed systems to meet the Board's needs was approached by dividing the task into three major sub-systems. They were:

1. Merchandising
2. Accounting
3. Compliance

In the Merchandising Sub-System which included liquor purchasing, warehousing, distribution, sales and store administration, the basic objectives were to reduce inventories to the lowest levels consistent with customer service and to reduce paper work in stores and elsewhere to a bare minimum.

Automatic Re-order System

The systems concept which is now in detailed design and programming includes full utilization of optically readable adding machine tapes as the principal means of input from the 700 store locations. In addition, the computer is to be used to automatically order merchandise both for stores from the warehouse and for warehouses from vendors.

When fully implemented, we believe that this automatic re-order system may be the most advanced system developed to date in the retail distribution field. It is based on the sales history of the store for a similar period over the past three years, weighted through exponential smoothing so that the most recent sales history has a higher value than older sales history. In this way, trends are recognized and given emphasis. The system also provides for an override of the automatic order by the store manager, when local conditions not known at the central office occur. The manager's override must specifically refer to the event in question and records concerning the accuracy of his adjustments to automatic orders are maintained since this is a factor in evaluation of the manager's job performance.

We expect that the new system will reduce average inventories by as much as one-third, or approximately $20 million.

Licensing and Enforcement

In the Compliance Sub-System, which includes licensing and enforcement, our basic objectives were to improve the quality and accessibility of the data needed to issue and review licenses and to maintain a history of the license from an enforcement point of view.

This information is now maintained manually in several massive files which are difficult to cross-reference and update. Information retrieval is often difficult and time-consuming.

In the new system, we expect to issue approximately 50,000 licenses per year from the computer, by sending the license holder a computer print-out of the license application in his file to be updated by the applicant rather than forcing the applicant to completely fill out a complex application each year. We also expect to standardize license and application formats from slightly less than 50 now in existence to about 8.

Finally, we expect to maintain license and enforcement files in a randomly addressable format. This will enable the Board members, enforcement officers and others to have immediate access to the license file which identifies the licensees, the license location, previous citations, enforcement visits, and other enforcement data.

Accounting Sub-System

The Accounting Sub-System serves as a central data bank and shares its inventory, supply, and sales files with the Merchandising Sub-System, while also sharing its licensing revenue files with the Compliance Sub-System. The Accounting Sub-System is the primary input area for all files through an input control division in the Office of the Comptroller. Input affecting financial data, including inventories, which is not introduced into the system from the Accounting Sub-System is logged by the computer for audit by the Comptroller's Office.

Sales and physical inventory data is received from the stores by the Comptroller's Office in the form of machine-scannable adding machine tape. Data concerning inventory shipments and receipt of new inventory is received from warehouses throughout the State over communication lines linked directly to the computer. This data is subject to later audit based on hard copy records of the transfers.

Disbursement, asset, adjustment and other accounting data are entered into the system from other divisions of the Comptroller's Office in the form of magnetic tape or punched cards.

As input data affects subsidiary files, it is automatically summarized and posted to the general ledger which is maintained within the computer. Thus, financial statements can be produced by the computer once any necessary adjusting entries have been made.

Significant savings will be made in auditing invoices and preparing statistical reports as many aspects of these functions will now be automated. For example, as a by-product of recording receipt of merchandise, the computer will determine the appropriate freight charge and report this item to the individual who will audit freight charges. This saves a fairly involved manual reference to freight tariffs.

Personnel

Although our primary objectives did not include an attempt to replace personnel, the peculiar age situation which prevailed at the Liquor Control Board with many employes reaching retirement age at this time lent itself to staff loss by attrition as we automated various functions. During the time I was Acting Comptroller (1966), the staff of the Comptroller's Office was reduced through attrition from slightly less than 300 employees to approximately 215.

Eventually, fewer than 100 people will be needed to staff the Comptroller's Office. I am certain that the reduction of staff can be accomplished through voluntary retirements and reassignments.

The foregoing should not be taken to imply that all has gone smoothly or that the system as finally and completely implemented will look exactly as I have described it. The Liquor Control Board has had its share of problems in equipment, programming, and people. We have been at

c.a IDEAS: SPOTLIGHT

The Technical Iron Curtain: The Communications Barrier Between Senior Management and the Computer Men

Peter Hall
International Computers, Ltd.
London, England

(Based on a report in "The Times", Printing House Sq., London EC4, England, May 13, 1969)

Computer men are frustrated by the seeming ignorance of management; while managers are so confused by computer experts' jargon that they become frightened and give up.

Prime responsibility for this state of affairs, it seems to me, belongs to computer people.

The biggest obstacle to the successful introduction of a computer system is not the manufacturer, but fear on the part of non-computer management. It is up to us computer men to remove this fear by insisting on proper educational programmes that help to show that we are human and can speak English as well as our own jargon.

Some computer installations have been doomed to failure because the wrong man was placed in charge. Four easily recognizable character types of "wrong man" are the amateur computer expert, the gadgeteer, the straw clutcher and the abdicator.

The amateur computer expert has read a few articles, has become firmly hooked by a few notions, and does not match the firm's requirements to his proposed system. He ends up with an interesting installation working three shifts a day and producing lots of paper, but doing no good to anybody.

The gadgeteer sprinkles his company with terminals, cathode-ray-tube display units, etc., irrespective of the real need and the pay-off. Everybody will have a lot of fun, but does he really improve the profitability of his company?

The straw clutcher is a director or works manager who is having a terrible time. Things are going wrong, and he is in a position higher than his incompetence level. He installs a computer because he believes that it has some magic power which will somehow restore the company's fortunes and save him personally from disaster.

The abdicator is a senior man who recognizes that his firm ought to have a computer because Joe Bloggs around the corner has one. He approves its purchase and, with a sigh of relief, forgets all about it. He believes he has done what is necessary to bring the company to the forefront of modern technology, but he does not wish to become involved. He tells the computer expert to do what he likes so long as he does not upset anybody. . . . □

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times between up to six months behind in the implementation schedule.

Membership of the Board itself has turned over almost completely since work began early in 1966. This resulted in the task force's having to orient each new Board member to conditions and objectives. For without one hundred percent support from the top, no progress would have occurred.

Several top executives have retired or died in the last fifteen months; this also increased the difficulties that were faced. Nevertheless, I am confident that the system as finally installed will meet all of the expectations outlined here.

You will notice that I have emphasized the Merchandising and Compliance Sub-Systems and the part that we in the Comptroller's Office played in formulating them. This was done purposely to emphasize that we no longer have an Accounting System as such. It has become a Sub-System in the Liquor Control Board's Management System. With the advent of computers containing large elements of core storage, extremely fast internal speeds, the ability to work on two or more programs simultaneously, and virtually unlimited on-line storage, the justification for the expensive process of separate sales, purchasing, distribution, and accounting systems has disappeared.

A Change in the Accountant's Role

Concurrent with this change, a change in the role of the accountant is also occurring. He can no longer afford to look upon EDP as simply a means of manipulating data through the system more rapidly. Better computers, increasingly sophisticated software, and improved quality in the work of in-house programmers is bringing about a new situation. In this situation, managers, accountants, and comptrollers who do not understand the applications performed by their company's computer, the way they are performed, and the ways they might be better performed, are not going to remain in their positions.

An EDP facility will not replace them, but people who understand how the facility works, will. The advancements in EDP technology which have occurred, especially the most recent ones, enable the top manager of a large organization to be more aware of, and to more directly affect, the operations of his organization than ever before. Certainly he retains a need for technicians and advisors, but only those who understand the data on which he bases his actions, and this is not possible, lacking un understanding of the system through which the data is gathered and processed to produce management's reports.

Too often I have seen financial managers and others allow EDP personnel to completely resystematize their areas of responsibility without fully understanding how the new system was developed or how it would operate.

It is easy to take the position that "the machine will never replace a professional like me" or to say, "that computer down there is just a big calculator." Most of the people I know who have taken a position like this have found themselves supplanted in the organizational hierarchy by individuals who recognized the need to understand the techniques of systems and computers.

Accounting as a profession almost lost the field of management consulting to Booz-Allen and other general consultants. Only recently have the big CPA firms made a comeback. I believe that as a profession, accountants must now recognize the need for a comprehensive knowledge of systems techniques and EDP.

Failure to recognize this need must result in erosion of the accountant or auditor's position as an advisor to management. □

REPORT FROM GREAT BRITAIN

Buy British

IBM unbundling arrived in Britain in the middle of yet another determined assault by a number of American manufacturers operating in the United Kingdom on the Ministry of Technology's "Buy British" policies. It went almost unnoticed therefore and, since IBM (UK) will make no pronouncement till April 1970, we will leave the topic for a moment.

What sparked the rumblings on Buy British was not the fact that the Government had awarded a large contract to International Computers—the company it has backed with $50m of taxpayers' money—but that it had awarded the $6m plum to IBM.

It is for two 360/50's, a mass of discs and other peripherals, plus some very fancy software to take over pay and personnel data from IBM 705's and a 1401 and handle 175,000 accounts for British troops.

All this appears straightforward and above-board. But International Computers is furious on the grounds that here was a piece of accounting work any computer manufacturer could handle. At the same time, IBM has indicated—unofficially, of course—that it had previously told the UK Government, through the Ministry, that unless it got a fair crack of the whip it would withdraw from all Government tenders.

Meantime, the long drawn-out fight over the customs and freight document system at London Airport, commonly known as the LACES system, is similarly fraught with arguments over this Buy British policy. It would seem—though events may contradict this view—that IBM is out of the running for this $8m—$10m network which will serve all the airlines using London as a freight centre. Whether the Army Pay Corps contract was a sop to IBM can only be surmised. This leaves Univac in the field with ICL. Univac is believed to have called in the U.S. Embassy to "see fair play", having put in a tender reportedly more than $1m lower than that of the British company.

Yet Univac and IBM both have giant systems installed with Britain's two national airlines. BOAC has IBM's Boadicea and BEA has the Univac Beacon network. Moreover Univac has won a number of big Government stores and records handling contracts while ICL's largest system specified for the Government area was for the Social Security centre at Reading, now more than three years back.

U. S. Manufacturers React

More important still, neither IBM nor Univac have seen fit to set up in Britain a significant computer operation.

It seems that both companies are screaming before they are hurt. This is, of course, a good policy with a government like the one we have now in Britain, which suffers from too tender a conscience where industry is concerned. Maybe the Ministry and the Board of Trade fear Britain will continue to be by-passed by IBM for major production moves. It undoubtedly will if concessions are made at each threat.

