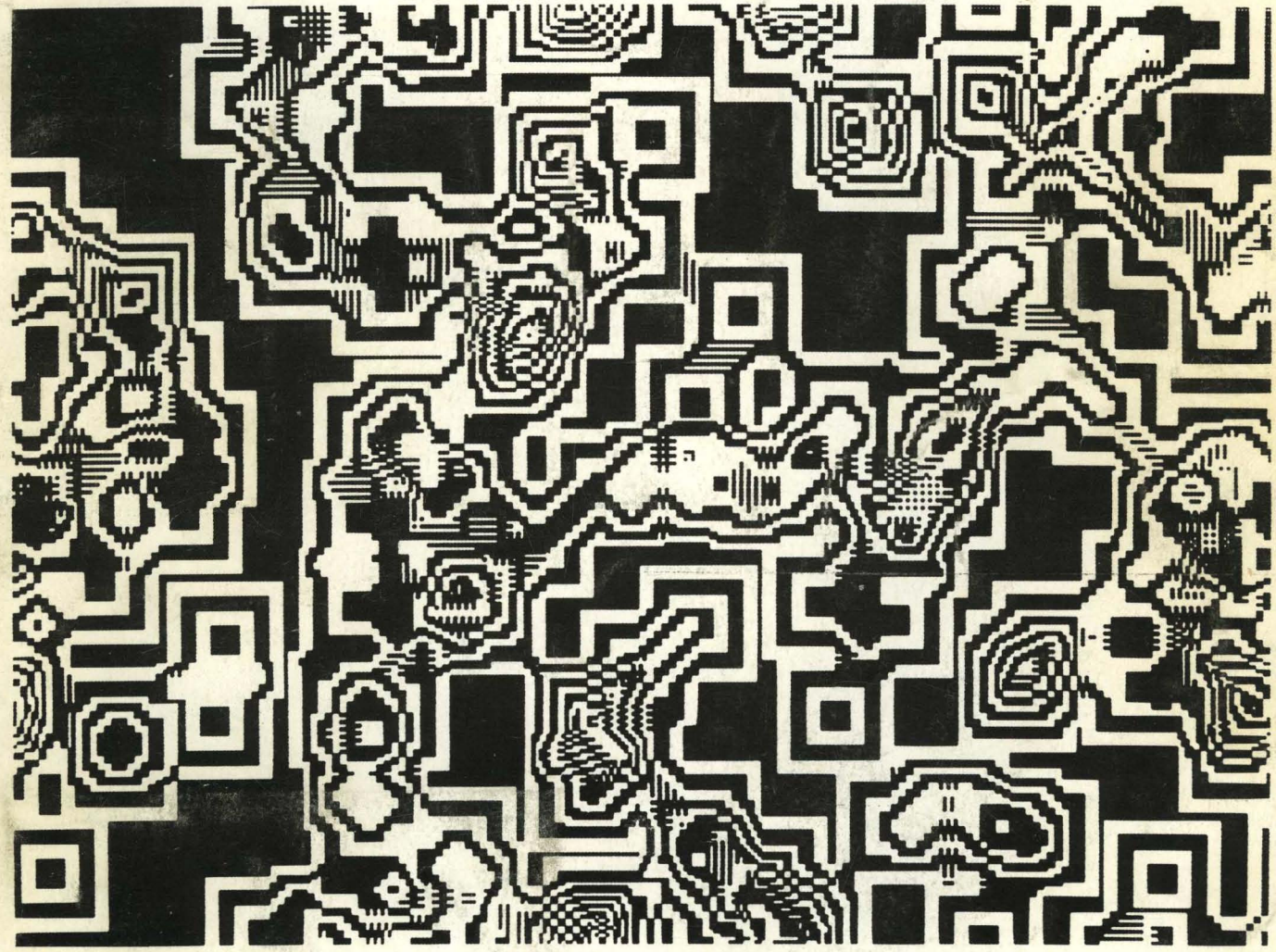
SCIENCE & TECHNOLOGY
August, 1970
Vol. 19, No. 8

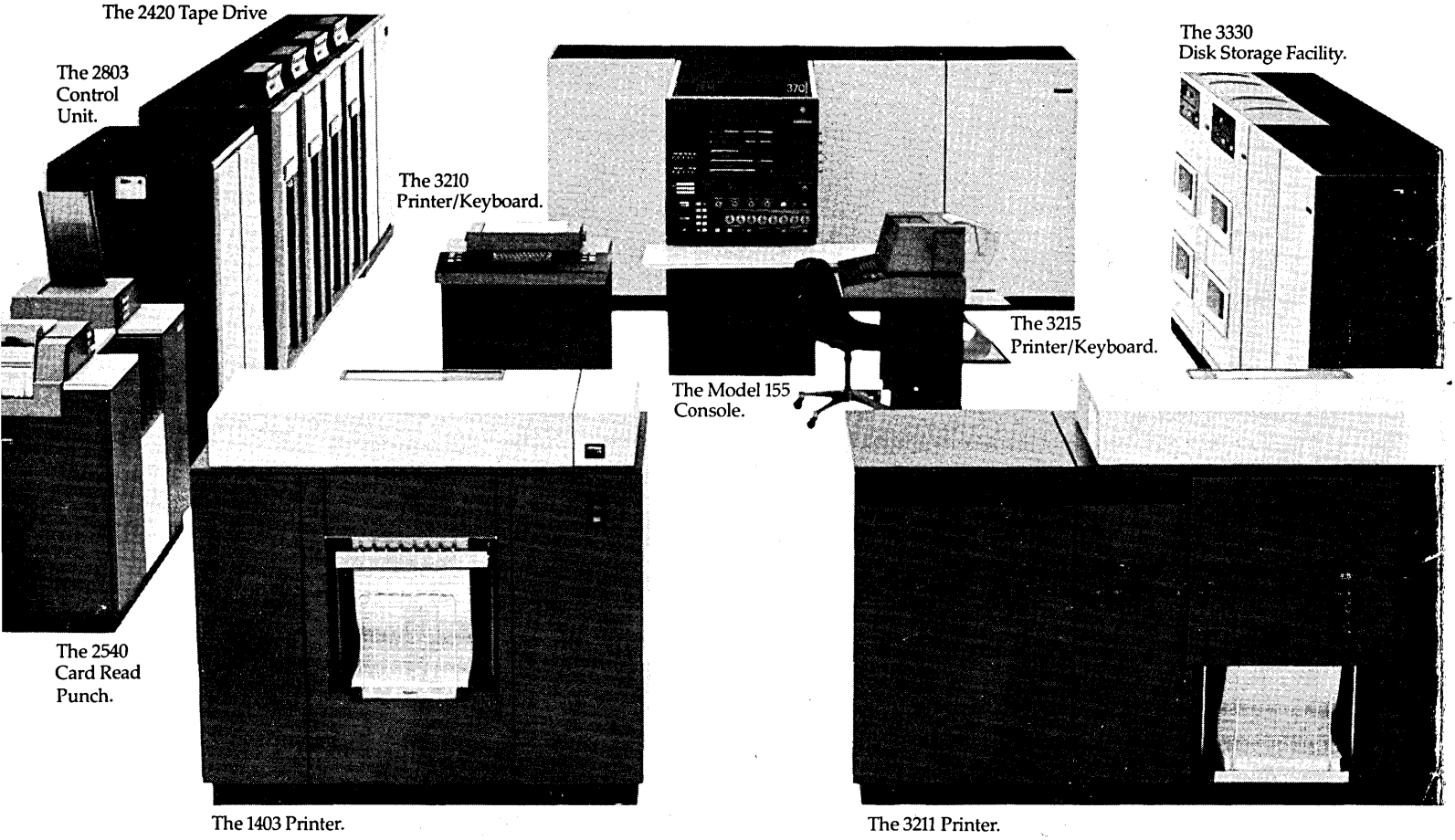
computers and automation



"Tapestry I"

8th Annual Computer Art Contest — First Prize

The 370.



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bytes) than our current files. And it can transfer it up to two and a half times faster. This file alone can significantly increase performance.

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Vol. 19, No. 8
August, 1970

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computers and automation

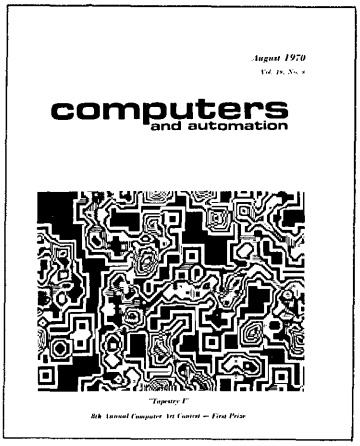
The magazine of the design, applications, and implications of information processing systems.

Computer Art

Computer Graphics

Computer Programming Languages

Computer Professionals



This Month's Cover

The front cover drawing is the winner of the first prize in C&A's Eighth Annual Computer Art Contest. The drawing, named "Tapestry I", is taken from a computer-generated film, "Pixillation", produced for American Telephone and Telegraph Co. at Bell Telephone Laboratories, Murray Hill, N.J. The artists are Lillian Schwartz and Ken Knowlton. For more information, see page 13 ff.

Departments

Key

[A] — Article
[F] — Readers' Forum
[E] — Editorial
[C] — Monthly Column

C.a EDITORIAL Computers and Truth

Sooner or later every computer professional is required to correlate the results of computer operations, "what the computer says", with the real world.

Suppose "the computer says" that J. Jones should be paid (and should be credited for withheld taxes) for the period June 6 to June 22 as follows:

Gross pay:	$111.04
Federal withholding tax:	16.10
Social security tax:	5.33
Massachusetts withholding tax:	4.00
Net pay:	$ 85.61

Is this true?

The inspection, the comparison with the real world, shows that J. Jones is a "student", and so no Mass. withholding tax should be deducted for him, and so the computer's results are partly wrong, and the program inside the computer was imperfect, and should be corrected.

Here in this case, the case of payroll calculations, we have of course two general conditions operating in our favor:

- ☐ *No Disagreement.* The facts and principles in this field of knowledge are completely agreed upon by all informed persons; and
- ☐ *No Hiding.* No deliberate efforts at hiding or concealing information are being made. (Nature may hide truth from scientists, but Nature is not using deliberate concealment and lying.)

These two general conditions for factual knowledge and computing are today so widespread for many fields of knowledge that we forget that these conditions are not universal.

There are a number of important areas of factual knowledge where these conditions do not apply, and instead:

- ☐ *Disagreement.* The facts and principles may be subject to widespread disagreement; or
- ☐ *Hiding.* A great many deliberate efforts to conceal (and to tell lies) may be occurring.

An example of the first area (disagreement) is the conflict going on in 1970 between the state of Israel and the Arab states, Egypt, Syria, Jordan, etc. In this case no more than a small portion of the facts or the principles could, I believe, be agreed upon by both sides. Any application of computers to problems in this area would be very seriously interfered with by this extensive disagreement. In such an area as this, apparently, computers could only be successfully applied to produce second approximations to a solution in cases where human beings have agreed on the first approximation to solutions.

The second area is still more complicated. In the case of crime, political assassinations, lies by vested interests, the activities of secret police, lies by governments, and similar conflicts between parts of a society and the whole society, there is often little doubt about many of the important facts and principles. One of those principles is that it is wrong to lie. The main defense of the deviant part of society is concealment; the fact of concealment in itself implies there is something needing concealment. Part of the application of computers to problems in this area consists of techniques to strip off concealment, and enable the whole society to know the facts and to judge.

I have just finished reading a horrifying story, *Murder to Order,* by Karl Anders, published 1967 by Devin-Adair Co., 23 E. 26 St., New York, 127 pp. This is reportedly the account of a secret agent of the Soviet Union, Bogdan Stashinsky, who on orders of the Soviet espionage system, in 1957 and 1959 assassinated two Ukrainian emigre leaders (Rebet and Bandera) living in West Germany, using a special weapon spraying cyanide gas into the victim's face; and Stashinsky reportedly received an Order of the Red Banner in November 1959 for his "successful contribution to the solution of an important problem." In 1961 Stashinsky fled to the West, confessed, was tried in a German court, and sentenced to six years at hard labor.

How true is this story? I never heard before of many of the persons mentioned as actors in this story. I never heard of the author, Karl Anders. The book has no index. There is no bibliography. Someone presumably translated all that is here reported from Russian and German into English; yet the translator is not identified. How am I to evaluate this story?

Probably the main purpose of the publication of this book is to fill its readers with horror at the Soviet Union KGB – but certainly many of the secret cloak and dagger operations of all nations having them, including certainly France, West Germany, and the United States, are likely to be just as horrifying.

What about the areas of knowledge where wide disagreement and extensive hiding are the rule? In spite of the difficulties, computer professionals can make important contributions by assuming, as part of the profession of information engineer, the task of development of computer techniques which help to discover the truth and discover grounds for agreement. These include techniques for:

1. The analysis of evidence;
2. The preparation of indexes, correlations, and concordances;
3. The pinpointing of questions to be answered;
4. The pinpointing of weak spots in the evidence;
5. The demonstration of lies and their correction;
6. The evaluation of evidence;
7. The derivation of reasonable judgments and conclusions.

Would it be hard to program reasonable judgment? Maybe not. The programming of reasonable judgments has been accomplished in chess and checkers programs, when a computer program evaluates a situation, in order to decide upon a move.