One claim made by competitors on the British market, to be so much better at big EDP systems than the ICL men, would bring a belly laugh if it were voiced in the U. S. after what we have heard on both sides of the Atlantic from Dick Brandon and John Diebold. It is somewhat impudent in the present U. S. climate of lawsuits for poor performance or failure of a number of installations, as well as the abandonment of the Burroughs 8500, the CDC 6600 cliff-hanger and so on.

It must not be forgotten that Honeywell in the UK has been developing a number of software packages for management purposes that its U. S. counterpart does not yet see required at home. UK techniques are good. Most British companies have little enough to throw around after taxes, and cannot afford prestige computers. It follows that the operating staff will be required to get the most—often too much—out of the equipment they are given. Programmes have to be more ingenious. Time-sharing was first conceived in the UK and IBM set up its PL-1 hothouse at Hursley. So have we so much to receive, apart from equipment already amortised by the U. S. military?

ICL's Reaction

I think the final word on the "Buy British" quarrel should be left to Arthur Humphreys, managing director of ICL. A few days ago he said rather ruefully: "What? ICL the Government's chosen instrument!

"If there *is* a Government policy to buy from ICL—as has so often been said by our competitors these last few years—we would like very much to see it. But we can't expect to have business handed to us."

Mr. Humphreys was confident of one market however—America. He is offering a number of interesting peripherals for the terminals market. These include a tiny and quite speedy line printer as well as card readers and punches.

IBM's Unbundling

To return to unbundling. No one in the UK has interpreted the "great event" as anything more than a breathing space for IBM while it prepares to take a swat at the leasing company mosquitoes, crunch the pesky software houses and settle the hash of CDC at the top of the range. But, we

(Please turn to page 59)

CALENDAR OF COMING EVENTS

Aug. 11-15, 1969: Australian Computer Society, Fourth Australian Computer Conference, Adelaide Univ., Adelaide, South Australia; contact Dr. G. W. Hill, Prog. Comm. Chrmn., A.C.C.69, C/-C.S.I.R.O., Computing Science Bldg., Univ. of Adelaide, Adelaide, S. Australia 5000.

Aug. 25-29, 1969: Datafair 69 Symposium, Manchester, England; contact the British Computer Society, 23 Dorset Sq., London, N.W. 1, England

Aug. 26-28, 1969: Association for Computing Machinery (ACM) National Conference and Exposition, San Francisco, Calif.; contact Pasteur S. T. Yuen, P.O. Box 2867, San Francisco, Calif. 94126

Sept. 8-10, 1969: American Institute of Aeronautics and Astronautics (AIAA) Computer Systems Committee, 1st Technical Specialist Conference, International Hotel, Los Angeles, Calif.: contact AIAA Headquarters, 1290 Sixth Ave., New York, N.Y. 10019

Sept. 8-12, 1969: International Symposium on Man-Machine Systems, St. John's College, Cambridge, England; contact Robert C. McLane, G-MMS Meetings Chairman, Honeywell Inc., 2345 Walnut St., St. Paul, Minn. 55113

Sept. 15-17, 1969: First International Conference on Programming Languages for Numerically Controlled Machine Tools, IFIP-IFAC, Rome, Italy; contact Dr. E. L. Harder, R & D Center, Westinghouse Electric Corp., Beulah Rd., Pittsburgh, Pa. 15235

Sept. 28-Oct. 1, 1969: Association for Systems Management International (formerly Systems and Procedures Association) International Systems Meeting, New York Hilton Hotel, New York City, N.Y.; contact Richard L. Irwin, Association for Systems Management, 24587 Bagley Rd., Cleveland, Ohio 44138.

Sept. 30-Oct. 2, 1969: Computers and Communications Conference (sponsored by the Mohawk Valley Section of the IEEE), The Beeches, Rome, N.Y.; contact John M. Harrington, Conference Chairman, 304 E. Chestnut St., Rome, N.Y. 13440

Oct. 1-5, 1969: American Society for Information Science, 32nd Annual Meeting, San Francisco Hilton Hotel, San Francisco, Calif.; contact Charles P. Bourne, Programming Services, Inc., 999 Commercial St., Palo Alto, Calif. 94303.

Oct. 6-10, 1969: Second International Congress on Project Planning by Network Analysis, INTERNET 1969, International Congress Centre RAI, Amsterdam, the Netherlands; contact Local Secretariat, c/o Holland Organizing Centre, 16 Lange Voorhout, The Hague, the Netherlands

Oct. 9-11, 1969: DPMA Div. 3 Conference, Lafayette Hotel, Little Rock, Ark.; contact Robert Redus, 6901 Murray St., Little Rock, Ark.

Oct. 13-16, 1969: Association for Computing Machinery (ACM) Symposium on Data Communications, Calloway Gardens, Pine Mountain, Ga.; contact Edward Fuchs, Room 2C-518, Bell Telephone Laboratories, Inc., Holmdel, N. J. 07735; Walter J. Kosinski, Interactive Computing Corp., P.O. Box 447, Santa Ana, Calif. 92702

Oct. 13-16, 1969: 1969 International Visual Communications Congress, International Amphitheatre, Chicago, Ill.; contact Internat'l Assoc. of Visual Communications Management, Suite 610, 305 S. Andrews Ave., Fort Lauderdale, Fla. 33301

Oct. 14-16, 1969: American Society for Cybernetics, Third Annual Symposium, National Bureau of Standards, Gaithersburg, Md.; contact Dr. Carl Hammer, UNIVAC Div., Sperry Rand Corp., 2121 Wisconsin Ave., N.W., Washington, D.C. 20007

Oct. 15-17, 1969: IEEE Tenth Annual Symposium on Switching and Automata Theory, University of Waterloo, Waterloo, Ontario, Canada; contact Prof. J. A. Brzozowski, Dept. of Applied Analysis and Computer Science, University of Waterloo, Waterloo, Ontario, Canada

Oct. 22-24, 1969: IEEE 1969 Systems Science and Cybernetics Conference, Philadelphia, Pa.; contact C. Nelson Dorny, Moore School of Electrical Engineering, Univ. of Pa., Philadelphia, Pa. 19104.

Oct. 26-30, 1969: ACM/SIAM/IEEE Joint Conference on Mathematics and Computer Aided Design, Disneyland Hotel, Anaheim, Calif.; contact J. F. Traub, Program Chairman, Computing Science Research Center, Bell Telephone Laboratories, Inc., Murray Hill, N.J. 07974.

Oct. 27-29, 1969: Electronics and Aerospace Systems Convention and Exposition (EASCON '69), Sheraton Park Hotel, Washington, D.C.; contact Howard P. Gates, Jr., EASCON '69 Technical Program Chairman, P.O. Box 2347, Falls Church, Va. 22042.

Oct. 27-29, 1969: Data Processing Supplies Assoc. Fall General Meeting, New York, N.Y.; contact Data Processing Supplies Assoc., 1116 Summer St., P.O. Box 1333, Stamford, Conn. 06904

Oct. 27-30, 1969: 24th Annual ISA Conference & Exhibit, Astrohall, Houston, Texas; contact H. Buntzel, Jr., Program Chairman, Bonner & Moore Assocs., Inc., Suite 1124, 500 Jefferson Bldg., Houston, Texas 77002.

Oct. 27-31, 1969: Business Equipment Manufacturers Assoc. (BEMA) Annual Business Equipment Exposition and Management Conference, New York Coliseum, Columbus Circle, New York, N.Y. 10023; contact Laurance C. Messick, Business Equipment Manufacturers Assoc., 235 East 42nd St., New York, N.Y. 10017

Oct. 30-31, 1969: Assoc. of Data Processing Service Organizations Management Conference, Regency Hyatt Hotel, Atlanta, Ga.; contact Jerome L. Dreyer, Assoc. of Data Processing Service Organizations, Inc., 420 Lexington Ave., New York, N.Y. 10017.

Nov. 3-5, 1969: 5th Annual IEEE Symposium on Automatic Support Systems for Advanced Maintainability, Chase-Park Plaza Hotel, St. Louis, Mo.; contact Matthew F. Mayer, Program Chairman, P.O. Box 4124 Jennings Station, St. Louis, Mo. 63136

Nov. 3-7, 1969: GUIDE International, Denver Hilton Hotel, Denver, Colorado; contact Jack Eggleston, GUIDE Secretary, Mgr., Programming R&D, Mutual of Omaha Insurance Co., P.O. Box 1298, Omaha, Nebraska 68101

Nov. 5-7, 1969: IEEE Northeast Electronics Research and Engineering Meeting (NEREM), War Memorial Auditorium and Sheraton Boston Hotel, Boston, Mass.; contact NEREM, 31 Channing St., Newton, Mass. 02158.

Nov. 6-7, 1969: First National Symposium on Industrial Robots, IIT Research Institute, Chicago, Ill.; contact Mr. Dennis W. Hanify, IIT Research Institute, 10 West 35 St., Chicago, Ill. 60616

Nov. 10-11, 1969: Digitronics Users Assoc. (DUA), 4th Annual Conference, Barbizon-Plaza Hotel, New York City; contact Secretary, DUA, Box 113, Albertson, Long Island, New York, 11507

Nov. 13-14, 1969: Conference on the Legal Protection of Computer Programs (sponsored by the Law Group of the British Computer Society), Bedford Hotel, Brighton, England; contact Conference Dept. of The British Computer Society, 21 Lamb's Conduit St., London, W.C.1, England

November 15-16, 1969: ACUTE (Accountants Computer Users Technical Exchange), Jack Tar, San Francisco, Calif.; contact ACUTE, 947 Old York Rd., Abington, Pa. 19001

Nov. 17-19, 1969: IEEE Eighth Symposium on Adaptive Processes, The Pennsylvania State Univ., State College, Pa.; contact Dr. George J. McMurtry, Program Chairman IEEE 1969 (8th) Symposium on Adaptive Processes, Dept. of Electrical Engineering, The Pennsylvania State Univ., University Park, Pa. 16802 c.a

PROBLEM CORNER

Walter Penney, CDP
Problem Editor
Computers and Automation

PROBLEM 698: FROM BINARY TO BCD

"Somebody goofed on this output," Al said.

"What's the matter?" Bob asked.

"All the numbers have been interpreted as binary and they should have been BCD. Here, for example, this 152. It's 1 0 0 1 1 0 0 0 in the machine, but this really represents 98. Now I have to figure out a way of changing all of these numbers. I don't want to run the whole program over again, this time with the proper output routine."

"How many numbers are there? Too many for it to be a hand job?"

"Oh, yes." Al sounded a little pessimistic. "Since I have the results on tape I'll just have to figure out a way of converting them to the BCD equivalents."

"That shouldn't be too difficult. How large are the numbers? If they're all about three digits, like that 152 you showed me, it might be simpler just to construct a table. Punch up the values and run your output again, this time replacing each number by its equivalent."

"Making up the table would be too big a job. Some of these numbers have six digits. There's nothing over a million, though."

Bob wrote something on the back of an IBM card. "Okay, then. This statement should do the trick."

What was the statement?

Solution to Problem 697: The Volume of a Mujib

The statement $V = T - (|T + A| - |T - A|)/2$ will yield values of $V = T - A$ if T is greater than A, $V = T + A$ if T is less than $-A$ and $V = 0$ if $-A \leqslant T \leqslant A$.

Readers are invited to submit problems (and their solutions) for publication in this column to: Problem Editor, Computers and Automation, 815 Washington St., Newtonville, Mass. 02160.

REPORT FROM GREAT BRITAIN

(Continued from page 57)

feel, this is one of President Nixon's many problems, though by no means the smallest.

So far as Britain is concerned, we shall not know what IBM (UK) proposes to do for nine months, though it has already said that the babe it will then produce doubtless will be startlingly like IBM Corporate's offspring.

But in Britain we have a Prices and Incomes Board, with nasty prying habits, to protect customers of big companies. It already stepped in during 1968 to prevent IBM from raising the leasing cost of equipment already installed and operating at customers' premises. If any more is made to raise the cost of computing on IBM equipment in Britain, there is no doubt at all that the Users' Association will again call in the watchdog Board with reasonably predictable results.

Honeywell's UK Growth Continues

Honeywell, "the other British computer company" is growing so quickly in Europe that it has had to reorganise on the European front after only 2½ years. By the end of this year the company will have close on 1,100 machines on order or installed in Europe with 20 to 25 per cent of these being process control installations.

Of the 1,000-odd machines more than half have been or will have been built at Newhouse in Scotland which is the company's main production unit outside the U. S. and which has an export performance of 70 per cent of production.

Three new operating areas have been created to serve countries in which the total computer market should grow from aroung $1,600m last year to $2,900m in 1971. This is a growth rate of not far off 25 per cent which is considerably steeper than the current pace of advance in the U. S.

Ted Schoeters

Ted Schoeters
Stanmore, Middlesex
England

Sept. 8-10, 1969: American Institute of Aeronautics and Astronautics (AIAA) Computer Systems Committee, 1st Technical Specialist Conference, International Hotel, Los Angeles, Calif.: contact AIAA Headquarters, 1290 Sixth Ave., New York, N.Y. 10019

Sept. 30-Oct. 2, 1969: Computers and Communications Conference (sponsored by the Mohawk Valley Section of the IEEE), The Beeches, Rome, N.Y.; contact John M. Harrington, Conference Chairman, 304 E. Chestnut St., Rome, N.Y. 13440

Md.; contact Dr. Carl Hammer, UNIVAC Div., Sperry Rand Corp., 2121 Wisconsin Ave., N.W., Washington, D.C. 20007

Oct. 27-29, 1969: Data Processing Supplies Assoc. Fall General Meeting, New York, N.Y.; contact Data Processing Supplies Assoc., 1116 Summer St., P.O. Box 1333, Stamford, Conn. 06904

Nov. 3-7, 1969: GUIDE International, Denver Hilton Hotel, Denver, Colorado; contact Jack Eggleston, GUIDE Secretary, Mgr., Programming R&D, Mutual of Omaha Insurance Co., P.O. Box 1298, Omaha, Nebraska 68101

Nov. 6-7, 1969: First National Symposium on Industrial Robots, IIT Research Institute, Chicago, Ill.; contact Mr. Dennis W. Hanify, IIT Research Institute, 10 West 35 St., Chicago, Ill. 60616

Nov. 10-11, 1969: Digitronics Users Assoc. (DUA), 4th Annual Conference, Barbizon-Plaza Hotel, New York City; contact Secretary, DUA, Box 113, Albertson, Long Island, New York, 11507

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Nov. 20-21, 1969: Conference '69: 1969 Data Processing Conference sponsored by the Empire Div. (13) of the Data Processing Management Association (DPMA), Statler Hilton Hotel, New York, N.Y.; contact Registrar, Conference '69, P.O. Box 1926, Grand Central Station, New York, N.Y. 10017

May 5-7, 1970: Spring Joint Computer Conference, Convention Hall, Atlantic City, N.J.; contact American Federation for Information Processing (AFIPS), 210 Summit Ave., Montvale, N.J. 07645

ACROSS THE EDITOR'S DESK

Computing and Data Processing Newsletter

Table of Contents

APPLICATIONS

RELATION OF SPEED TO HIGHWAY ACCIDENTS IS SUBJECT OF COMPUTER-BASED STUDY

A 14.5-mile section of Indiana State Route 37, north and south of Bloomington, is the test area for a computer-based study seeking to answer the question: Is excessive speed the major cause of highway accidents? The study — funded by the National Highway Safety Bureau, U.S. Department of Transportation — uses an IBM 1800 data acquisition and control system to continuously monitor the test area on a 24-hour, seven-day-basis. The project is analyzing the amount of risk involved in driving at all speeds apart from those considered normal.

The stretch of highway is linked electronically to the computer at the university. Vehicles traveling the study highway (a typical two-lane road) register directly on the computer through buried wires and roadside vehicle detectors. Researchers analyze the data every hour to determine the normal traffic flow profile and the speeds of vehicles involved in accidents.

Results, including type and size of vehicle, proximity to others, and direction, are stored on magnetic tape. After further refining, the information is forwarded to Research Triangle Institute (RTI), Raleigh, N.C., primary contractor for the study, for final analysis. Results of the study will enable highway engineers to develop mathematical models of vehicle behavior at certain speeds, and under certain road conditions. This, in turn, should help in the design of better roads with more realistic speed limits.

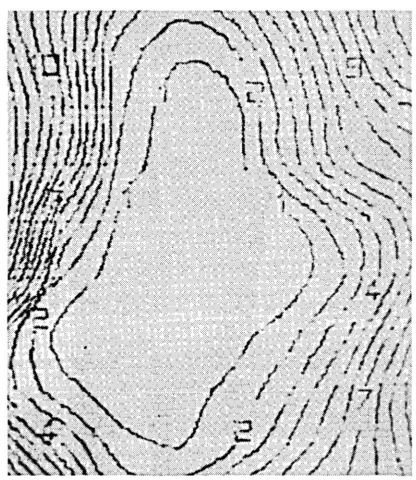
PHYSICS LAB ADAPTS SMALL COMPUTER TO DO LARGE JOB

Using a relatively small computer to do a job normally requiring a large data processing system would be considered an impossible task by most data processing people, but the Nuclear Center Laboratory at Lowell Technological Institute (Lowell, Mass.) is doing just that. For lack of a larger computer on campus, Dr. Suresh C. Mathur, Donald R. Donati, and Richard Hully developed a way of adapting large analytical nuclear structure programs to their 16K core memory PDP-9.

By using the mass storage capacity of the computer (a magnetic tape recording system) they developed a program technique that allows the PDP-9 to use only a portion of the total program at a time, while the bulk remains in mass storage. Three nuclear structure programs originally written for large computers (with core memories in the range of 32-128K) are now being used with the PDP-9. The program run times on the PDP-9 computer compare favorably with those on the larger computers.

FIELD-OF-VISION MAPS AND COMPUTER SYSTEM USED IN EARLY DETECTION OF THE MAJOR CAUSES OF BLINDNESS

Often the onset of major diseases affecting the eyes, and the resulting change in one's field of vision, go unnoticed; and in the early stages, conventional tests sometimes are not conclusive. The University of Texas Southwestern Medical School at Dallas has disclosed development of a new method for early detection of the seven major causes of blindness. These major causes each affect a person's field of vision, with each showing a characteristic pattern of visual loss. By studying the patterns of a person's blind spots, eye specialists are able to diagnose in early stages those major diseases which cause blindness.



— Large island-like area in this segment of a field-of-vision map depicts a blind spot in a person's viewing field. Surrounding lines represent degrees of visual capability.

The new testing method uses an IBM 1130, a re-wired portable television set and a modified program (originally developed by IBM to make geologic maps). A patient undergoing the new tests, covers one eye while focusing the free eye on a spot in the center of the television screen. Punch cards, fed into the system by the examiner, cause white dots of light, or "blips", to appear momentarily on the screen. The location, intensity and size of each dot of light vary. As the patient sees a blip, he moves a lever below the TV screen toward the blip. Factors such as the speed and accuracy of the patient's responses are measured by the IBM computing system. Following the test, the IBM system automatically prints maps of the patient's viewing field. Once a disease is identified and treated, ophthalmologists will repeat testing to determine the effectiveness of their remedial treatment.

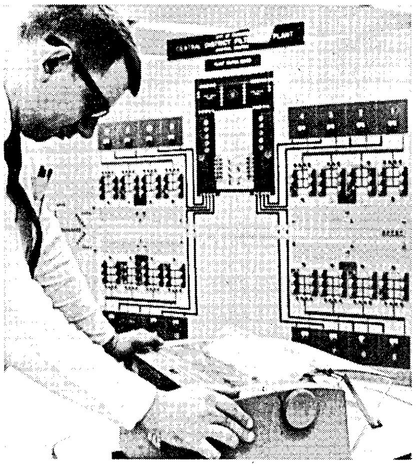
While the value of detailed visual field tests has long been recognized, the cost of equipment, specialized training of technicians and the human error factor, have kept such tests from being part of a routine examination. With the new technique, costs would be relatively low. Several ophthalmologists, each with a testing screen, could share a single computer linked to their offices through regular telephone lines.

"The public health impact of this new system will be significant," said Dr. John R. Lynn, chairman of the school's Department of Ophthalmology, who guided development of the new technique. The new system was among the medical exhibits at the American Medical Association's annual convention in New York City in July.