In essence, therefore:

1. Computer people need to recognize the areas of knowledge where proffered computer input is full of departures from truth;
2. They need to become experts in removing errors from proffered computer input;
3. They need to participate actively in removing "garbage" from the input.

Edmund C. Berkeley

Editor

Letters To The Editor

Some Positive Reactions to May Issue Article by Sprague

I have just finished reading your article in the May issue, "The Assassination of President John F. Kennedy: The Application of Computers to the Photographic Evidence". I found it extremely interesting, although it is too bad that a mass circulation magazine did not publish your article, since unfortunately the impact of *Computers and Automation* is so small compared to the giants of the publishing world.

For the past three years I have studied virtually everything available on the assassination of President Kennedy, including the 26 volumes of the Warren Commission Report. I believe that I have the same feelings about the subject as you and others who have researched the case -- outrage and frustration that the public is constantly being misled by the news media regarding the assassination, and especially the Garrison investigation. Best wishes for further success in your research.

MICHAEL GERACE
47 Centre Lane
Milton, Mass. 02186

I recently had access to one copy of your magazine, and was fascinated by the article on President Kennedy's Assassination. After reviewing that issue, I would appreciate information on how I might obtain my personal subscription to this highly informative publication.

J. E. LAWSON, Design Engineer
Data Corp.
7500 Old Xenia Pike
Dayton, Ohio 45432

I recently received some subscription promotion material from you. I had entered a renewal of my subscription a few days before your letter reached me. Please use the money for my subscription premium in any way which will support your magazine and/or the exposure of covert activities which appear to be counter to the interests of America and our future. A great deal of exposure would be required to get through the smokescreen of the TV to the voter.

JAY HART
1961 Oldham
Austin, Tex. 78705

You are to be congratulated on the fascinating array of articles in your May issue. Of particular interest to me was the excellent article by Dick Sprague on the application of computers to the photographic evidence of Kennedy's assassination.

ALDER M. JENKINS
Director of Public Relations
SofTech
391 Totten Pond Rd.
Waltham, Mass. 02154

A Word of Thanks

Thank you for your fine magazine, professional articles, and stimulating puzzles.

DAVID C. NIVEN
Systems Supervisor, DSD
Honeywell Inc. EDP
1320 Dublin Rd.
Columbus, Ohio 43212

READERS' FORUM

ACM COUNTER CONFERENCE — STATEMENT OF PURPOSE

David E. Burmaster
Room 803
545 Main St.
Cambridge, Mass.

A group within the Association for Computing Machinery (ACM), unhappy with the ACM's decision to hold its 1971 conference in Chicago, has scheduled a simultaneous "Counter" Conference to be held Aug. 3-5, 1971, at the Harvest House Motel, Boulder, Colorado. We who organized the Counter Conference have received several inquiries as to the nature of the conference. Following is our statement of purpose.

Statement of Purpose

We who organized the Counter-Conference were drawn together by various overlapping concerns. We now recognize these as concerns for various aspects of *professionalism.* We understand this latter term as follows:

(1) A distinguishing mark of a professional, in any field, is his acceptance of *responsibility* for the consequences of his activities, including indirect and remote consequences. We believe that the ACM does not adequately emphasize this aspect of professionalism. For example, we believe that the ACM's decision to hold the 1971 National Conference in Chicago was particularly irresponsible, since Chicago is an established symbol for the repressive side of current American life.

(2) Another distinguishing mark of a professional is his maintenance of *standards* of technical work in his field.

(3) The final distinguishing mark of a professional is the *technical excellence* of his own work.

We do not assert that a high level of professionalism is unachievable within the ACM. Most of us are ACM members, and many of us hold responsible positions in that organization. We are working *within* the ACM, and we expect to continue to do so. We have no plans for organization of a competing society. If, however, we were merely to abstain while the ACM is in Chicago, we would share responsibility for the ACM's action. This we cannot do.

The Counter-Conference will emphasize all of the aspects of professionalism. The timing of our meeting is intentional, as is its location away from Chicago. It is our further intention that an exemplary standard of technical quality will be maintained at our sessions. □

COMPUTERS OFFER NEW OPPORTUNITIES FOR THE BLIND — COMMENT

Dr. Charles E. Hallenbeck
Dept. of Psychology
Univ. of Kansas
Lawrence, Kan. 66044

In your February 1970 issue you printed an article entitled "Computers Offer New Opportunities for the Blind" [page 37] which was of considerable interest to me as Associate Editor of the A.C.M.'s *Newsletter for Blind Computer Programmers.* The article described the special techniques used by four programmers at the Los Angeles County Data Processing Center, techniques which enable these blind programmers to perform their tasks productively. I would like to point out, however, that some of your readers may be misled by what I believe to be an undue emphasis on the need for sighted assistance to provide on-the-job help to blind programmers. I do not contend that the best way for a blind programmer to perform his work is to avoid help where it is useful and appropriate, but many techniques other than those referred to in the article cited have enabled scores of other blind programmers to perform their tasks with far less reliance on sighted assistance than indicated.

The article listed four procedures unique to blind programmers. The third was identified as "compilation for Syntax", and begins with the statement, "An assistant is required at this point to read the programmer the error messages in the program listing, and insert the corrected statement cards in the source deck after he has typed the corrections and had them key-punched." As the article continues, the fourth item, "Program Testing", contains the following statement, "Test results will need to be described by an assistant, who will also document the program".

Your readers may be interested to know that many line printers can be made to print Braille quite easily by inserting between the paper and the hammers which strike it, a length of ordinary dime store elastic. Then, instead of printing the characters intended for display, they are diverted to a tape or other temporary scratch file, and translated into a pattern of periods and blanks. When this pattern of periods and blanks is finally printed with the printer's hammers cushioned, the result is a readily readable Braille output. The quality is not high, and unless special paper is used the raised dots are not long-lasting, but most

blind programmers use this technique to obtain 80-80 listings, compiler diagnostics, and test runs for programs being de-bugged. Most computer manufacturers maintain their manuals on magnetic tapes, and some (most notably I.B.M.) even release such tapes to blind programmers for embossing directly into Braille by this method. Sighted assistance is sometimes faster, but not at all indispensable.

As for correcting source decks, once again most blind programmers have a simple mechanical card reader by which the contents of any column on the card can be examined to determine its contents. "Reading" punched cards this way is very slow and wasteful of skilled manpower, but searching through sequence numbers on a card's margins is quick, and permits the blind programmer to handle his cards independently. The cut corner must surely have been suggested by a blind programmer on Hollerith's original staff.

One final comment refers to the implication that blind programmers cannot document their work without sighted assistance. It is certainly true that flow-charting is a problem with which many programmers do need help, but automatic flow-chart generating software does exist, and the many other details of documentation require no particular assistance. I am afraid that the article may have inadvertently combined two facts about the four programmers whom it described. First, that they are blind programmers, and second, that they are relatively newcomers on their jobs. It is neophyte programmers, whether blind or sighted, who often benefit most from the assistance and advice of their co-workers and supervisors. Blind programmers often progress to supervisory positions of responsibility, a fact which clearly disproves the necessary connection between blindness and the need for help with documentation. □

"THE HOUSE IS ON FIRE" — MORE COMMENT, PRO AND CON

I. From Robert D. McConnell
IBM-GEM Pacific Support Center
APO San Francisco, Calif. 96331

Please discontinue my subscription and refund the unpaid balance. My reasons are expressed by the letters in the May issue from Messrs. Beus, Mleko, and Parker ["The House is on Fire" — Comments, page 8]. I subscribe to technical publications, with my own money, to keep abreast of the technological changes in this industry. I subscribe to other more qualified and better balanced publications for political commentary. The dearth of technical information in your magazine of late demonstrates your intention to use a technical format for personal editorializing.

II. From E. C. McIrvine, Manager
Technical Analysis
Xerox Corp.
P.O. Box 1540, Bldg. 105
Rochester, N.Y. 14604

As I am sure many of your readers do, I tend to run about three months behind in my periodical reading. Consequently, I just read your February editorial, "The House is on Fire".

I could not agree more with the sentiments expressed. The overlap of computational linguistics with natural linguistics, along with the observed philosophical implications of linguistic analysis, give the computing field an opportunity to play a key role in humanizing society. If we fail to step up to that role, we perform a disservice to humanity.

To date, I have always followed your journal through library reading. With this letter I enclose a check for a personal subscription, as a small token of support for your editorial policy.

III. From the Editor

It is very pleasing to an editor and publisher to receive a letter like Mr. McIrvine's, and to have our editorial point of view supported to the extent of his becoming a subscriber.

It is, of course, not pleasing to an editor and publisher to receive cancellations of subscriptions in opposition to our editorial point of view. But we cannot be all things to all people. We feel a strong responsibility to use the editorial freedom which our status as a paid circulation magazine grants us. And our objective is to use *Computers and Automation* as a way to help develop not only the better use of computers, but also better input into computers. □

WINNERS OF 1970 MARTIN LUTHER KING MEMORIAL PRIZE CONTEST

The winners of the Second Annual Martin Luther King Memorial Prize Contest have been announced. They are: David F. Foster, 3233 M St. N.W., Washington, D.C.; and Mrs. Florine L. Way, P.O. Box 499, Monticello, Fla. 32344. Mr. Foster's essay, "Computers and Social Change: Uses — and Misuses", is being published in this issue. Mrs. Way's essay, "Teacher + Technology: Creating Individualized Reading Lessons" is scheduled for publication in next month's issue.

The winning essays were selected as the best articles submitted in the general field of the application of information sciences and engineering to the problems of improvement in human society. First place prize money of $300 (an anonymous gift to *Computers and Automation*) was divided between the two winners ($150 each).

Judges for this year's contest were: Dr. Franz L. Alt of the American Institute of Physics; Dr. William H. Churchill of Howard University, and Edmund C. Berkeley, Editor of *Computers and Automation.* □

" 'INSTANT INSANITY' FAILS TO FRUSTRATE COMPUTER" — COMMENTS

I. From John Bieler
3 Dogwood Lane
Turnersville, N.J. 08012

In the "Applications" section of your June issue [page 50] you described the use of a computer to solve the "Instant Insanity" puzzle. The object of the puzzle is to arrange four cubes in a stack so that each side of the stack has exactly one face of each of four colors.

Elementary analysis reveals several errors in the calculations:

1. Each cube has 24, not 64 possible combinations. Its orientation is uniquely determined by a selection of one of six possible choices for its bottom face, and then a selection of one of four possible choices for its "south" (or "east", or "north" or "west") side.
2. Because there are four cubes, each with 24 possible orientations, and there are 24 permutations of the four cubes, there are clearly 245, or 7,962,624 total combinations, not 16,777,216.
3. It is obvious that any solution gives rise to a class of 192 related solutions. These solutions are arrived at by the 24 permutations of the cubes, four possible orientations resulting from rotations about a vertical axis, and two selections based on an arbitrary top-bottom inversion (24x4x2=192).

In January, 1969, I solved the problem on Temple University's Control Data Computer, and determined that there is essentially one class of related solutions – 192 solutions in all.

II. From James E. Renouf
UNIVAC DP Services
300 N. State St.
Chicago, Ill. 60610

Many of your readers have taken the opportunity to question some of the statements I made pertaining to the solution of the Parker Bros., Inc. game, "Instant Insanity". I sincerely appreciate their interest, but I cannot really dispute or affirm any of the facts and counter claims sent to me, as I am not a mathematician. I would like, however, to relate some of the assumptions I made when writing the FORTRAN V program for the Univac 1108 computer: (1) I am rotating all four cubes on three axes, inclusively exposing all four sides of each plane for each iteration of each rotation – (4x4x4) = 64 rotations per cube. (2) I am rotating all 4 cubes in the same manner – (64x64x64x64x) = $64^4 = 2^{24} = 16{,}777{,}216$ rotation iterations. The end result of this is 256 solutions which are all unique in that each solution requires a different number of rotations on 1 or more of the 3 axes for 1 or more of the 4 cubes.

The 256 solutions are not all unique in the turns of color combination, in fact many of them are duplicates.

One other point worth mentioning is that I have come across at least two "Instant Insanity" games that do not match in the terms of having the same adjacent sides containing the same colors. Thus it may be that our puzzles differ. □

CANADIAN CONFERENCE CONCLUSION: CONTROLS ON COMPUTERS ARE NEEDED TO PROTECT INDIVIDUALS

(Based on a report in the *Financial Times of Canada,* 1061 St. Alexander Street, Montreal, Quebec, Canada, June 1, 1970)

Delegates from government, industry, and universities, at a conference on computers, privacy and freedom of information held recently at Queen's University, concluded that controls are needed to avoid potential abuses of the large information systems predicted for the future. The 150 delegates participated in three days of heated discussion, and their consensus was reached only after lengthy argument, particularly from representatives of credit bureaus and private service companies. There were strong initial fears expressed by some delegates that the controls designed to prevent abuses might in fact limit freedom of information and communication.