CENTRAL WATER FILTRATION PLANT (CHICAGO) RELIES ON COMPUTER FOR QUALITY AND QUANTITY REPORTS

Nearly one billion gallons of water flow daily through Chicago's Central Water Filtration Plants' 51 acres of purification equipment. Staff engineers at the water treatment facility depend on an electronic sensing network for up-to-the-minute reports on quality and quantity of the Lake Michigan water being processed for almost three million residents of Chicago and some 40 suburbs.

Remote sensing devices at more than 300 points in the process feed data to an IBM 1800. As the computer gathers data, it prints out such information as filter performance, amount and concentration of chemicals used for purification, reservoir levels and weather conditions. The sensors continually measure these factors to help insure the highest quality water possible. The computer also compares readings of key instruments with pre-set standards. Any deviation from standard readings triggers an off-normal report to supervisors who decide on corrections.



The 1800 checks the instruments for variation from normal every two minutes. To gather all other operating data, the computer "polls" each of the sensors every two minutes. The electronic messages are converted into numbers which are printed in report form hourly on the control room terminal. At midnight, a 24-hour summary is printed.

James W. Jardine, city commissioner of water and sewers, said computer monitoring permits pinpoint control of the multi-phase water treatment process. He said the computer also monitors the distribution of the water which is pumped into the plant but flows by gravity from the plant to the seven district pumping stations. The 1800 records the rate of flow and engineers adjust the intake according to the rise or fall of demand. Excess flow in a period of low consumption could flood the plant reservoirs.

HEART "PACEMAKER" PROJECT TO HELP ATLANTA'S 75 HEART "PACEMAKER" PATIENTS

The Rich Electronic Computer Center of Georgia Tech has a new data acquisition system for conducting special research projects, including what may be a novel method of aiding heart patients with battery-operated "pacemakers". The project being considered would help Atlanta's 75 heart "pacemaker" patients in determining when they will need new batteries.

According to Dr. I. E. Perlin, Chief of the Computer Center, patients will be able to call in their EKG's over the telephone for feeding directly into the data acquisition system. The system will convert the analog impulses of the heart beats into a digital format and record this information on magnetic tape. The tapes then will be fed into one of the Center's computers for a prediction of when the patient will need a new battery. This prediction service will, it is hoped, prevent unnecessary operations to replace the battery, and also allow the patient time to make arrangements for the operations when needed.

EDUCATION NEWS

COMPUTER ENVIRONMENTS INSTITUTE ACCREDITED BY THE VETERANS ADMINISTRATION

Computer Environments Institute (CEI) of Burlington is the first data processing school in Vermont to receive accreditation by the Veterans Administration. The announcement of this distinction was made by Dr. Daniel J. McCarthy, CEI's president. With its accreditation, CEI now is able to offer courses in computer education to military veterans who are subsequently reimbursed for tuition costs by the federal government.

CEI offers day, evening, and Saturday classes in computer programming and operation. It is operated by Computer Environments Corporation which has eight other computer schools throughout the Northeast.

ARMY SCHOOL STARTS TWO-YEAR TEST OF CAI

The United States Army Infantry School, Fort Benning, Ga., has put a battlefield on-line to a computer through CRT units for a two-year test of computer-assisted instruction. Before the test ends in September, 1970, over 20,000 Army personnel will come in direct contact with the computer. The project is the result of a team effort by subject matter specialists (Army instructors), education specialists at Fort Benning, computer programmers and Honeywell's Electronic Data Processing Division.

Equipment includes a Honeywell Model 200 computer system and 50 television-like cathode ray tube (CRT) devices. The 50 CRT devices are in a 200-man classroom. Each CRT unit puts a student in direct contact with the computer by means of a keyboard console. The computer, programmed to react to a wrong answer, tells the student what is wrong, provides remedial instructions and requests the student to perform the work again. After a correct answer, a new problem is displayed on the CRT screen.

The civilian manager of the project, William F. Freeman, says the study for the Continental Army Command will seek to answer three questions:

What is the best way to use the CRT devices for the practical exercise phase of Army training?

What are the benefits and problems that arise from computer-assisted instruction?

What types of practical exercise are best suited for computer-assisted instruction?

Among the first programs for the project are two practical exercises in directing mortar fire for officer students. A third program has been developed to train enlisted mechanics by practical experience in the use of an Army parts manual. Other programs will be developed during 1969-70. The effectiveness of the programs as teaching tools will determine what programs the Army will add to the system.

COMPUTER EDUCATION CENTER ESTABLISHED BY INTER-ACT CORP.

Inter-ACT Corporation, a subsidiary of Advanced Computer Techniques Corp. of New York City, has established a new learning center in the Burlington Industries building in New York City. Two types of programs are being offered: participatory courses — continuing sessions on topics of broad current interest; and lecture/workshops offering an orderly presentation of knowledge available on a particular subject.

Participatory courses are intentionally designed with open ends; participants start when they can join a group with convergent interests. They remain until both participants and instructors agree the students have acquired the depth of knowledge consistent with the students goals and Inter-ACT's standards. The first such course, which started June 30th, is "The Design of Applications Systems for Operation in a Real-Time Environment." Instructors will be available from June 30th to August 29.

Lecture/workshop courses are limited to ten or fewer to enable instructors to provide the level of personal attention essential in advanced computer courses. The first such course was "Computer Technology for Non-Technical Personnel". This introductory course surveys computer anatomy, computer language, computer applications, and the technology of implementing a computer system. Offered June 30th through July 3, it will be offered again August 25 through 28.
(For more information, circle #41 on the Reader Service Card.)

NEW PRODUCTS

Digital

GE-120 COMPUTER / General Electric

The GE-120 computer, fourth in General Electric's GE-100 series, is primarily for users of small-to-medium sized computers. The GE-120 fits between the smaller, less-sophisticated GE-115 and the more powerful GE-130. All are upward compatible.

The GE-120 is available in both magnetic tape and disc configurations. Memory cycle time is four microseconds. Memory capacity is 12,288, 16,380 or 24,576-bytes.

New software available with the GE-120 includes the Report Program Generator, GE-100 RPG, making the machine compatible with competitive equipment. Users of competitive computers can move to the GE-120 without the expense and trouble of reprogramming. In addition to the RPG, the software library includes Operating Systems, Assembly Programming System, COBOL '65, FORTRAN IV, and Sort-Merge Generators.
(For more information, circle #42 on the Reader Service Card.)

EXPANSION OF 6000 SERIES / Control Data Corp.

CDC's announcement of expansion of its 6000 series of super-scale computers is highlighted by a new system called the 6700. The expanded series includes a smaller 6400 configuration and additional options which apply across the entire compatible 6000 line. The new approach is geared to several different customer growth requirements, according to Robert M. Price, vice president, sales for CDC.

If a customer's growth requires more core memory, 49K and 98K options have been added to the 32K, 65K and 131K sizes to permit growth in smaller, yet significant, steps. Greater growth requirement is provided by the new 6700 multi-processor system which uses primary and secondary processors standard to the 6000 series.

The 6700 provides greater throughput than the 6600, and has all the other advantages of the 6000 series computers, including field-tested and proven 6000 series software. The CDC 6700 uses the 6000 series peripheral and input/output equipment.

The new smaller 6400 system consists of a central memory unit which the user can upgrade from the minimum memory capacity of 32K words of core memory to as high as 131K in increments of 49, 65 and 98K. The basic configuration consists of the 32K central memory, seven peripheral processors, nine I/O channels, console display with keyboard, a large capacity disk file and controller, two data channel converters, four magnetic tape transport units and associated controller, a card reader, card punch and line printer.
(For more information, circle #43 on the Reader Service Card.)

SERIES 1808 COMPUTER / Arma Division of AMBAC Industries

A parallel-organized general purpose computer has been added to the Arma Division's family of miniaturized Micro-D computers. The new computer, Series 1808, weighing less than 9 pounds, is an 18-bit word computer with 56 instructions. The 1808 has a multilayer board configuration, T^2L type integrated circuits, and a wide temperature memory. Mainframe storage is in blocks of 4096 18-bit words, which are addressable either directly or indirectly. Software for all Micro-D computers has been prepared in FORTRAN for execution on an IBM 360.

The Series 1808 is now in production for weapons delivery, navigation and fire control applications. The computer is also suited for solving a variety of other real-time aerospace applications such as electronic warfare, information processing, command and control, and data displays.
(For more information, circle #44 on the Reader Service Card.)

Special Purpose Systems

MODEL 816 DATA PROCESSOR / Beckman Instruments, Inc.

The Model 816, a completely self-contained data processing system, is capable of accepting both digital and analog information, processing the data in digital form, and producing an output that can directly interface with a variety of recording devices.

A 4,096-word core memory is used to store the processing program and to act as a reservoir for information being processed. Changes in the program can be accomplished entirely in software, with minimum expense and virtually no down-time. Processing versatility is expanded by a variety of hardware options affecting the input/output capabilities of the Model 816 system. Most of these options make use of interchangeable plug-in cards, which again permit the Model 816 to be adapted to changing requirements with minimum delay and expense.

The system is adaptable to a broad range of instrumentation, process control, and data reduction applications. Since the 816 can be completely preprogrammed at the factory with all interface equipment and software built in, the system is particularly useful for specific applications where the operator is only marginally familiar with computer technology.
(For more information, circle #46 on the Reader Service Card.)

ADAC SYSTEM / Astrodata, Inc.

Digital Equipment Corporation's small PDP-8/L digital computer is the central control element of Astrodata's latest analog and digital system, the ADAC system. The new system can be used for both data acquisition and control.

ADAC acquires low- and high-level analog signals, provides for on-line monitoring and control and produces a digital computer compatible output. The system can acquire a range of input signals from five millivolts to ten volts over a broad speed range and can be easily expanded in the field. The standard system consists of an analog input section with a low-level multiplexer and an analog-to-digital converter, an intercoupler for connecting the analog and digital sections of the system, the PDP-8/L and a teletypewriter.

Software accompanying the system includes assemblers, a FORTRAN compiler, a symbolic tape editor, utility and maintenance programs, device diagnostics, checkout routines, modular data acquisition packages and DEC's conversational language, FOCAL®. First deliveries of ADAC systems are scheduled for September.
(For more information, circle #45 on the Reader Service Card.)

Memories

RANDOM ACCESS MEMORIES / Andersen Laboratories

This series of random access memories is designed to replace core memories for applications in which the fast access time capability of more costly core memories is not utilized. For suitable applications these random access memories replace other equipment at less than 50% of the cost according to the company. Such applications encompass keyboards, printers, copiers, and various communication devices.