But as opinions converged, there was general agreement that a system of licensing data banks will eventually be necessary. Among the recommendations of the delegates were:

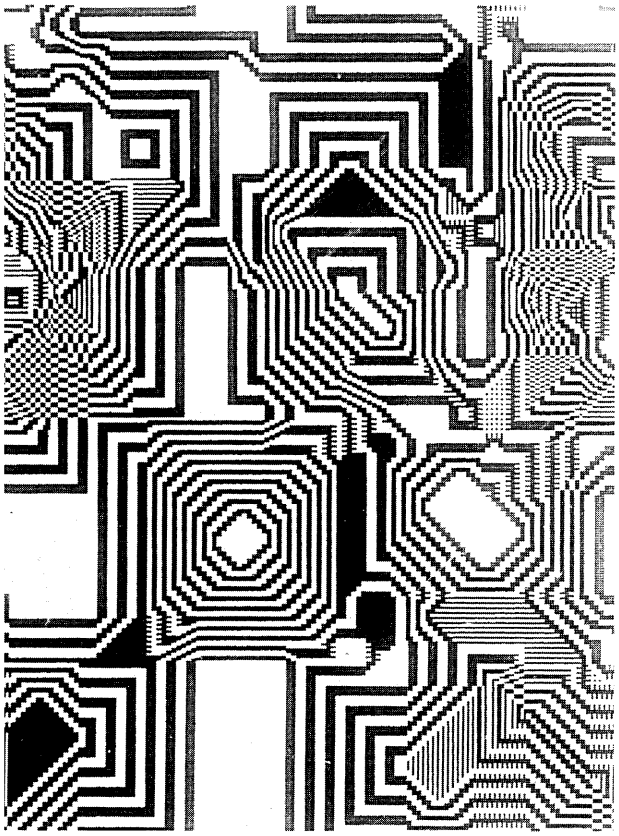
- Lesiglation to provide for the right to privacy and the right to freedom of information.
- Criminal penalties for breaches of legislation; special, general and, where necessary, punitive damages for abuses of privacy.
- An independent commission to investigate specific complaints against operators of computer data banks or other information systems.
- Comprehensive licensing of data banks, including different levels of licenses for information of varying sensitivity.
- A public fund to pay for individual losses in cases where there has been damage but where legal recourse is impossible.
- Bonding of personnel working with data files.
- Legal guarantees that an individual may see and correct his own file at any time; provisions to make individuals aware that files exist on them.

The conference emphasized that credit bureaus are merely the most visible area where abuses of privacy could occur. Any organization – including government – which systematically compiles information about identifiable individuals was seen as a potential source of trouble.

Mr. A. E. Gotlieb, Deputy Minister of Communications, warned that the gap between technological development and legal regulation could result in complete separation of the "manipulators" of information and the rest of society.

The conference was organized by the Department of Communications and the Department of Justice. The recommendations of the delegates are expected to play a significant part in the formulation of government policy concerning data banks. □

Eighth Annual
COMPUTER ART CONTEST



TAPESTRY II
— Lillian Schwartz and Ken Knowlton

The first prize in our 1970 Computer Art Contest has been awarded to Lillian Schwartz and Ken Knowlton of Bell Telephone Laboratories, Murray Hill, N. J. Their winning entry, "Tapestry I", has been published on the front cover of this issue. A second entry, "Tapestry II", is shown above.

These pictures were frames from a computer-generated film, "Pixillation", produced for American Telephone and Telegraph Co. as follows:

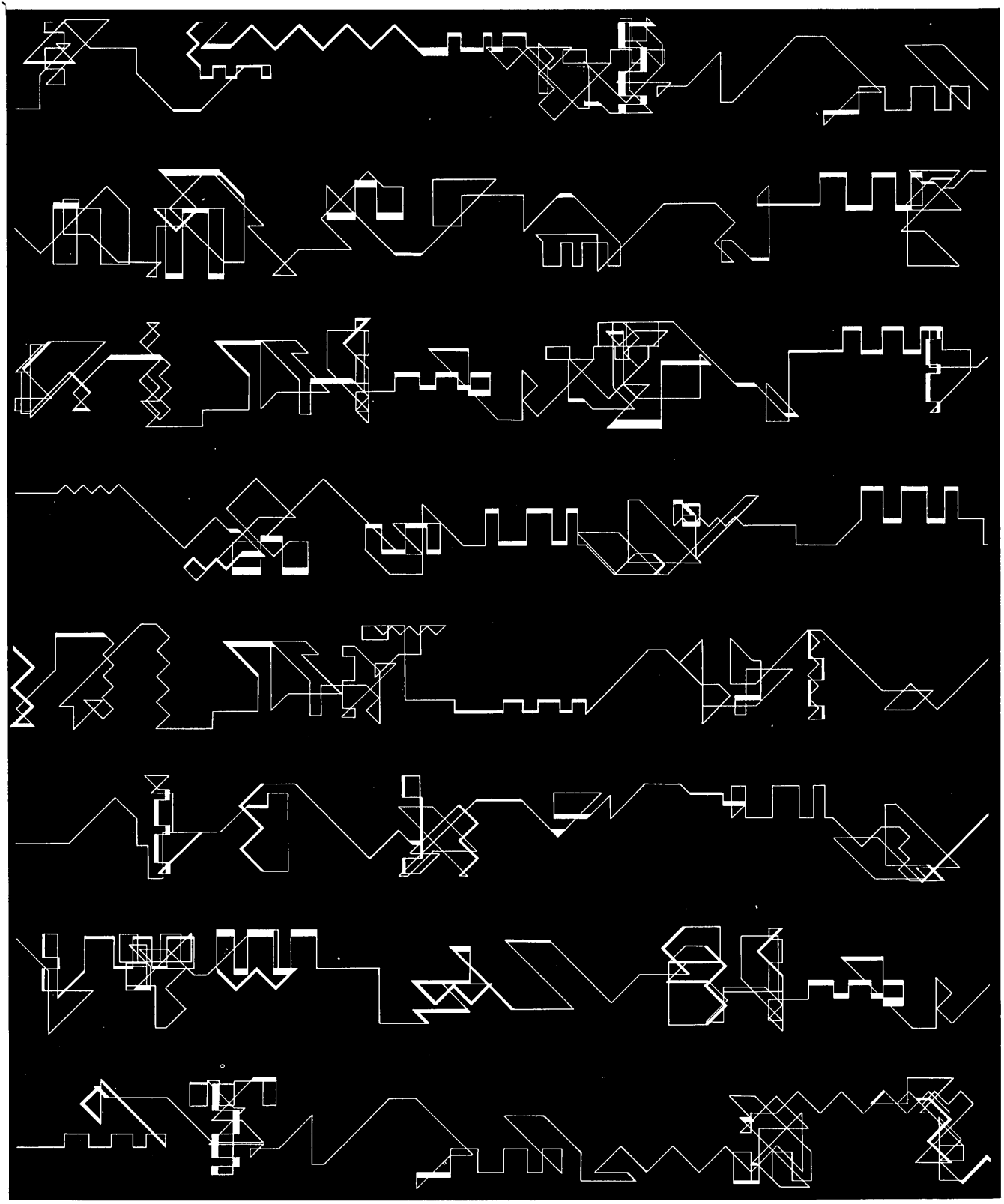
> Each original 35mm frame of film was produced as a 240 X 340 array of dots and blanks by a Stromberg-Datagraphics 4060 microfilm printer controlled by an IBM 360/50 computer. The programming system used was a special one for performing global and local operations on two-dimensional internal arrays of alphanumeric characters, which are ultimately output as black, white, or frame-by-frame random dots.

Judges for this year's contest were Leslie Mezei of the Department of Computer Science at the University of Toronto, Toronto, Canada, and Edmund C. Berkeley, Editor, Computers and Automation. One of the strong elements considered by the judges this year was the new, creative uses of the computer as an artist's tool.

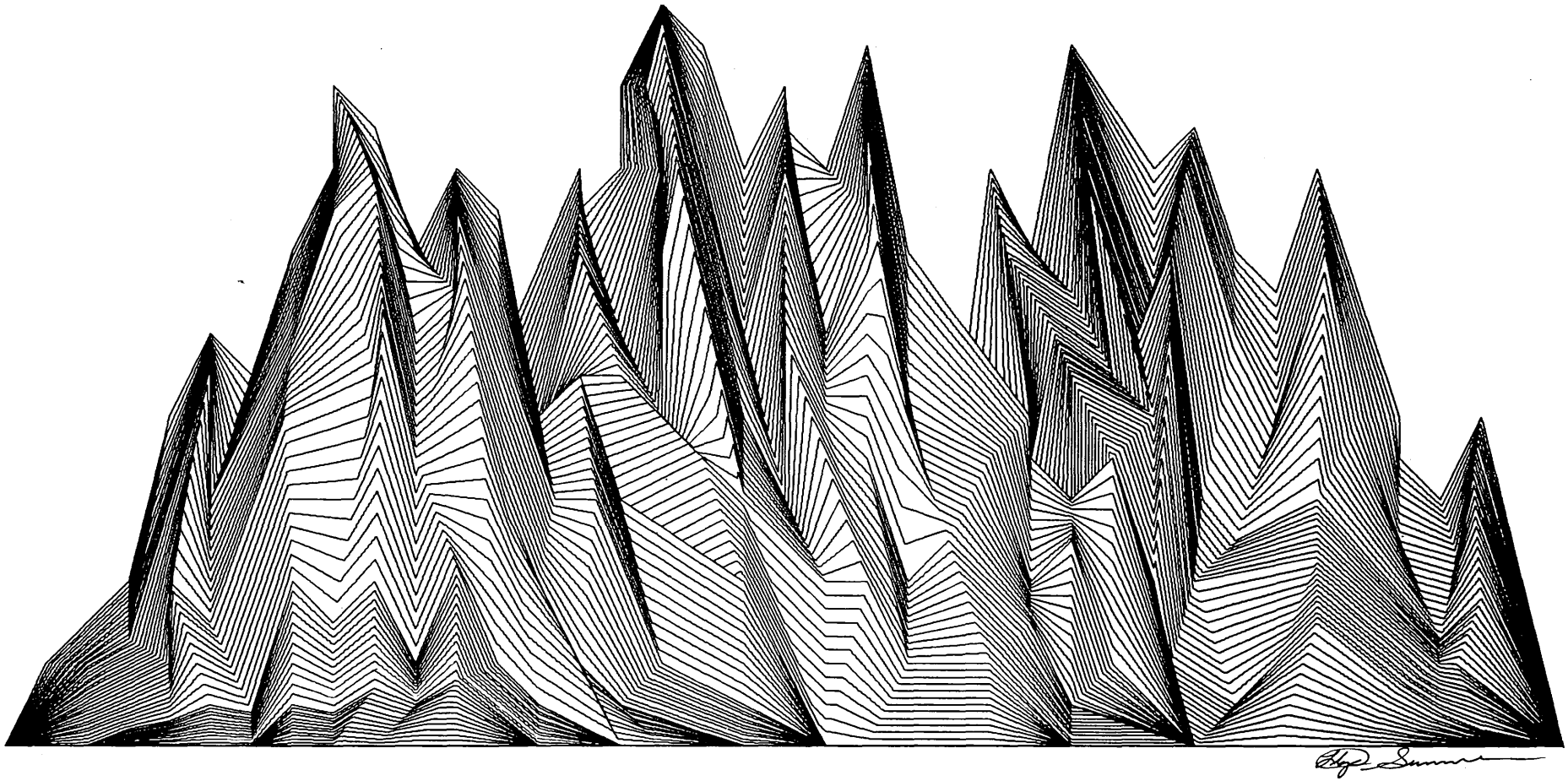
The computer art on the pages which follow receives honorable mention. For some of the drawings, the explanation is obvious or can be inferred easily; for others, explanations are given. In a number of cases, the computer and the peripheral equipment which produced the drawings have not been specified as much as we would like, because that information did not reach us by the close of the contest. 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 response to our Eighth Annual Computer Art Contest was very good. We received nearly 120 computer drawings from all over the world — France, Holland, Italy, Japan, South Africa, Sweden, and the United States. We are grateful to all those persons who sent us entries. A complete alphabetical listing of the names and addresses of all persons who submitted entries in this year's contest appears on page 24. In forthcoming issues of Computers and Automation, we hope to publish some of the drawings we were not able to include in this issue.

For August, 1971, we plan our Ninth Annual Computer Art Contest, and we cordially invite contributions of computer art from all our readers and others who are interested in computer art.



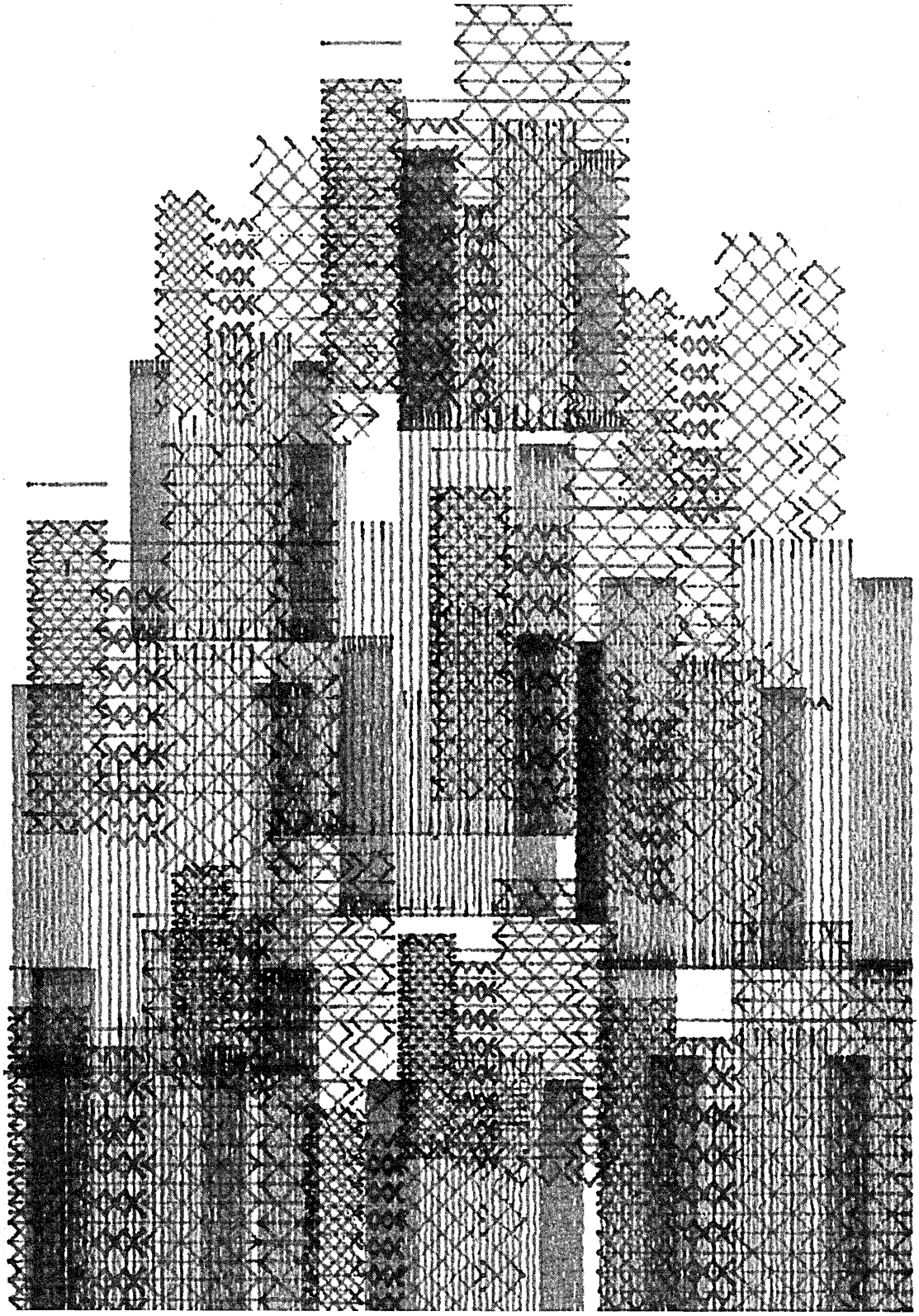
STAIRWAYS
— Manfred Mohr



IN WILDERNESS
— Lloyd Sumner

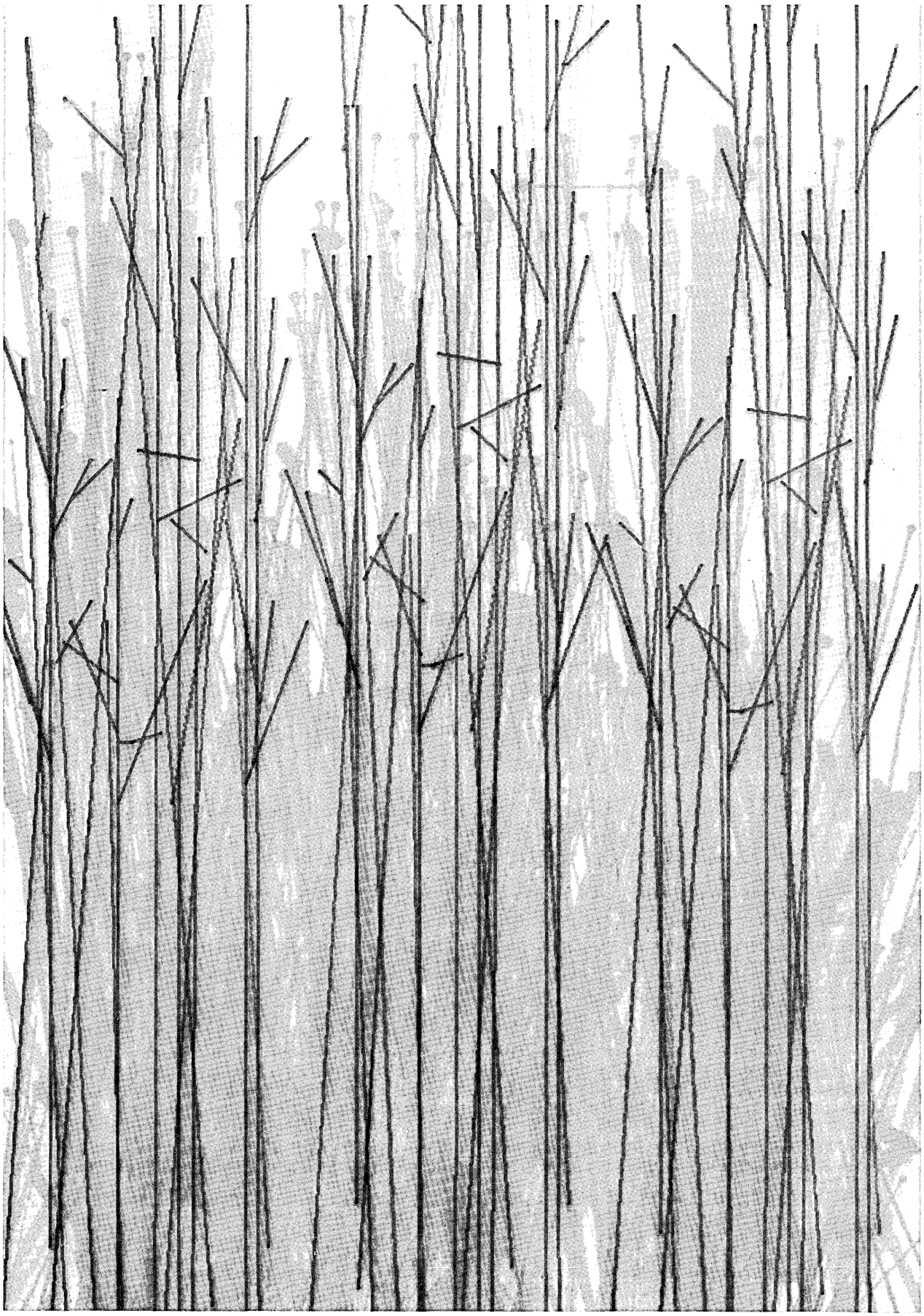
Produced with the aid of a Burroughs B5500 computer and a CalComp 565 plotter, and programmed in ALGOL. (Brochures describing Mr. Sumner's extensive work in computer art are available free upon request. Mr. Sumner's address is listed on page 24.)

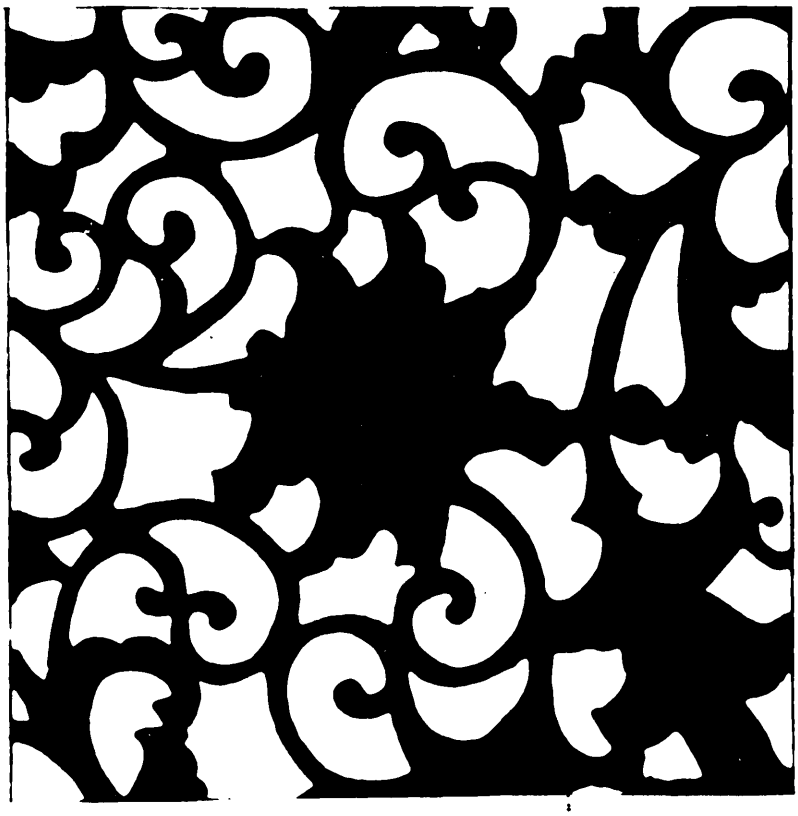
CITY PAINTING
— Grace C. Hertlein



"City Painting" and "The Field" were produced on an IBM 1620 computer and a CalComp digital plotter, using a combination IBM Drafting System/FORTRAN machine language. "City Painting" shows a technique which enables the artist to repeat a module in submodular form, and spontaneously develop the painting as in manual creation. For "The Field", fine and thick nylon bristle brushes were used in the flow-pan assembly of the plotter. Original work was in brown, green, and gold inks on mylar overlays. For a detailed description of Mrs. Hertlein's work, see "An Artist Views Discovery Through Computer-Aided Graphics", beginning on page 25.