Digital storage is accomplished by the wiresonic method. As opposed to conventional serial wiresonic memories, the RAM series permits read out of specifically addressed information without requiring the entire memory to be unloaded.

The series has low power, from 5 volts, 2.2A to 12 volts .1A for various models. Access time varies from 1.1 to 8.4 microseconds for the series. Size is 12.5 inches x 9.8 inches x 1.5 inches.
(For more information, circle #47 on the Reader Service Card.)

PHOTO-OPTICAL RANDOM ACCESS MASS MEMORY (FM390) / Foto-Mem, Inc.

The Photo-Optical Random Access Mass Memory (FM 390) has multi-billion bit capacity. FM 390 is used to replace and/or supplement magnetic tape, disc or drum devices.

The FM 390, which may be used separately or combined into one system, employs a Photo-Data Card (PDC)® for data storage. PDC, according to the company spokesman, has many advantages over magnetic storage: a) a 100 to 1 reduction or greater in material cost; b) storage space reduction of 150 to 1 or greater; c) a 50 millisecond access time. A typical Photo-Data-Cell® holds up to 3 billion bits of information. A typical installation might hold several trillion bits of data on line.
(For more information, circle #48 on the Reader Service Card.)

FILE STORE CORE MEMORY SYSTEMS / Standard Logic Inc.

This 4-wire coincident current, integrated circuit magnetic core memory has 1.75 microsecond full cycle time, multiplicity of address options, DTL/TTL interface, full and half cycle operation. The system is designed for high speed random/sequential access applications. The device can operate as a stand alone or functional memory module.

Standard capacity is up to 1024 words (32 bits) per module; access time is 600 nanoseconds. Operational modes include clear/write, read/restore, write only, read only, and read/modify/write.
(For more information, circle #49 on the Reader Service Card.)

VERSASTORE IV CORE MEMORY / Varian Data Machines

This coincident-current core memory system operates asynchronously with a full cycle time of 900 nanoseconds and an access time of 350 nanoseconds. The VersaSTORE IV is useful for storing off-line data, controlling a general purpose computer, or programming automatic equipment.

Two models of the VersaSTORE IV system are available. One model has a storage capacity of 4096 words of 40 bits or 8192 words of 20 bits; a larger model can store up to 8192 words of 40 bits or 16,284 words of 20 bits. Bit length is available in 8-bit increments for both versions of the system.

The system provides control modes of full cycle (read/restore and clear/write) as well as split cycle (read/modify/write) and half cycle (read and write only). Address options include random/sequential access and sequential interlace access.
(For more information, circle #50 on the Reader Service Card.)

Software

AIMES (Automated Inventory Management Evaluation System) / University Computing Co., Data Link Div., Dallas, Texas / Designed from the retail merchant's point of view, the new program automates inventory control and provides a wide variety of reports. Modular nature of the AIMES system permits selection of only the reports desired. Retail firms with their own computers may lease or buy outright; AIMES service also is available through any of Data Link's eight computer centers.
(For more information, circle #51 on the Reader Service Card.)

CIP (Console Interface Program) / Worldwide Computer Services Inc., Hartsdale, N.Y. / Systems integration and debug time on IBM/360 or RCA/70 computers is reduced by as much as 40%; CIP intercepts any Operator, Program Check, Interval Timer, or Unrecoverable Error (RCA/70) interrupt and automatically displays the module name and the interrupt location in both absolute and relative values. CIP may be used with BAL and COBOL programs and runs under IBM's TOS, DOS or OS and RCA's TDOS operating systems. Output device may be either a printer, tape, or typewriter. It is supplied free of charge for a 30 day evaluation period.
(For more information, circle #52 on the Reader Service Card.)

COGO / Scientific Data Systems, El Segundo, Calif. / A civil engineering coordinate geometry package for use with Sigma 2 computers; civil engineers with minimal computer experience can solve a variety of coordinate geometry problems. System operates under the SDS Sigma 2 Real-Time Batch Monitor and is callable, for operation in a batch background mode, from user's program library. Coded in FORTRAN, COGO has standard or extended precision arithmetic (3 word format).
(For more information, circle #53 on the Reader Service Card.)

COMPUMETER / Computyne, Inc., Deer Park, N.Y. / A software management program developed for both DOS and OS operation; printouts permit analysis and evaluation of all Series 360 system operations and programming; production time is increased up to 30%. Printed-out daily reports can be summarized on a weekly, monthly or weekly and monthly basis for the review and assessment of efficient usage, operator productivity, debugging, and re-run and maintenance cycles.
(For more information, circle #54 on the Reader Service Card.)

DEADLINE! / Synergistic Cybernetics, Inc. (SCI), Alexandria, Va. / Developed specifically for planning and scheduling computer center operations; the system includes multi-processing scheduling capability, consideration of primary and alternate equipment availabilities, consideration of inter-job dependencies and inherent physical delays, leveling of machine and manpower requirements and pinpointing imbalances and bottlenecks throughout the computer center. DEADLINE! has been introduced on a purchase or lease basis with single computer center purchase rights at $7000.
(For more information, circle #55 on the Reader Service Card.)

INTERCOMM / Programming Methods, Inc. (PMI), New York, N.Y. / A software interface linking the application, the files, the computer, the Operating Systems, and the Teleprocessing handlers. The system operates in a multi-programming, multi-tasking, real-time or stand-alone environment. Intercomm assumes full responsibility for I/O functions, the scheduling of application programs, and their full overlapped processing; permits a total communications environment with COBOL, BAL, PL1, FORTRAN, ALP, or RPG applications

programs; and takes full advantage of IBM 360's hardware features, the data management capabilities of the Operating Systems (OS, DOS) and the access techniques provided by IBM (BTAM and QTAM).
(For more information, circle #56 on the Reader Service Card.)

3R (Request, Retrieve, and Report) / System Development Corp., Santa Monica, Calif. / System is capable of cross-relating information from four files and is compatible with all third generation computers. User completes three forms specifying content and format of desired report; forms are converted into punched cards which direct the computerized information retrieval. Programs are written in COBOL; no knowledge of computer programming is required. 3R is priced at $8750.
(For more information, circle #57 on the Reader Service Card.)

TESTMASTER COBOL/360 / Hoskyns Systems Research, Inc., New York, N.Y. / A third generation testing system making the production of error-free programs practical and cost-effective, regardless of their size. Typical throughput is 200 independent tests on each of 5 subroutines in fifteen minutes on a 360/40. All testing instructions, including those for test data generation, are written in COBOL; all result values are printed in edited format. TESTMASTER presents the programmer with an exception report, typically reducing test output by 90%.
(For more information, circle #58 on the Reader Service Card.)

Peripheral Equipment

INPUT 2 OCR SYSTEM / Recognition Equipment Inc.

With INPUT 2 and its dual reading ability a document now can be prepared in many locations by hand with simple pencils, or with ordinary business equipment. The new system reads both handprinted information and typed or printed information in ordinary type styles.

The INPUT-2 machine-printed basic vocabulary includes 40 characters, reads several standard type faces, and is not limited to highly stylized characters. The vocabulary is wholly contained on printed circuit boards and can be expanded to 120 characters in 10-character modules. Handprinted numerals 0 - 9; the letters C, S, T, X, and Z; and plus and minus signs comprise the handprinting vocabulary. The only requirement imposed is that the character be printed simply, without any loops or frills. A box on each document serves as a guideline for the person making the data entry.

Data is read from two lines at once at a speed of 600 documents per minute. Information is recorded on magnetic tape in computer language for immediate further processing. INPUT 2 simultaneously prints out needed lists on a line printer and performs document sorting.

The system includes an Electronic Retina and Recognition Unit, a three-pocket document transport, a general purpose digital computer, plus a magnetic tape unit and line printer. The document carrier can be expanded to include 12 output pockets. A 1000 lpm line printer can replace the 600 lpm one, and three magnetic tape transports also can be added.
(For more information, circle #59 on the Reader Service Card.)

960 VIDEOJET PRINTER / A. B. Dick Company

The 960 Videojet high speed communications printer has been built to meet computer industry requirements for remote printing via conventional voice grade telephone lines, (in wide use for data transmission in computer time-sharing and other data network systems). The 960 automatically answers the Dataphone subset used in these data systems, prints the information transmitted, and terminates the Dataphone call — unattended.

The 960 is a non-impact printer utilizing a stream of controlled ink droplets to print 250 characters per second on conventional business forms. Character spacing

and line length are set to the computer industry norm (10 characters per inch and a line length of 136 characters). The character spacing is variable, however, from five to fifteen characters per inch allowing up to 204 characters on a single line. The device accommodates the 80 character line common in communications networks. The Videojet 960 is adequately quiet to allow its use in situations where impact printers have not been feasible.
(For more information, circle #60 on the Reader Service Card.)

BCOM — MICROFILM RECORDER / Burroughs Corporation

The new microfilm recorder, designated BCOM for Burroughs Computer Output-to-Microfilm, is capable of recording computer output on microfilm at up to 40 times faster than a line printer can record the same information on paper. A high speed film viewer can be used to locate individual frames of information in seconds, and copies of displayed records can be reproduced from film on either paper or film. BCOM can microfilm computer-generated records at up to 96,000 characters per second as data is transferred from magnetic tape. Microfilm is stored in cartridges in 100-foot lengths for use with film viewers and printers.
(For more information, circle #61 on the Reader Service Card.)

SP-20 STRIP PRINTER / Clary Corporation

This high reliability Teleprinter can be used for remote printout in computer and communication systems. The Clary SP-20 Alphanumeric Teleprinter accepts data input at Standard DTuL Logic Levels in six-bit binary ASCII code either parallel or serial entry. Printout of alphanumeric data (64 character complement) on pressure sensitive paper is at rates up to 1200 characters per minute. Off-the-shelf availability is offered in three configurations: printer head only; printer head and control; or printer head control and power supply.
(For more information, circle #62 on the Reader Service Card.)

DIGINET 500 DATA SYSTEMS / General Electric

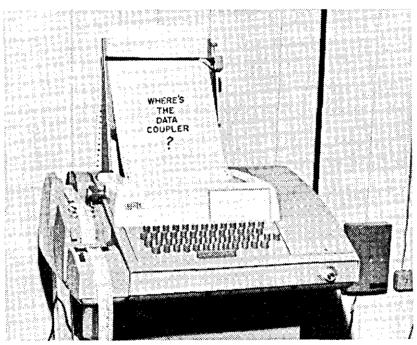
The DigiNet 500 wideband data systems operate at 230 kilobits per second — nearly 100 times faster than voice channel digital communications. Speed is the difference between the DigiNet 500 series and the previously announced DigiNet 400 series — the DigiNet 500 is more than four times faster than the 400 series.