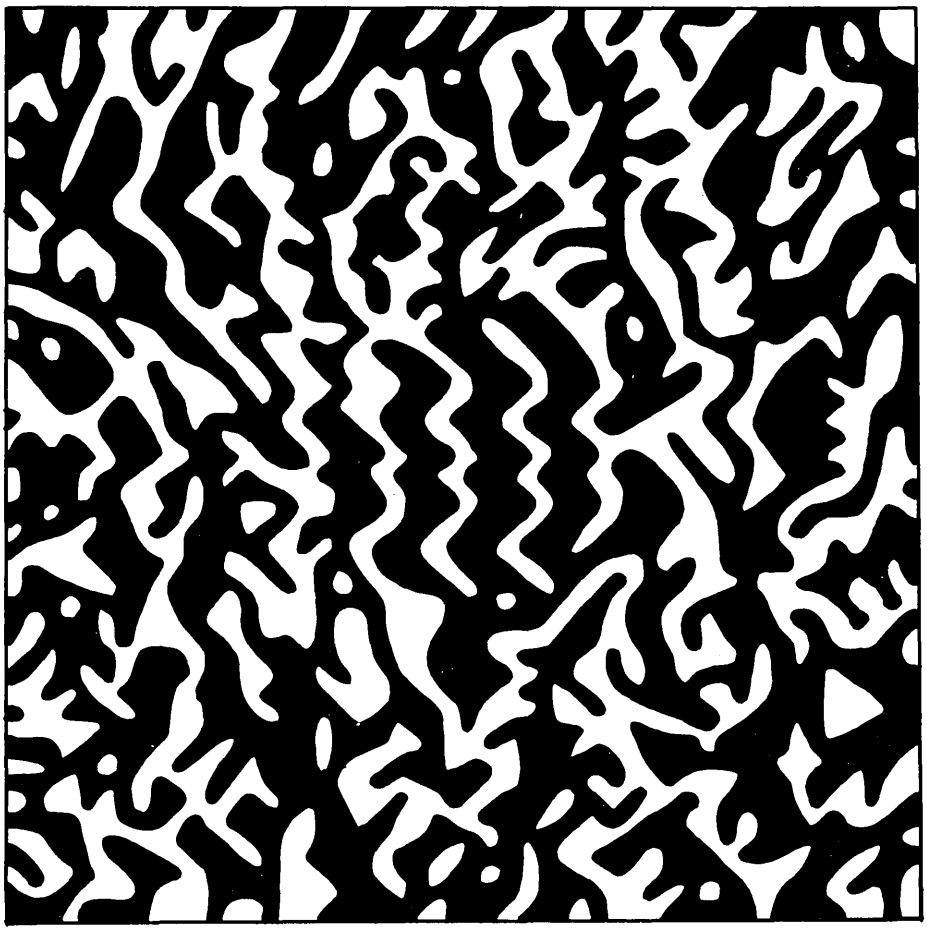
THE FIELD
— Grace C. Hertlein

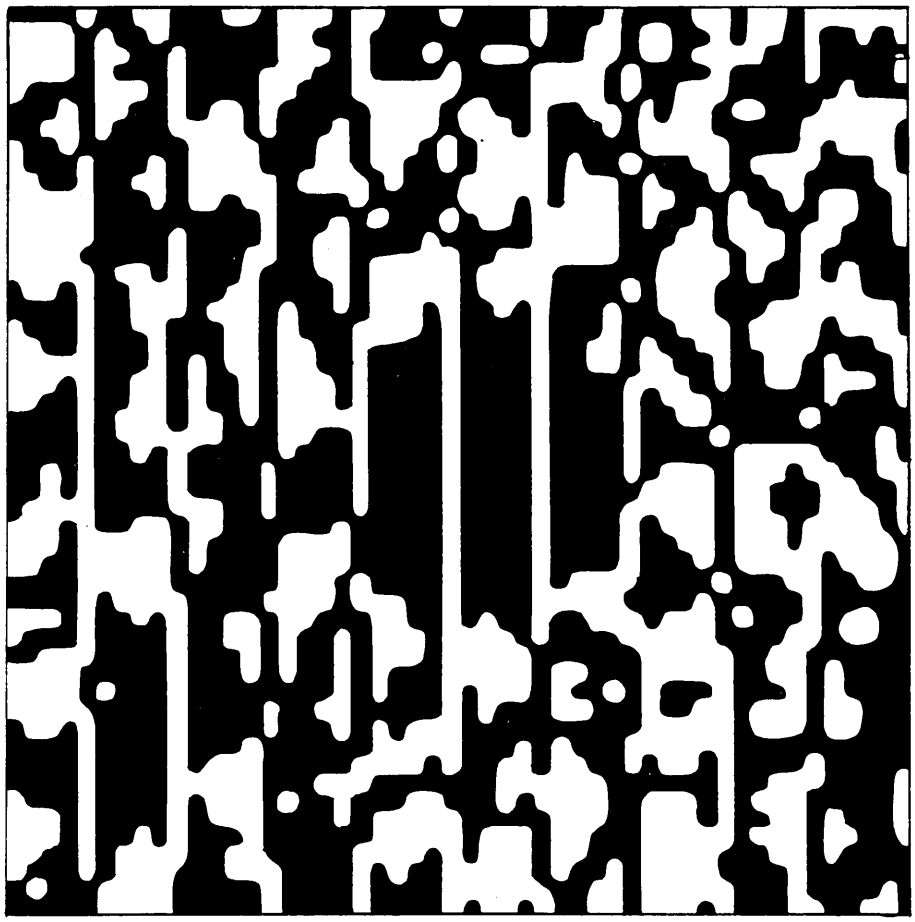


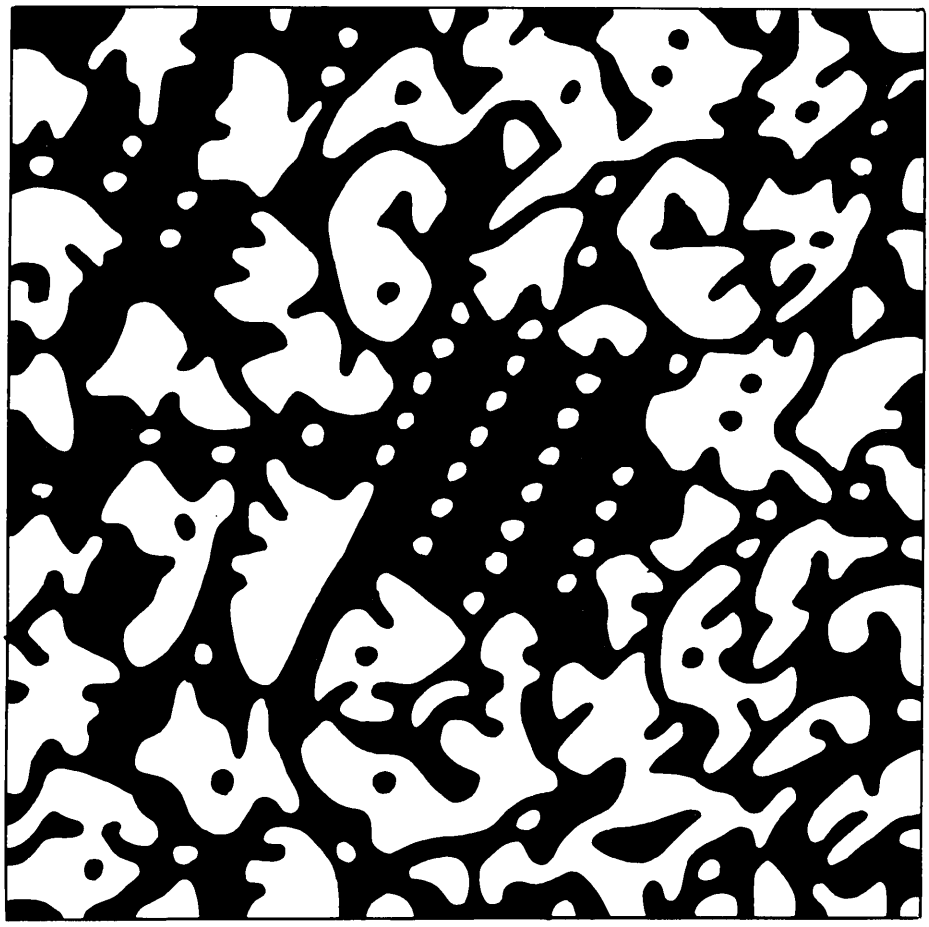


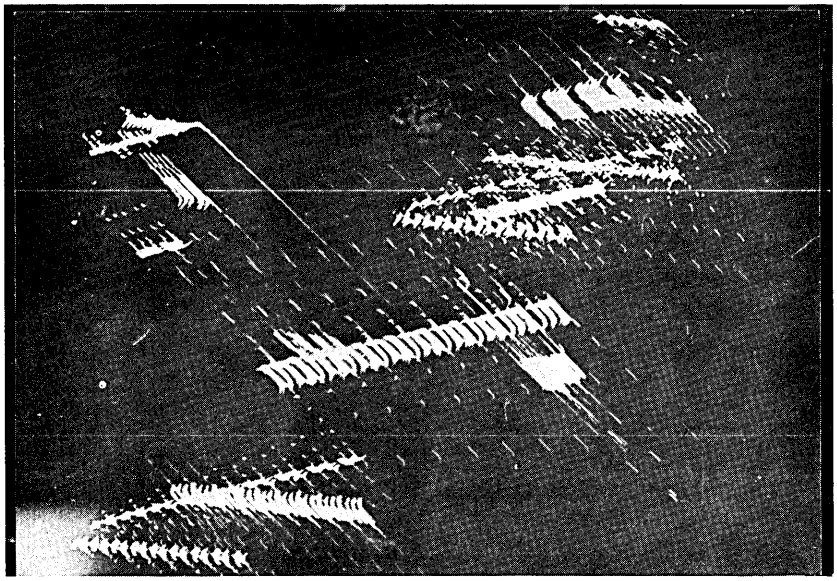
SOURCE PATTERN — AND THREE TRANSFORMATIONS
— Sozo Hashimoto

The source pattern at the left is a traditional Japanese arabesque pattern. The pattern is transformed by computer into various designs such as those shown below and on the adjacent page. An IBM 7040 computer programmed in FORTRAN was used.





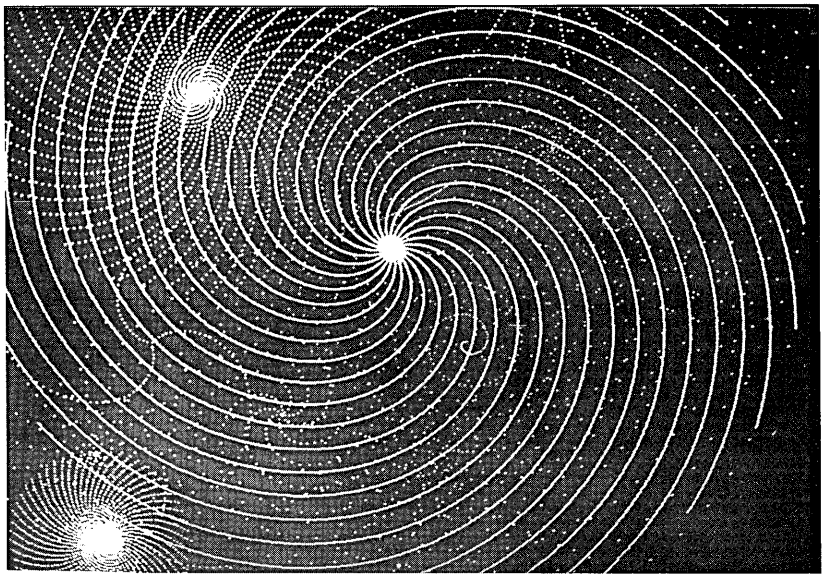




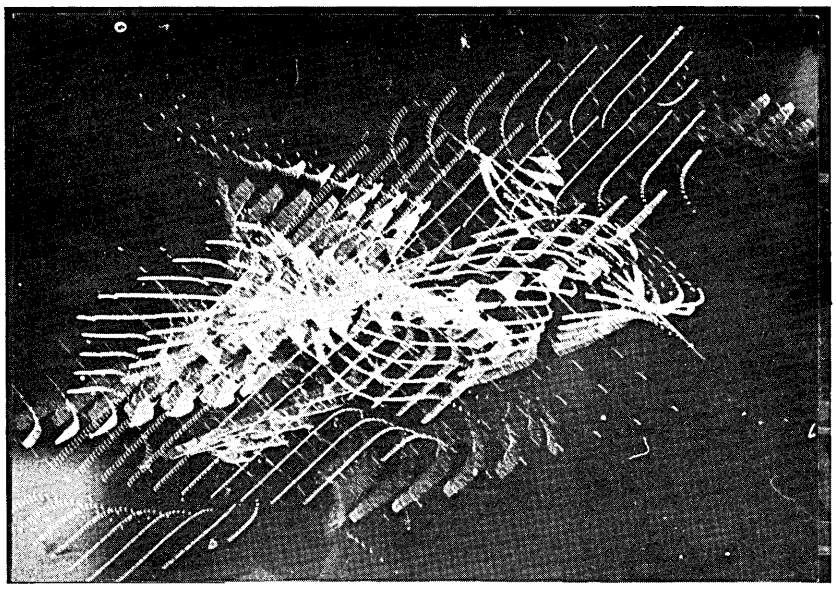
FOSSIL II

— Goran Sundqvist

The three drawings on this page are taken from a Tektronix 611 display terminal connected to a SAAB D22 computer. The pictures are made from a simple program to produce a circle, with different and varying parameters for radius, center coordinates, and angles.



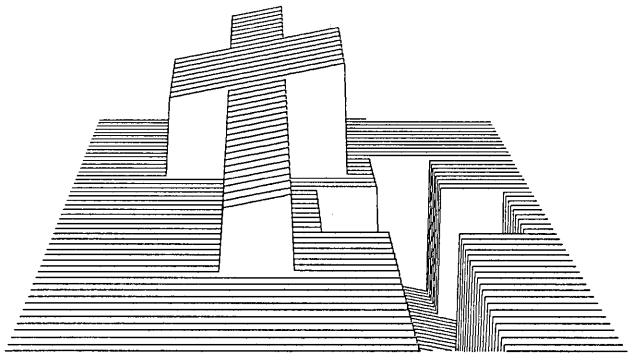
SPIRALS



FIREBIRD

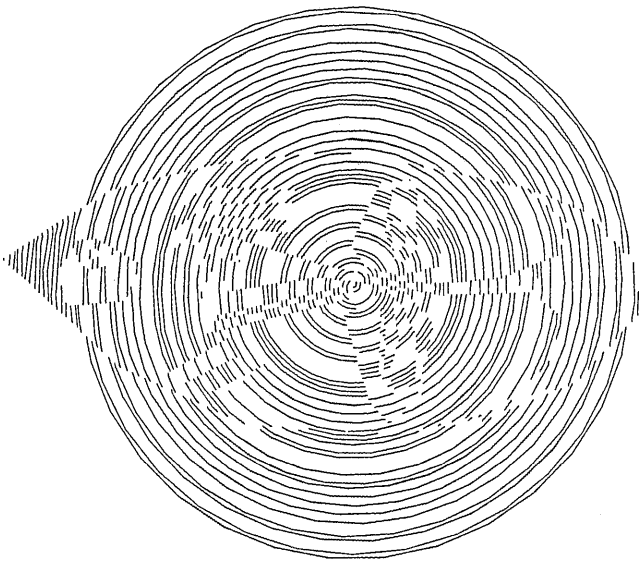
CROSSES
— Leonard Kilian

A cross was described as a planar function of two variables. A second cross was described as the negative of the first function. These were plotted using a perspective from the front and above. This drawing and the two below were programmed in FORTRAN and run on a Univac 1107 computer using a CalComp plotter.