DigiNet 500 Systems may be used to connect high-speed computer terminals at remote locations to a central computer facility for extremely rapid turn-around or high volume "remote batch" processing jobs; for "load leveling" to redistribute computerwork overflow; and to make alternate or back-up computer facilities in another location more accessible.

DigiNet 500 equipment has standard AC power supply with optional DC primary power operation. The system is compatible with Western Electric 912A wideband data test set equipment.
(For more information, circle #63 on the Reader Service Card.)

COMMUNICATIONS TERMINAL SYSTEM / Data Access Systems, Inc.

Model DF33ASR-0 communications terminal system is shown below with no data coupler in the picture because the terminal device uses a direct connection to the standard telephone line. Communications components are built into the terminal thus providing a compact arrangement without the need of extra acoustic devices.



The terminal, suited to a wide range of applications such as time sharing, terminal to terminal communications and computer access, transmits and receives at 100 words per minute. A fully filtered transmitter and receiver data set rejects harmonic and spurious signals assuring error free transmission.

The terminal is available in a variety of configurations and may also be used for automatic answer or unattended mode operation.
(For more information, circle #64 on the Reader Service Card.)

Data Processing Accessories

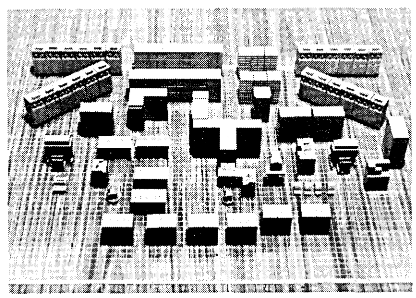
MANUAL KEYBOARD PUNCH FOR TAPES / Data Devices, Inc.

The Model 58 paper tape punch utilizes a keyboard, similar to that of a typewriter, allowing untrained operators to prepare printer control loops and computer data input codes. The punch will prepare 5 track or 8 track paper tapes.

Each numbered key corresponds to one tape channel, with the least significant bit being located to the right of the keyboard. The operator uses a typewriter-type space bar to advance the tape to the next location to be punched — one frame at a time. The frame being punched is displayed to the operator on a digital readout slot.
(For more information, circle #65 on the Reader Service Card.)

COMPUTER ROOM PLANNING KITS / "Visual" Industrial Products, Inc.

Two new scale model planning kits are now available for computer room planners. The models, scaled ¼" = 1", include a planning grid board. The 360 kit, of interest to most concerns, consists of 35 items and sells for $59. For large instal-



lations, a 65 item kit is available for $99 complete. Also, over 500 items for office and computer room planners are available on a per model basis.
(For more information, circle #66 on the Reader Service Card.)

TWO NEW HIGH SPEED FORMS SEPARATOR MODELS / Standard Register Company

New high speed forms separator models, designed to accommodate the increasing speeds of computer printers, separate two- and three-part continuous forms and remove interleaved carbons at variable speeds up to 250 linear feet per minute.

The new models, designated 1439-2 and 1439-3 (two- and three-part separators respectively), have the same appearance as Standard Register's established four-, six- and eight-part devices, but occupy less floor space. Both are equipped to handle a maximum form width of 18½ inches and a maximum form length of 11 inches. Carbon rewind spindles take between 500 and 600 ft. of carbon tissue. Slitter assemblies for the removal of either or both margins and for center cutting are available as optional equipment.
(For more information, circle #67 on the Reader Service Card.)

COMPUTING/TIME-SHARING CENTERS

UCLA TO BE FIRST STATION IN NATIONWIDE NETWORK LINKING COMPUTERS OF DIFFERENT MAKES

UCLA will become the first station in a nationwide computer network which, for the first time, will link together computers of different makes, using different machine languages, into one time-sharing system. The project, supported by the Defense Department's Advanced Research Project Agency (ARPA), was proposed and is headed by ARPA's Dr. Lawrence G. Roberts. While computer networks are not an entirely new concept, they have all been highly specialized and single-purpose systems (e.g., SAGE radar defense system; the airlines' SABRE reservation system; and the nation's electronically switched telephone system). In contrast the planned ARPA system will link a wide assortment of different computers for a wide range of unclassified research functions.

The system, in effect, will pool the computer power, programs and specialized know-how of about 15 computer research centers, stretching from UCLA to M.I.T. Each computer in the network will be equipped with its own interface message processor (IMP) which will double as a sort of translator among the Babel of computer languages and as a message handler and router.

UCLA's part of the project will involve about 20 people, including some 15 graduate students. They will play a key role as the official network measurement center, analyzing computer interaction and network behavior, comparing performance against anticipated results, and keeping a continuous check on the network's effectiveness. For this job, UCLA will be using a highly specialized Sigma 7 computer (developed by Scientific Data Systems, Los Angeles, Calif.). The first stage of the network, a subnet joining UCLA, Stanford Research Institute, the University of California at Santa Barbara, and the University of Utah, will go into operation this fall. The entire network is expected to be operational in late 1970.

AMERICAN BIOMEDICAL SUBSIDIARY OPENS CENTER IN CHICAGO

A new computer center in Chicago and the inauguration of a new computer time sharing service for hospitals and clinics, has been announced by American Medical Computer Centers, a subsidiary of American

Biomedical Corp. Three Chicago area hospitals have already contracted for the services and letters of intent have been received from two others. Equipment at the center includes two Honeywell computers, a model 1200 and a model 125. Teletype input-output terminals are installed in each hospital and are online with AMCC's central computer.

The system provides patient accounting and other accounting and administrative services. Basic information is carried over telephone lines to the central computer from the terminals. Patient statements and administrative reports are then retrieved by the terminal on demand and printed out in the hospital. AMCC has adopted the Honeywell HCSS time sharing system (developed jointly by Honeywell, Inc. and Minnesota Blue Cross).

CONTROL DATA OFFERS ITS CYBERNET SYSTEM TO SERVICE ORGANIZATIONS

Robert O. Young, director of marketing for Control Data Corporation's Data Centers division, has announced that CDC will market computer time through its CYBERNET Services to independent service organizations on a wholesale, retail or OEM basis. The CYBERNET computer network includes seven Control Data 6600 computers and five 3300 computers linked together by wideband or voice grade communication lines which span the United States and Canada.

Independent service bureaus may now buy super-computer time at any one of 30 Data Centers throughout the country and resell the time at a profit. This type of contractual arrangement will be available only to firms whose primary business is providing data services to the using public.

COMPUTER-RELATED SERVICES

SOFTWARE TESTING SERVICE OFFERED BY COMPUTER CENTER, INC.

Potential purchasers of software now may commission an independent test of the programs being considered. A new service, known as PAT, for Program Analysis and Testing, will test the performance and functional characteristics, as well as the documentation of existing and contemplated consumer programs. PAT will assure that the purchaser's specifications for the software are complete and will certify that the software supplied by the developer complies with these specifications. It will also certify that there is full documentation and freedom from failures. Interim service reports provide preliminary information to the users of the service, while a final test report will indicate PAT support or rejection of the program as it relates to the test sponsor's operation. Program developers may also utilize PAT. Jerome Markman, President of Computer Center stated that PAT costs will depend on the scope of the program being tested and will vary from 10 to 20 percent of development costs.
(For more information, circle #68 on the Reader Service Card.)

COMPUTERIZED SYSTEM PROVIDES LIBRARIANS WITH PRINTED CATALOG CARDS

A computerized service, known as the "Card-Mate Publication System", provides librarians with monthly sets of printed catalog cards on a wide range of subjects. The service is offered by a newly formed information retrieval company, Products of Information Systems (P.O.I.S.), Newport Beach, Calif. The service is designed to provide subscribers with cards for every book cataloged by the Library of Congress in the subject areas covered.

The P.O.I.S. staff reviews daily the complete output of the Library of Congress, as represented by the Library's printed card division. Cataloging for each title, exactly as done by the Library of Congress, is prepared for placement in the appropriate file and then is placed in protected storage in a large computer.

On the same day as the last catalog entry for the month is made, the automated selection routines are used to choose all titles in the current file for each card mate subscription category. Each group is then processed for typesetting, printing and shipment to subscribing libraries. Complete sets of catalog cards are received a few days after the Library of Congress completes its monthly cataloging of all newly acquired books — far in advance of time required with conventional methods.
(For more information, circle #69 on the Reader Service Card.)

NEW ENGLAND-BOUND EXECUTIVES RECEIVE COMPUTER AID IN LOCATING HOMES

Executive Relocation, Inc. (ERI), Wellesley Hills, Mass., is a service business for major organizations interested in minimizing the disruption of executive relocation. ERI's service allows companies to give executives coming to New England a computer-produced profile of the most attractive homes for sale or rent in towns of the executive's choice. The computer selects the homes from its master file based on the executive's stated preference for location, size, price and 30 other features — including such things as the availability of country clubs or boating facilities.

Working with an executive's company, ERI starts its support as soon as the executive's transfer plans are definite. A letter of welcome to New England is sent by ERI, along with a comprehensive package of home-buying data. The package contains profiles of communities most likely to be of interest to the executive and his family; a map of Greater Boston; sketches of various types of home styles popular in the area; and a two-part Personal Data Sheet.

The executive specifies the family preferences on the confidential Personal Data Sheet and mails this back to ERI. Here, the preferences are transcribed into machine-readable form and fed into the computer for analysis and matching. Immediately prior to the executive's visit to Boston to begin his home search, the ERI computer processes this data against its master file of up to 3000 current home listings from 160 different communities. Those homes matching the 35 desired requirements within 90% accuracy are printed out on 3½ x 9 inch forms. The forms contain realtor's name and a fairly detailed description of each home. The forms are then sent by mail immediately to the relocating executive, who arrives in Boston with the most current listing of available homes.

Normally ERI finds from five to eleven 'hits', or suitable houses, in the first computer pass. In cases where fewer than five 'hits' occur, the computer automatically selects appropriate homes from communities with characteristics similar to those specified, prints those out also, so that each executive receives a minimum of five homes to his specifications.

Earl Altwater, Jr., Vice President and Treasurer of ERI said, "The key to successful service by ERI is our network of brokers. We have 52 of the leading real estate brokers in New England affiliated with us. They provide us with daily listings for our computer. We provide them with a regular flow of qualified, ready-to-purchase prospects." ERI clients find homes in an average of approximately three days.
(For more information, circle #70 on the Reader Service Card.)

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Honeywell Computer Control Div., Framingham, Mass.	National Computer Franchise Corp., Chicago, Ill.	Twenty H1648 time-sharing computer systems which will be used to set up franchised time-sharing centers in 20 major U.S. cities	$10 million
HF Image Systems, Culver City, Calif.	United Air Lines	An automatic microfilm information retrieval system to help provide improved customer service	$7 million (approximate)
Sperry Rand Univac Division, Philadelphia, Pa.	Otto Versand, Hamburg, West Germany	Two UNIVAC 1108 Computer Systems for use in real-time order processing, customer accounting, shipping, market research and for compiling statistical information	$4.5 million
	Ebauches Company, Grenchen, Switzerland	A UNIVAC 1108 Computer System which will serve as the core of a Management Information System for the watch company	$3.3 million
Cubic Corporation, San Diego, Calif.	U.S. Air Force	The design and engineering of sub-systems for an advanced aircraft navigation and guidance system	$2 million
Computer Sciences Corp., Los Angeles, Calif.	Army Aviation Systems Command, St. Louis, Mo.	Participation in the design and development of a computer-based information system to provide stricter control over contracts under the U.S. Army Materiel Command	$1.6 million
Sperry Rand Univac Division, Philadelphia, Pa.	Computer & Business Management, Inc. (C.B.M.), San Antonio, Texas	Equipment including 16 UNIVAC 9200 and 10 UNIVAC 9300 Computer Systems for use in education and training franchises	$1.5 million
	Suffolk County, Hauppauge, Long Island, N.Y.	Two UNIVAC 418-III computer systems for computerizing operations of county agencies	$1.5 million
IPI (International Petrodata, Inc.), Calgary	SONATRACH, Algeria	The design, construction and implementation of a highly sophisticated well data information system for all of Algeria	$1.2+ million
Northrop Corporation, Beverly Hills, Calif.	U.S. Air Force	Modification kits for voice reporting systems in Minuteman ICBM silos	$1,122,364
General Research Corp., Santa Barbara, Calif.	City of Los Angeles, Calif.	Design and installation of an "advance command/control system" for Los Angeles' Fire Department	$831,000
Applied Dynamics, Ann Arbor, Mich.	McDonnell Douglas Astronautics Company, Santa Monica, Calif.	Manufacture and installation of a large-scale analog/hybrid computing system; will be used to analyze control systems, propulsion systems, vehicle dynamics and system geometry for general missile weapon systems and space vehicles	$739,000
Computing and Software, Inc., Panorama City, Calif.	National Aeronautics and Space Administration	Continuation of scientific computing services at NASA's Langley Research Ctr., Hampton, Va.	$700,000
Computer Sciences Corp., Los Angeles, Calif.	U.S. Army Board for Aviation Accident Research, Fort Rucker, Ala.	A computer-based information system that will enable the U.S. Army to rapidly determine the cause of Army aircraft accidents and establish appropriate preventive measures	$583,000
Informatics Inc., Bethesda, Md.	Department of Housing and Urban Development (HUD)	Implementation of major new management systems to facilitate HUD operations nationwide	$445,158
Computer Methods Corp., Los Angeles, Calif.	Bell Telephone Laboratories, Inc.	Delivery of software systems to the Business Information Systems Programs (BISP) organization in Cranford, N.J.	$410,000
Middle Atlantic Educational and Research Center (MERC), Lancaster, Pa.	National Science Foundation	Helping launch the nine-institution, time-sharing computer network this fall; funds will be used to hire staff, purchase equipment, install computer and terminal units at participating institutions, and meet some of next two years operating expenses	$400,000
Ampex Corporation, Culver City, Calif.	General Computer Systems, Inc., Dallas, Texas	100 Model TMZ digital tape memories to be incorporated in new keyboard-to-magnetic tape systems manufactured by the firm	$350,000
	North Electric Co., Galion, Ohio	Magnetic core memories and memory stacks for use in the Seventh Army Tactical Switching system (SATS)	$300,000+
Systems Associates, Inc.	Jet Propulsion Laboratory	A telecommunication systems analysis subcontract to provide analytic support for the NASA Mariner Mars 1971 space mission	$120,000+
Redifon-Astrodata, Ltd.	British Ministry of Technology	A Ci-5000 Analog/Hybrid Computing System for installation at the Royal Radar Establishment, England, for use in research and development of guided weapons systems	$100,000+
World Systems Laboratories, Inc., Bethesda, Md.	HEAD START	Review of all HEAD START data from 13 Evaluation and Research Centers across the nation; techniques to bring this data into a central HEAD START data bank will then be devised and monitored	$58,500
Computer Usage Co., Inc., Greenwich, Conn.	Applied Physics Laboratory Johns Hopkins University	Development, check-out and test of programs in Polaris missile telemetry; programs will be developed for the IBM system/360 Model 91 and the SEL 840A MP computers	$10,000

NEW INSTALLATIONS

OF	AT	FOR
Burroughs B340 system	Farmers & Merchants Bank, Menomonee Falls, Wis.	Bank work now being sent to an outside data processing service center
	First National Bank, DeKalb, Ill.	Proof transit, demand deposit accounting, savings and installment loans and other applications
	Hillsboro Bank, Plant City, Fla.	Proof and transit, demand deposit accounting, savings and installment loans
Burroughs B500 system	American National Bank, St. Joseph, Mo.	Processing all banking applications; also income and expense reports for customers of their correspondent banks in a four-state area
	Arlington Trust Co., Arlington, Va.	Replaces a B170 system to provide needed flexibility and power to keep pace with growth rate; will also process work for customers
	First National Iron Bank, Morristown, N.J.	Operating in conjunction with a B300 system already installed at the center; used for demand deposit, savings, loan, payroll and proof and transit applications (system valued at over $160 million)
Control Data 3300 system	Totalizator Agency Board, Melbourne, Australia (2 systems)	Handling all off-track horse and dog race betting in the State of Victoria
GE-415 system	Oklahoma Gas and Electric Co., Oklahoma City, Okla.	Preparation of electric bills; also on-line for customer inquiries in the Oklahoma City area
IBM System/360 Model 20	Boston Stock Exchange, Boston, Mass.	Processing all buying and selling transactions in little more than half the time formerly required
IBM System/360 Model 50	Irish International Airlines, Dublin Airport, Dublin, Ireland (2 systems)	A computerized reservations system, called ASTRAL, serving 220 television type consoles which link the airline's offices throughout Ireland and Britain (systems valued at $5 million)
IBM System/360 Model 65	Northwestern Mutual Life Insurance Co., Milwaukee, Wis.	Processing all computer programs relating to policyholders; NML's Direct Access Life Insurance System (DALIS) incorporates these programs which range from pre-underwriting application processing to premium posting (system valued at $7.5 million)
IBM System/360 Model 75	University of Florida	Control of Computing Center operation in the Space Sciences Research Building; switching over to the 65 model ignited "musical computers" at the University as other models were re-installed elsewhere and Model 75 assumed control in support of education and research in scientific and business fields
IBM 1130 System	Cahokia Flour Co., St. Louis, Mo.	Meeting demands, keeping track of inventory and maintaining an accurate record of each account
	Information Systems Management, Richland, Wash.	Full computer facilities within the corporation; connected to an IBM System/360 (and other large scale systems) via telephone lines, provides capabilities of largest computer centers in Northwest
NCR Century 100 system	Charterhouse Japhet & Thomasson, London, England	Use by bank's rapidly growing investment management department; subsequently by the foreign exchange department for producing contracts, maintaining records and providing information on foreign exchange positions
	Norris Oakley Richardson and Glover, London, England	Keeping clients' files on-line; system will maintain portfolios as a by-product of initial data processing operation which will include information for internal accounting and management reports
	Northwest Michigan College, Traverse City, Mich.	A shared computer facility (17 high schools in the Traverse Bay area) for data processing instruction and school administrative work
	Red Food Stores, Inc., Chattanooga, Tenn.	Order processing and shipping; inventory control, accounts payable and payroll processing
	City of Prescott, Arizona	Processing payroll, appropriations, traffic violations and utility billing
SDS Sigma 7 system	COMSERV, Philadelphia, Pa.	Providing time-sharing services for business, scientific and engineering users throughout Delaware Valley; also remote and local batch processing (system valued at $1.5 million)
UNIVAC 494 system	Keydata Corp., Watertown, Mass.	A stand-by to the 494 placed in operation last fall; firm offers time-shared, on-line business data processing to subscribers in 11 Eastern states
UNIVAC 1108 system	Rieter Company, Winterthur, Switzerland	Production planning and control, technical and scientific problem solving, future planning and forecasting; also general accounting and payroll (system valued at $2.7 million)
	British Petroleum, London, England	Processing BP's large-scale linear programming work (system valued at $3.6 million)
UNIVAC 9200 system	Trunkline Gas Co., Houston, Texas	Use as a remote terminal for scientific and business data processed on a UNIVAC 1108 system
UNIVAC 9300 system	Amarillo College, Amarillo, Texas	Administrative business operations and student instructions
	Wellesley College, Wellesley, Mass.	Administrative business and student instruction in programming

BOOK REVIEWS

Neil Macdonald
Assistant Editor
Computers and Automation

We publish here citations and brief reviews of books and other publications which have a significant relation to computers, data processing, and automation, and which have come to our attention. We shall be glad to report other information in future lists if a review copy is sent to us. The plan of each entry is: author or editor / title / publisher or issuer / date, hardbound or softbound, number of pages, price or its equivalent / comments. If you write to a publisher or issuer, we would appreciate your mentioning *Computers and Automation*.

Wood, Paul E., Jr. / Switching Theory / McGraw-Hill Book Co., 330 West 42 St., New York, N.Y. / 1968, hardbound, 390 pp., $13.50

This book provides a comprehensive and up-to-date introduction to switching theory, the study of switching networks and their behavior. The author seeks to include central topics and to emphasize fundamental results. The book presents a logical development of switching theory, beginning with basic mathematics and postulate systems, and concluding with applications in digital systems. The eight chapters include "Boolean Algebra"; "Combinational Networks"; "Minimum-Complexity Combinational Networks"; "Topics on Combinational Networks"; "Sequential Needs"; "Minimum-Complexity Sequential Networks"; "Asynchronous Sequential Networks"; "Clocked Sequential Systems". There is one appendix, and an index.