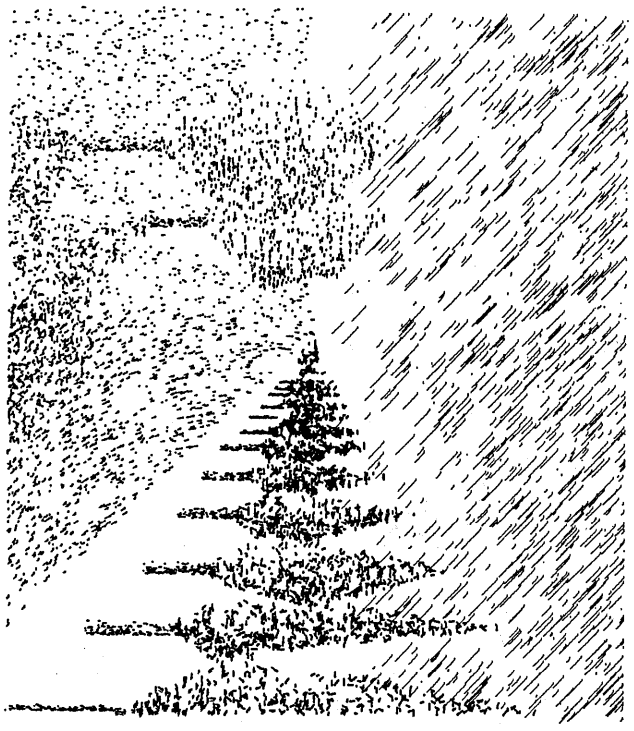
MASK
— Leonard Kilian

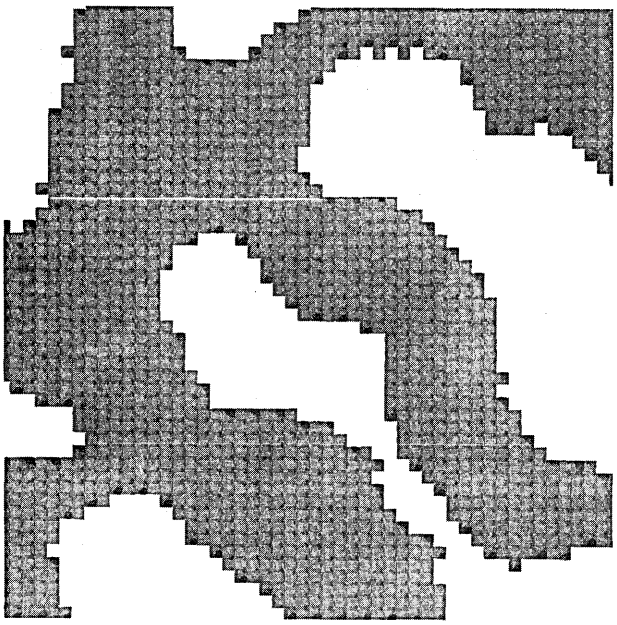
A linear outline based on a picture representing an African mask was input. A spiral was drawn so that whenever it intersected any of the input lines, the pen position reversed. A second spiral interlocking with the first one was drawn in the same way so that the picture could be drawn in two colors.

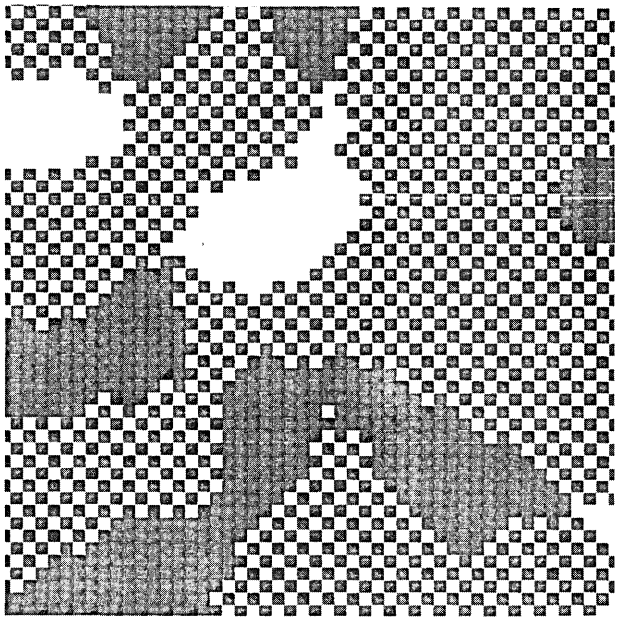


LANDSCAPE
— Robert Venn and Leonard Kilian

The outline of a landscape was sketched, breaking it down into various areas (trees, grass, road, etc). In each area points were chosen at random at a specified density, lengths were random within limits, and angles were either controlled or random.

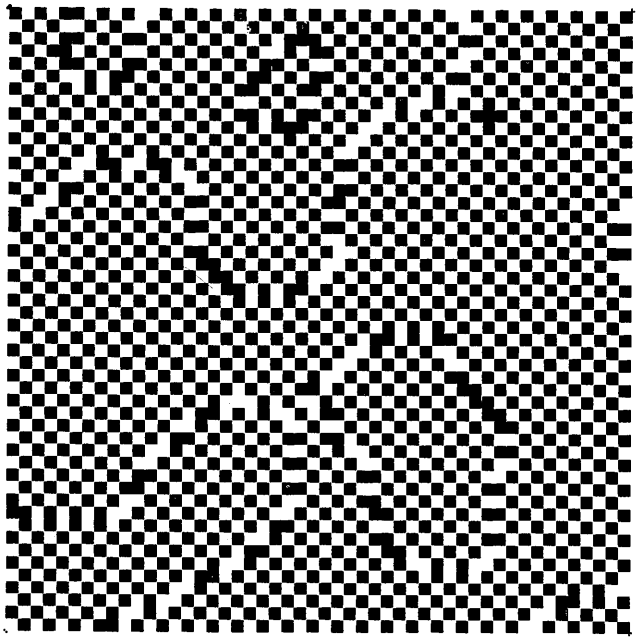


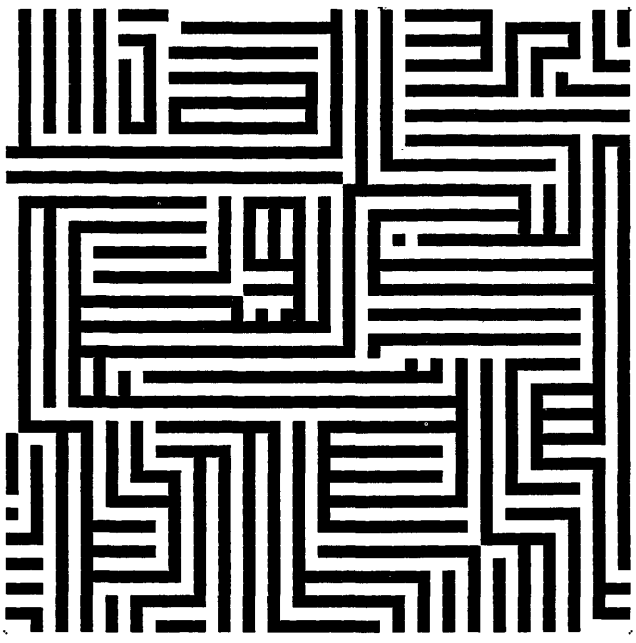


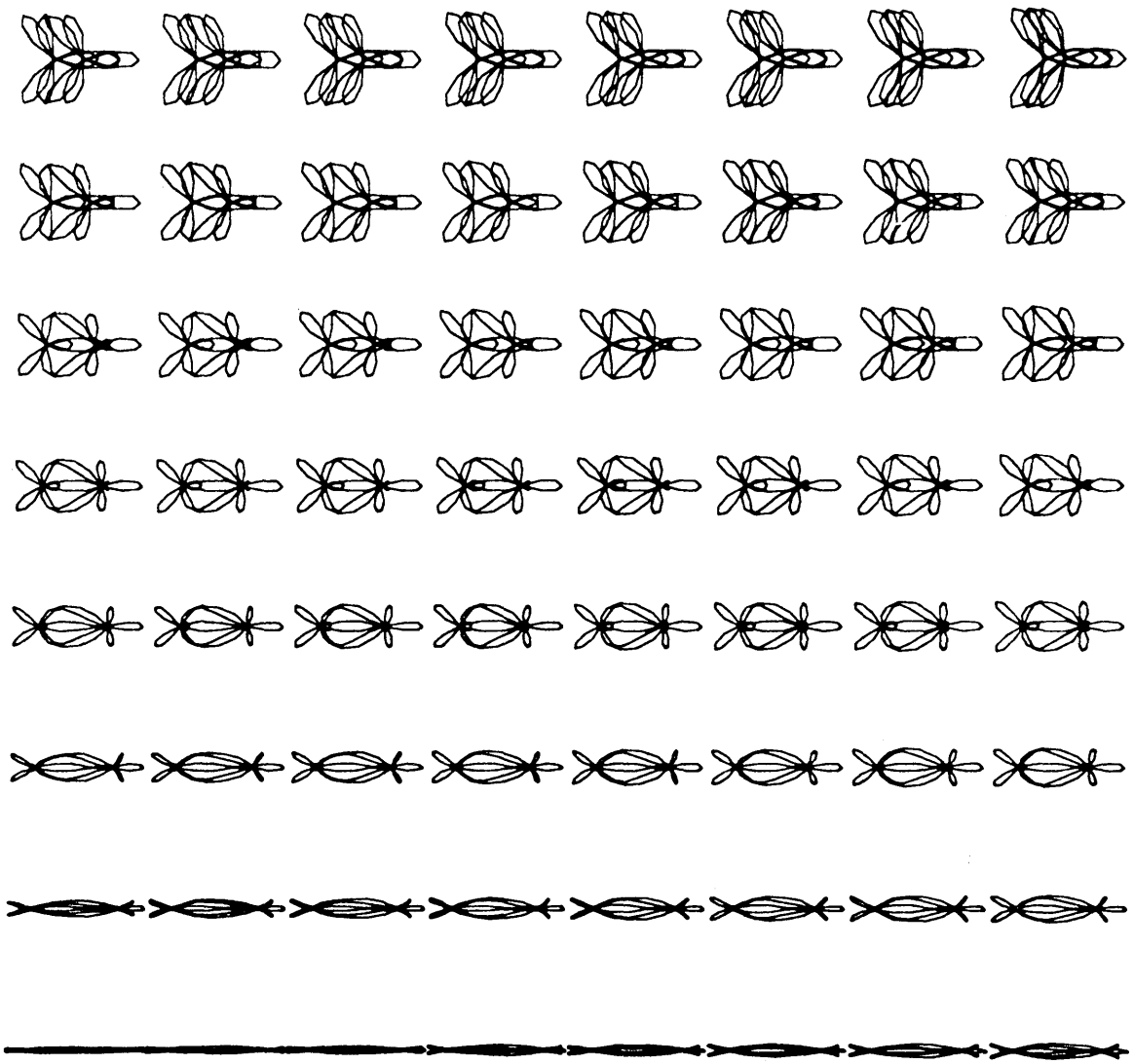


CRYSTALLIZATION
— Leo Geurts and Lambert Meertens

These four drawings were made from a program to design patterns that combine regularity and irregularity in a natural way. The process is not unlike that of crystallization, where a regular structure grows out of chaos. The program starts by generating a random pattern of black and white squares, and then step by step a specified regularity is imposed upon it. In the upper lefthand corner, for example, the desired regularity was that the color of a square must be the same as the color of its neighbor in any of the four principal directions. This regularity is achieved by determining the color of a square from those of its four neighbors. Color is determined in this way for all squares of the field, taken in a random order. After the first "sweep" over the field, additional sweeps are made, until one of the following conditions is met: (1) none of the squares has changed color; or (2) the number of color changes was greater than that in the previous sweep over the field. Different regularities were imposed on the other three drawings. The program was written in ALGOL 60 and run on an Electrologica X8 computer.

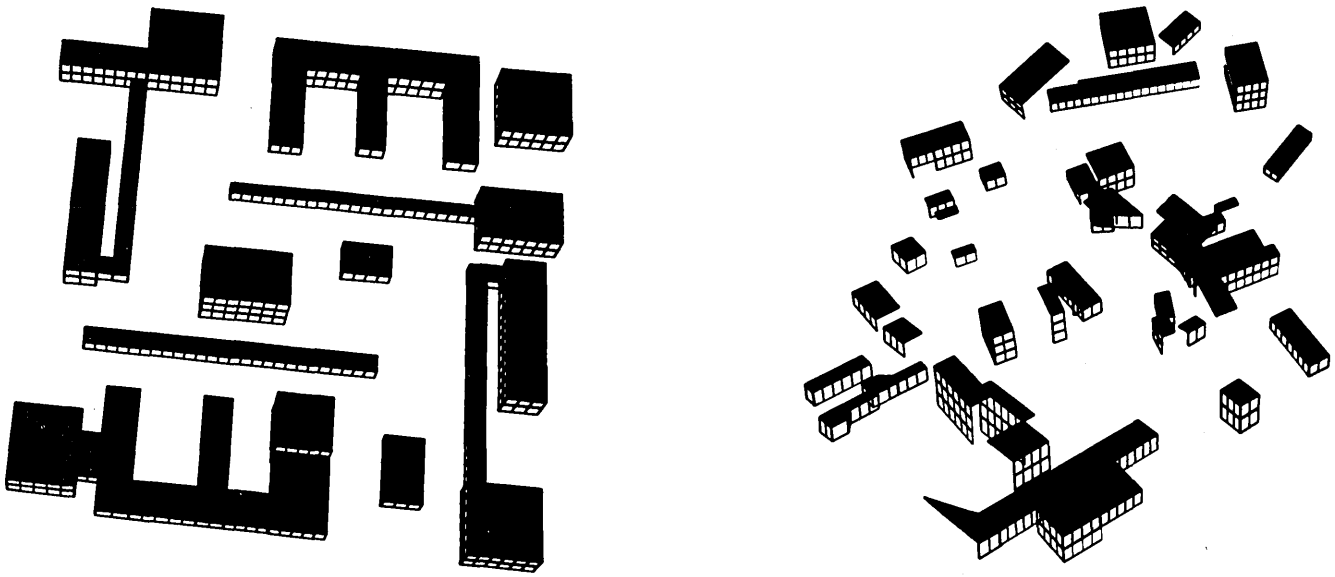






EVOLUTION
— Donald K. Robbins

Programmed for a Univac 1106 computer, and drawn on a Stromberg-DatagraphiX 4020 plotter.



ENTROPY
— Leigh Hendricks

The program for these drawings was run on an IBM 7090 computer and plotted on a Stromberg-DatagraphiX S-C 4020.