The book has grown out of a course in switching theory taught at Massachusetts Institute of Technology, by the author, who was a staff member at Lincoln Laboratory 1961-67.

Nelson, Carl E. / Microfilm Technology: Engineering and Related Fields / McGraw-Hill Book Co., 330 West 42 St., New York, N.Y. 10036 / 1965, hardbound, 397 pp., $?

This book is a direct outgrowth of research, development, systems planning and successful application of unitized microfilm in equipment engineering areas of the Bell Telephone System. The content of the book reflects this experience and concerns itself only with the application of unitized microfilm to engineering data. The eighteen chapters include: "The Function of Microfilm in an Engineering Organization"; "Development and Processing"; "Mounting Unitized Film"; "Readers and Viewers"; "Unitization"; "Filing and Storage Equipment"; "Microfilm File Administration"; "Evaluation of the Microfilm System". There is a glossary of terms, an index, and a classified bibliography. The author is a past president of the National Microfilm Association, and has been 26 years in the field.

Lieberstein, Melvin H. / A course in Numerical Analysis / Harper & Row, Publishers, Inc., 49 East 33rd St., New York City, N.Y. 10016 / 1968, hardbound, 258 pp., $?

This book aims to prepare a mathematically minded and trained student to use numerical analysis in the sciences. A semester of advanced calculus (introduction to analysis) is a prerequisite. The thirteen chapters include: "Approximate Solution of One Non-Linear Algebraic Equation by Iteration"; "Methods for Solving Linear Systems"; "General Theory of Convergence for Linear Iterative Methods for Linear Systems"; "Initial Value Problems for Ordinary Differential Equations"; "Stability of Difference Methods for Parabolic Equations"; "Initial Value Problems of Second-Order Equations in E^{2n}"; "The Detached Shock Problem". There are eight appendices, and an index. The author is a professor of mathematics at Wichita State University in Kansas.

This is an advanced mathematical work and on the whole makes rather little reference to computers.

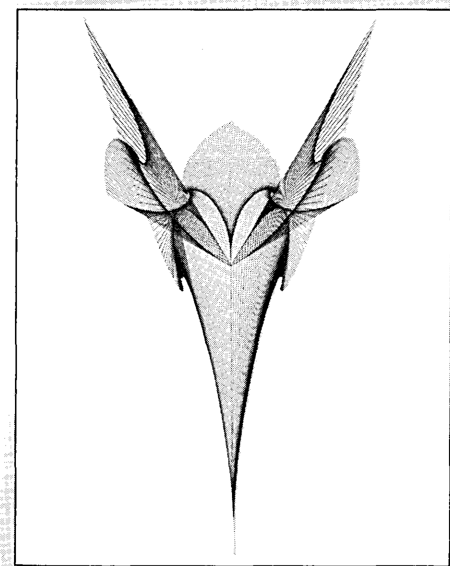
Wegner, Peter / Programming Languages, Information Structures, and Machine Organization / McGraw-Hill Book Co., 330 W. 42 St., New York, N. Y. 10036 / 1968, hardbound, 401 pp., $?

This book covers machine language, machine organization, multiprogramming systems, assemblers, macros, LISP, ALGOL, PL/I, simulation languages and many other topics in programming. The text develops a unifying framework within which programming languages may be classified and studied. The construction of this framework starts with the notion of an information structure. A computation is viewed as a sequence of information structures generated from an initial representation by the execution of a sequence of instructions. This point of view allows the subject of programming to be dealt with as a coherent discipline rather than a loose collection of techniques. This approach gives practical results since it allows many of the practical problems arising in programming to be analyzed more clearly and simply. The 4 chapters, with subtitles, include machine language and machine organization; assemblers, symbol tables, and macros; macro generators and the lambda calculus; procedure-oriented languages. The two appendices are: syntactic specification and syntactic analysis; the syntax of ALGOL. Last comes an Index.

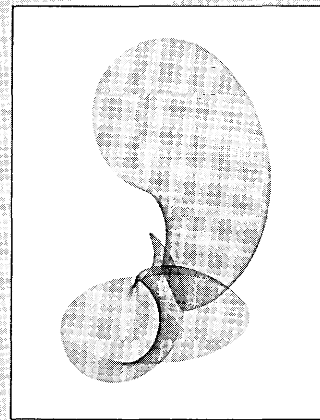
The author holds several degrees from London Univ. (England), from Cambridge Univ. (England), and Penn State Univ. He is Associate Professor of Computer Science at Cornell Univ.

ADVERTISING INDEX

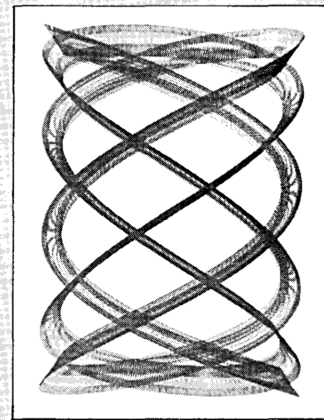
Following is the index of advertisements. Each item contains: Name and address of the advertiser / page number where the advertisement appears / name of agency if any.



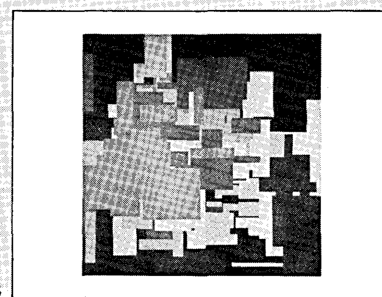
HUMMINGBIRD



INSPIRALATION



PLEXUS

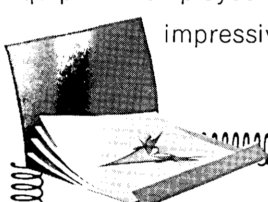


IDEALIZED BRUSH STROKES

SPECIAL OFFER!

full color reproductions of computer-generated artwork

Here is a unique opportunity to own a distinctive and unusual set of four prints from the 1968 Computer Art contest. Each print is 12" x 16" and is reproduced in magnificent full color on heavy weight quality paper suitable for framing. Symbolic of the computer industry, these attractive and interesting prints are ideal for decorating your office, den or home. Packaged in a handsome folio, they make distinctive gifts for friends or business associates. Each is imprinted on the back with a description of the programming technique, computer and plotting equipment employed to produce the art. Everybody in the computer field will want a set of these beautiful and impressive prints. Send for yours now. Supply is limited.



ORDER FORM

Gentlemen: please send your folio of computer art prints.
Enclosed is my ☐ check ☐ money order for $10.00.

NAME______________________________

COMPANY______________________________

ADDRESS______________________________

CITY______________ STATE__________ ZIP______

For orders of more than 10 sets, write for quantity price list

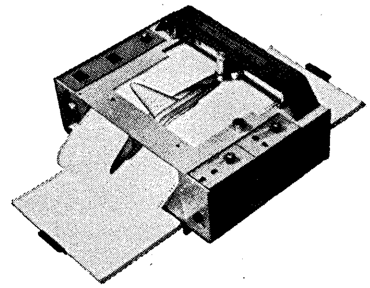
Compro
1060 KINGS HIGHWAY NORTH
CHERRY HILL, N.J. 08034
609-667-4709

CØMPLØT™:

For Digital Graphics At Its Best

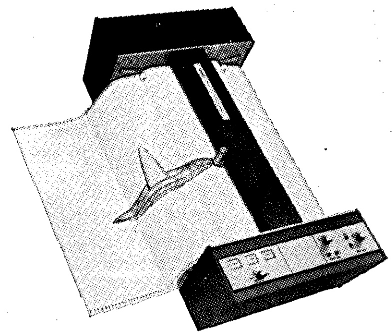
DP-1 Digital Incremental Plotter designed for use online, offline or with time sharing. Produces clean, clear graphic records annotated with alphanumerics at 300 increments/sec. Two step sizes: .01″ or .005″, Z-fold paper moves bi-directionally and is perforated for tear out to file size. Paper is 11″ wide x 144′. Accepts AC or DC coupled inputs. Free 5 year software update service. Request Bulletin #468 DP-1.

Price $3550



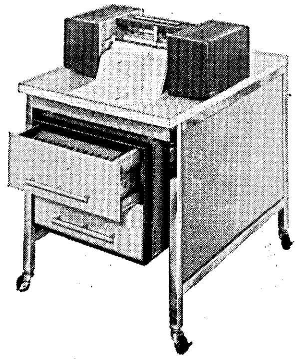
DP-3 Digital Incremental Plotter with 22″ wide plotting surface. Plots at 300 increments/sec. with .01″ or .005″ step size. Step size can be changed in minutes. Z-fold paper 22″ wide x 144′ is perforated for convenient tearout. DP-3 can be used online, offline or in time share mode. Accepts AC or DC coupled inputs. 5 year software plan included. Request Bulletin #868 DP-3.

Price $6400



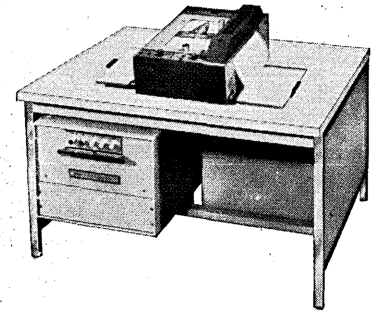
DP-5 Ultra High Speed Digital Incremental Plotter for computer graphics. Plots at a continuous speed of 1200 increments/sec. Conventional (300 increments/sec.) programs can be used at approximately 4 times normal speed. Step size is factory set at .005″ or .0025″. DP-5 features 11″ wide x 144′ long Z-fold paper for operational convenience. May be used online or offline, and accepts AC or DC coupled inputs. Housekeeping software for plotting for 5 years. Request Bulletin #269 DP-5.

Price $11,000



PTC-3 Plotter/Teletypewriter Controller allows graphic plotting at a remote time share terminal. PTC-3 acts as the interface between a 103A2 Data set, or equivalent, or an appropriate acoustical coupler and the teletypewriter and plotter. Incoming data can be accepted normally on the TTY or displayed graphically on the plotter. Controller is available in a desk or housed in a wrap-around case for bench or table mounting. May be used with DP-1 or DP-3. Request Bulletin #468 PTC-3.

Price $5250



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