COMPUTER ARTISTS

The following is an alphabetical listing of all persons who submitted entries in the Eighth Annual Computer Art Contest of Computers and Automation. The names of persons whose drawings are published in this issue are marked with an asterisk (*). We are planning to publish in the future some of the drawings we were not able to include in this issue.

Caulkins, David, 11934 Currituck Dr., Los Angeles, CA 90049

Dayhoff, Ruth, National Biomedical Research Foundation, 11200 Lockwood Dr., Silver Spring, MD 20901

Dempsey, James G., Proctor & Gamble, 6090 Center Hill Rd., Cincinnati, OH 45224

Derby, Steve, 2411-B W. Orangewood, Phoenix, AZ 85021

DiLeonardo, D. J., Westinghouse Electric Corp., Bettis Atomic Power Lab., Box 79, West Mifflin, PA 15122

Elenbaas, J. A., Dow Chemical Co., Barstow Bldg., 2020 Dow Center, Midland, MI 48640

Eschbach, Darel, University of Toledo, Manager, Computation Center, Toledo, OH 43606

* Geurts, Leo J. M., Mathematisch Centrum, Tweede Boerhaavestraat 49, Amsterdam, Holland

* Hashimoto, Sozo, 28-2 2-chome Komazawa, Setagaya-Ku, Tokyo, Japan

* Hendricks, Mrs. Leigh, Sandia Corp., Sandia Base, P. O. Box 5800, Albuquerque, NM 87115

* Hertlein, Grace C., Computer Science Dept., Chico State College, Chico, CA 95926

* Kilian, Leonard, University of Notre Dame, Notre Dame, IN 46556

Klein, Charles, Box 6 RR 1, Sugar Grove, IL 60554

* Knowlton, Ken, Bell Telephone Labs, Murray Hill, NJ 07974

Lecci, Auro, via Pagnini 31, 50134 Firenze, Italy

Lerman, Harvey N., 921 Thistle Lane, Maitland, FL 32751

Lipscomb, James S., 26 Woodfall Rd., Belmont, MA 02178

Mattox, Charles, 820 Hermosa Dr. N. E., Albuquerque, NM 87110

* Meertens, Lambert, Mathematisch Centrum, Tweede Boerhaavestraat 49, Amsterdam, Holland

* Mohr, Manfred, 58 Bld. Latour-Maubourg, Paris 7, France

Pass, E. M., Georgia Institute of Technology, Rich Electronic Computer Center, 225 North Ave. N. W., Atlanta, GA 30332

Radford, T., 10 Forest Dr., Pinelands, Cape Town, South Africa

* Robbins, Donald K., Advanced Techniques Div., Sandia Corp., P. O. Box 5800, Albuquerque, NM 87115

Salecker, Anton G., Bureau of E. D. P., New York State Dept. of Transportation, 1220 Washington Ave., State Campus, Albany, NY 12226

Sandoval, Abad E., 3511 B Arizona, Los Alamos, NM 87544

* Schwartz, Miss Lillian, Bell Telephone Labs, Murray Hill, NJ 07974

Seeley, Richard W., 234 Ximeno Ave., Long Beach, CA 90803

Shah, Bharat K., Dept. 178, Cessna Aircraft Co., Wichita, KS 67201

Sperry, A. B., Hewlett Packard, Calculator Products Div., P. O. Box 301, Loveland, CO 80537

* Sumner, Lloyd, Computer Creations, P. O. Box 1842, Charlottesville, VA 22903

* Sundqvist, Goran, Kraftdata AB, Box 3118, 103 62 Stockholm 3, Sweden

* Venn, Robert, University of Notre Dame, Notre Dame, IN 46556

Walker, Dr. Evan Harris, 1507 Bay View Drive, Havre de Grace Heights, MD 21078

Webber, Stan, Armco Research, 3312 Glencoe Ave., Middletown, OH 45042

AN ARTIST VIEWS DISCOVERY THROUGH COMPUTER-AIDED GRAPHICS

Grace C. Hertlein
Chico State College
Chico, Calif. 95926

"The limits of the computer artistically are the limits of the artist's imagination, and the degree to which the artist accepts the computer as an aid to his creation."

Today we find ourselves in the midst of a technical revolution in art. The fusion of art and technology has grown dominant; there is a growing and more complex use of machines as creative tools. For me, the computer has become a symbol of man's creative, affirmative use of science and technology for constructive, creative purposes. But what prompts a traditional artist to enter the domain of technology in order to find new tools to express his creativity?

Understanding Contemporary Art

In order to understand the contemporary approach to art, the artist needs to know something about contemporary uses of materials and tools. I became aware of this need several years ago when, after having taught art and painted for several years, I began graduate study to prepare myself to work at a college level. In retrospect, I find that through love of the classics, I had developed a "mental set" regarding the past, in an attempt to define enduring thought and creation. I affirmed the past – but not the present. I waited until an author was a dead master to read him; I affirmed artists whose reputations were securely considered a part of the "sacred" art heritage. In so doing, I unconsciously ignored today; I made no attempts to understand what my contemporaries were doing and creating. I had had no first-hand experience of attempting to create art using a complex machine.

Grace Hertlein is an Assistant Professor at Chico State College. She is one of the few artists working in the field of computer graphics who was formerly engaged in fine art painting and sculpture. Mrs. Hertlein began national exhibition in major museums in this country in 1956. She began her work with the computer in 1968. Exhibitions of her computer art have included the 1969 Fall Joint Computer Conference, and the 1970 International Computer Art Conference at Brunel Univ. in London. She is preparing a two-volume series on computer-aided graphics, to be completed early next year. She received her M.A. from Chico State College in June of this year.

But slowly I began to look at the computer as an artistic tool, which might serve as a foundation for technological works in many areas. I could see a clean, precise, highly intellectual dimension in works with a technological emphasis. I began to perceive what our machine-age society was attempting to do, affirmatively and creatively, within today's vernacular.

Of course, to read of machines and art is one thing; to see illustrations of it is another – but direct experience of producing art with machines was the challenge I decided to accept. I encountered many difficulties, including the need to learn computer programming, and the need to think in more precise scientific, mathematical terms. I had to learn to accept the discipline and demands of the computer. I found it disconcerting to be "always wrong" and the machine "always right". I learned to be more exact, and soon took strong delight in attempting to keypunch a perfectly accurate, very long program.

My first work with the computer came through a seminar on "Computer-Aided Graphics". I had no grand ideas; my work was merely an experiment – an experiment through which I discovered that the machine was indeed an artist's tool.

Media Dictates Form

In art, the media and material often dictate the form. In sculpture, the type of stone demands a specific level of development and tool usage. The form of the stone often dictates final form and design. In the same way, the computer and the digital plotter dictate the form and expression of the work produced with them. These machines possess certain qualities – and limitations – which afford new dimensions for art. They offer a precision, a quality of draftsmanship, not to be found in hand creations. A new level of detail is possible, with complex, subtle repetitions in exquisite tracery. Variations can be attained through changes of scale and color which provide the best qualities of dry point, ink drawing.

Note: For examples of Mrs. Hertlein's work, see pp. 16 and 17.

First Experiments

My first experiments consisted of a simple component design repeated in variation in scale and color. Theoretically, I knew that the plotter was suited to the linear style that I had developed through working for prolonged periods of time with egg tempera as a painting vehicle. Egg tempera requires the artist to use fine lines, one applied directly over the other, or slightly offset, until a fine pattern is achieved and a texture is built up. Thus my natural inclination to linear patterns was ideally suited to the computer.

I continued my experimentation for six months, but the results of my work was stiff, limited, and unsatisfactory. Theoretically, I felt that a component design, repeated in variation, could be the building block for endless creation. Yet if the simple component was not satisfying, what would a more complex component reveal?

But as more computer time – and more ideas – came to me, I persisted. Using the IBM Drafting System, I programmed a city facade of four buildings, keypunched the large deck of cards, proofread them, and ran the program. The results of this effort were much more satisfying, yet the program was planned inefficiently. I reprogrammed it and reduced the machine time by 50%. Through this drawing, which I called "The City", I felt I had projected the symbolic representation of the complexity within technology which I had hoped to achieve.

Running the component programs brought forth further experimentation. "The City" could be subdivided into four sub-components. Each component could be run independently, or in varying combinations with other sub-components. Color overlays on mylar could be used. The drawing could be repeated in variant scale on mylar with several changes in pen and ink color. Borrowing from my pre-computer painting and graphics experiences, I experimented with transparent, opaque inks. Methods were devised to attach fine art papers to the drum-mounted perforator papers, and accurate registration was attained. Radiograph and KOH-I-NOOR pens of different sizes afforded other dimensions. Brushes were found to fit the flow-pen assembly.

"What if . . .?"

The dominant question, "What if . . . ?", brought forth continuously new ideas. "The City" could be run in seemingly endless variation and scale, with mirroring images, etc. constantly revealing new ideas for further experimentation. Module, miniature (scale/.25) variants proved satisfactory. This suggested serialization of components, with variations in color and ink. A technique resembling block printing resulted. This was attained by loading the deck with fifteen or more identical components, and manually placing the components where desired. When satisfactory results were achieved, the entire program could be converted to the pre-planned mode to achieve exact duplication. Presently, pre-planned module repetitions in color are being laminated within transparent acrylics in dimensional form. Mylar is printed on both sides with special inks in patterns using from three to five colors.

Perhaps the most satisfying method of creating art with the machines which I found was that of free painting. This began with the use of the elements of "The City" component. A more radical version of block printing (loaded deck programming) was used. The computer started and stopped more frequently, with only portions of the component design placed manually. The remainder of the component was placed on the paper in a manner resembling free painting. Thus the pen had now become a free drawing/painting tool. The results of this method are individual works that cannot be duplicated exactly, whereas the pre-planned and loaded-deck modes are repeatable. But I found that by using my first component design on water-color paper with changes in pen width and transparent and opaque inks, I could finally produce technical results which strongly resembled my prior paintings – and which were very satisfying to me.

The use of different kinds of art papers with different pens and inks produced highly individualistic effects. Experiments were made on papers ranging from rice paper to parchment, all with unique – and satisfactory – results.

The "Joyous" Machine

I "played" with the machine from that time on – eleven months after my first experiments. I relied heavily on my previous experiences in printing, painting, and the teaching of art. Techniques and ideas from all of these areas were successfully applied, and I finally achieved a sense of freedom. The machine became my subordinate, and I was free to esthetically play. I even experienced a sense of joy, and was reminded of Tinguely's ideas of a "joyous machine", which previously had seemed far too exaggerated to me:

> For me, the machine is above all an instrument that permits me to be poetic. If you respect the machine, if you enter into a game with the machine, then perhaps you can make a truly joyous machine – by joyous I mean free. That's a marvelous thing, don't you think?[1]

After a year and a half's experimentation, I now feel that computer-aided graphics is a valid art form. I know from first-hand experience that a personal style can be achieved by an artist who uses this technical tool as an aid in creation. I believe that in the very near future, computer-aided graphics will occupy an accepted position in the graphics field, much as the recent acceptance of the collograph has made it a common media in graphics. In addition, theoretically at this point, computer paintings should become more complex technically and esthetically.

The limits of the computer artistically are the limits of the artist's imagination, and the degree to which the artist accepts the computer as an aid in creation. If an artist can absorb technology, learn to think in new ways and become liberated within such technical usage, he can transcend the conditions of using a complex machine and express his vision poetically, in a personal way. Thus ultimate freedom for the artist within technology can be achieved through acceptance, discipline, excellence in technology, and artistry. □

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1. "Cybernetic Art: The Computer as Renaissance Man", *SDC Magazine*, Vol. 12, No. 4, April, 1969.

INTERACTIVE COMPUTER GRAPHICS IN ARCHITECTURE

Sheldon Lee Anonsen
Ellerbe Architects
333 Sibley St.
St. Paul, Minn. 55101

"Can the architect effectively exchange his drawing board for a CRT and his pencil for a light pen?"

A few Architectural/Engineering (A/E) firms have been using the computer to a limited extent in the design of buildings for as long as a dozen years. Many other A/E firms have acquired computing capability, either with their own in-house computer or through time sharing, over the past several years. However, with relatively few exceptions, the computer design applications have been only in the several fields of engineering commonly involved in the design process – structural, civil, mechanical and electrical – and, of these, applications in structural and civil engineering have dominated.

Some architecturally oriented computer applications are available but these are fairly few in number. Examples are routines for calculating such things as sight-lines in the design of stadia or auditoriums, elevator requirements for the design of office buildings, and fire exit code restrictions for the size and relative locations of stairways. Architects have not to any appreciable degree utilized the computer directly in the design process, such as in the arrangement of spaces and in the form development of a building. Nor, for that matter, have they even prepared programs that might assist them in design, with the exception of some elementary development work going on in several academic institutions and in a handful of architectural offices.

The Job of the Architect

It is necessary to understand the nature of the practice of architecture in order to appreciate the apparent reluctance or hesitation on the part of architects to employ the computer in the design process. By greatly simplifying the many functions performed by an architect in practicing his profession, we can state that architecture's prime role is to design buildings which are functional and aesthetically pleasing within defined cost limits.

These cost limits are related to construction costs which are, of course, numerical. As a result, the computer can fairly easily assist in determining anticipated construction costs by functioning essentially as a high speed calculator, multiplying material and unit labor costs times the quantity of materials involved. Architects are beginning to use the

Sheldon Anonsen has an extensive background in the planning and design of commercial, medical, and educational facilities. As Manager of the Systems and Development Div. of Ellerbe Architects, he develops and coordinates methods for investigative procedures and for the analysis and interpretation of data as it applies to the design of facilities. He is also a lecturer at the Univ. of Minn. School of Architecture.

Mr. Anonsen received a Bachelor of Architecture degree, and a Master of Science degree in physics and mathematics from the Institute of Technology at the Univ. of Minn. He is a registered Architect, holds a certificate from the National Council of Architectural Registration Boards, and is a Corporate Member of the American Institute of Architects. He is also a member of the American Management Association and the Association for Computing Machinery.

computer as an aid in cost estimating, and several independent service companies have been organized to provide computer-aided cost estimating to architectural firms as well as to building contractors.

Determining Aesthetic Qualities

It is in the functional and aesthetic design of buildings where most architects have been hesitant to think in terms of computers. In fact, a few have been actually fearful of the employment of computers in architectural design! This has resulted from a fear that the computer will perhaps dictate the aesthetics in a design, and therefore will essentially remove this important function from the domain of the architect. This reasoning is, of course, unjustified and has resulted from a lack of understanding on the part of these architects. The computer cannot consider aesthetics – at least until such time that the quality of an aesthetic has been defined in quantitative terms. Balance, symmetry, form, scale and other qualitative attributes of architectural design have frequently been taught, discussed and defined, but they have not been quantified into a general aesthetic. And, as they most probably will not be quantified, the architect need not fear that the computer will perform his function of aesthetic design.

"What architects are now beginning to realize is that the computer can perhaps actually enhance their own capabilities to determine aesthetic qualities. . . ."

Rather, what architects are now beginning to realize is that the computer can perhaps actually enhance their own capabilities to determine aesthetic qualities by assisting them in or relieving them from many of the other design tasks which consume a great deal of their talent and time. These other tasks primarily involve the functional aspects of a building design, and it is here that the computer will be able to play a most important role in the architectural design process.

The Architectural Program

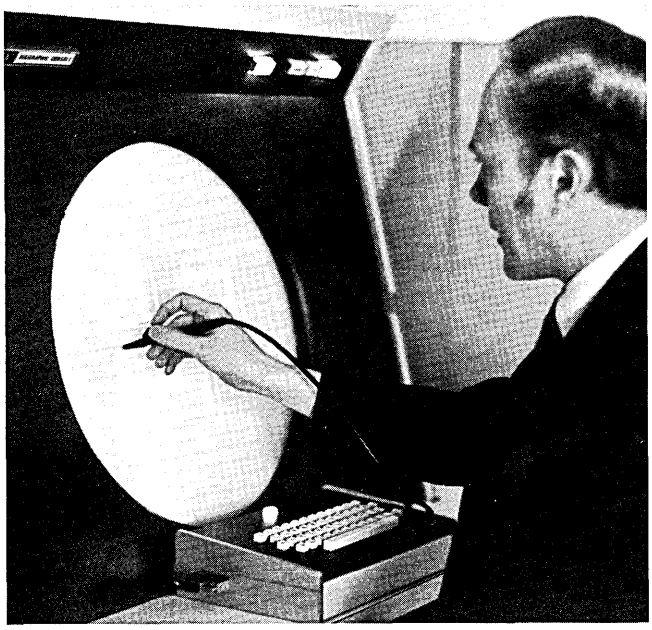
Prior to starting the design of a building, the architect usually prepares an *architectural program.* This architectural program defines, frequently in narrative format, the detailed space requirements, the relative relationship of each space to the others, material distribution requirements, the impact of existing site conditions, and many other considerations that will or may have a direct bearing on the proper functioning of this building for its intended use. The architect then uses this architectural program, along with other pertinent documents such as building codes and zoning ordinances, as his guide in the actual design of the building.

Many of these functional attributes are not directly susceptible to numerical calculations and therefore are not readily applicable to computer operations. However, if these functional attributes could be properly coded according to some systematic procedure, then the detailed information contained in the architectural program could conceivably be stored in the computer's data base. There it could be used either to assist the architect in the design process, or to test and evaluate his design solutions against the architectural program criteria. This should be accomplished more quickly and accurately than by his traditional manual methods.

"The computer cannot consider aesthetics – at least until such time that the quality of an aesthetic has been defined in quantitative terms."

Coding Functional Attributes

This then, was the approach taken by Ellerbe Architects. About two years ago, we began experimenting with various techniques of coding the functional attributes of the architectural program. In reality, we attempted to translate the architectural program data into a code language which could be easily interpreted by an individual *and* which could be properly manipulated by a computer. The coded language developed was used on a manual basis in the design of several medical institutions and educational facilities. It met with sufficient success to assure us that this aspect of our approach was correct.



Our approach was to place these coded functional attributes in the computer's data base and then let them guide or monitor our aesthetic design development in an interactive mode using a Cathode Ray Tube (CRT). We still, however, had to test the validity of this direct man-machine interaction in the architectural design process. Could the architect function in real time, designing a building on the face of a CRT while being assisted and guided by the computer's data base containing the coded architectural program? Could the architect effectively exchange his drawing board for a CRT and his pencil for a light pen? We felt the architect must be able to easily interact with the computer in a manner such that he can maintain aesthetic freedom while being guided by the computer in handling functional attributes and in maintaining control of building costs.

Hardware

To answer these questions, Ellerbe Architects commenced an experimental project to determine the applicability of current computer hardware to the architectural design process. Arrangements were made in September of 1969 to buy computer time and professional services from the Hybrid Computer Laboratory at the University of Minnesota. The equipment available for our use consisted of a CDC 274 Digigraphics CRT connected to a CDC 1700 digital computer with disk and tape drives, card reader and teletype console. We didn't use any of the analog computer capabilities of this hybrid computer laboratory. For hard-copy output, two CalComp 12 inch drum plotters were also available.

This research effort was labeled Operation GREAT (*G*raphics *R*esearch with *E*llerbe *A*rchitects *T*echnology) and it was oriented towards developing the software required for very elementary interactive manipulations of simple architectural space components used during the initial design stage. There were three specific objectives for Operation GREAT:

1. To determine whether, with appropriate software, current computer hardware could be effectively utilized in the design process of architectural practice;
2. To determine if this interactive approach could be simply and easily applied by architects with no prior experience or understanding of computers; and
3. To determine if this computer-assisted design approach could be employed without increasing the architect's total design costs for a project.

Software

The software developed at the Hybrid Computer Lab for this CDC 274 Digigraphics system provided us with a number of routines for developing and manipulating various architectural shapes. These were limited to plan drawings – that is, two-dimensional space representations. There were two reasons for imposing this two-dimensional limitation. The first was that most functional characteristics of a building have traditionally been developed and presented as plan drawings, and our emphasis in this research project was to determine whether development of functional attributes could be enhanced with computer assistance. The second reason was that three-dimensional perspective drawing routines already exist, complete with "hidden line" capability, for presentation on the CRT or by computer plotter. We were familiar with these routines and were aware of their potential for the architectural design process and, therefore, felt that nothing of significance would be gained for our current purpose by incorporating a three-dimensional capability at this time.

"The software routines provided for nearly all interaction with the computer through the light pen."

The routines developed provided for nearly all interaction with the computer through the light pen. Exceptions were scale factors, which determined the drawing size, and space labels, such as room numbers, which were inserted using the alphameric keyboard. The light pen control was used to move the tracking cross and to activate light buttons presented on the face of the CRT.

One line drawings of architectural spaces were produced by moving the tracking cross on the screen. Two modes were available – perpendicular and oblique – and the option was made by the designer activating his selected light button. These light buttons were the actual words, "PERPENDICULAR" and "OBLIQUE" presented on the CRT screen. To determine his drawing mode, the designer would simply position the light pen over one of these words and depress the switch on the end of the light pen with his finger. If he selected the perpendicular mode, all lines drawn would be either true horizontal or true vertical, irrespective of the accuracy of the designers hand movements. The oblique option connected straight lines between points established by movement of the tracking cross whether vertical, horizontal or diagonal.

To start the process for drawing spaces (which we called "macros") on the CRT, the designer would first make a light pen selection of the word "BUILD" from a list of light button words presented as a menu on the right hand side of the CRT screen. This menu would then disappear from the screen and the two words PERPENDICULAR and OBLIQUE would appear. Upon making a light pen selection of the desired mode, these words would disappear from the screen and the tracking cross would appear at the center of the screen. This tracking cross would then be moved about on the face of the screen with the light pen and these movements would determine the shape of the macro. If the macro represented the plan view of a room, for example, the computer would calculate the area of this room immediately upon completion of drawing it and would present this area on the left hand side of the CRT screen.

Manipulating Drawing Spaces (Macros)

The other light buttons in the menu at the right of the screen were used to manipulate these macros or to perform other special functions concerning these macros. For example, the light button "COPY" would produce an exact duplicate of a specified macro. If the designer were planning a motel or the patient room layout of a hospital – each of which contain a number of repetitive rooms – he would design one in detail and then produce all the others simply by touching the word "COPY" with the light pen.

If a given space, or macro, were to be deleted from the

computer storage, the designer would touch the menu word "DELETE" with the light pen and the selected space would disappear from the screen and from computer storage. If the designer only wished to remove a macro from the screen for a time, still preserving this macro in computer storage, he would touch the light button "REMOVE". This macro could be recalled to the screen at any later time then, by touching the light button "DISPLAY" and typing in the label, or room number, of this macro on the alphameric keyboard. It would then reappear exactly as it had been before its removal.

The "ROTATE" light button permitted rotation of macros on the screen according to light pen commands with the tracking cross. "ZOOM", on the menu, permitted enlarging a macro so that more intricate work could be done with it, such as inserting furniture or other small items in the space, and then zooming the macro down again to a smaller size after placement of these items.

The light button "COMBINE" was used when two or more macros were to be combined into a "super-macro". In this manner, individual spaces could be developed and then inserted into the total plan configuration. When working with a super-macro, which might represent the total building plan, for example, all the light button commands would act on this total plan exactly as they did on the individual macros. In this manner we could produce one floor of a multi-story building and, using the light button, "COPY", produce a second identical plan. These could, for example, represent two different floors of a high rise motel. We could then make whatever modifications are necessary, if this second floor is not exactly like the first, but we would not have to draw this floor in its entirety – only the changes.

Hard Copy Output

If the designer wished a hard copy output of a drawing on the CRT screen at any time, he would simply touch the light button "CALCOMP" with the light pen and the information on the screen would be immediately transferred onto magnetic tape. This magnetic tape would then be used to drive the computer plotter and the plotter would draw on paper the plans the designer had developed on the CRT screen.

Doors and windows could be easily inserted in the building plan by using the light button "D AND W" and the alphameric keyboard to insert dimensions. The tracking cross would be used to indicate the location and, in the case of doors, the direction of the swing of the door.

This, then was our basic software approach in order to determine whether existing computer hardware might be applicable to interactive architectural design. From this elementary approach, we were able to project the potential for much more complex architectural processes and our assessment of its potential capabilities was very definitely affirmative. Our first objective of Operation GREAT was, therefore, accomplished. We were convinced that, with appropriate software, current computer hardware could be effectively utilized in architectural design.

Eight "Guinea Pigs"

To determine our second objective – whether the practicing architects would accept this approach – eight Ellerbe staff members were enlisted into the project! They included our three top designers and five key Project Architects. Only one had had any practical exposure to computers and none had any familiarity with interactive graphics. These eight experienced, professional architects served as the "guinea pigs" in the Operation GREAT experiment.

They came to the Hybrid Computer Laboratory once each month during the course of the project and had about 20 minutes of "hands-on" experience apiece at these sessions. All eight quickly grasped the potential use of this equipment and, with only a few minutes of instruction, were designing and positioning various shapes on the CRT screen with the light pen. Their enthusiastic acceptance and demonstrated ability to interact easily with the computer assured us that no stumbling block would result from the actual participation in this computer-assisted design approach by the architects themselves.

Determining Costs

The project continued through January of this year. From our involvement and observations over this four-month period we were able to project total costs for using this interactive design method. These costs included not only the architects' time, but the computer hardware expenses and the software development and support necessary to the system. Using even very conservative estimates, we found that the time saved by the architects in the design process would more than offset the costs generated by computer equipment and software expenses. Thus the third objective of Operation GREAT was determined. This computer-assisted design approach could be employed without increasing the architect's total design costs for a project. Rather, this approach would, in all probability, actually reduce the total design costs while, at the same time, increase the functional quality of the design and yet not reduce or restrict aesthetic design capabilities. We were very pleased with the results of this research project!

"Using even very conservative estimates, we found that the time saved by the architects in the design process would more than offset the costs generated by computer equipment and software expenses."

Implementation

Following the success of this first phase of Operation GREAT, the Ellerbe Board of Directors gave the green light to proceed with the second phase of this project, the implementation phase. Therefore, it is expected that by the end of 1970 we will be doing the initial design of actual projects on computer graphics equipment to be installed in our St. Paul office. The development of software will continue, perhaps indefinitely, and, as each new application package is completed, the architect will be able to extend his interactive design efforts on the computer until, perhaps in a few years, the entire building design, from initial schematics to completed working drawings and specifications will be performed on the face of the CRT.

It perhaps won't be long before the expression "well, back to the old drawing board" will become a part of history! □

COMPUTERS AND SOCIAL CHANGE: USES – AND MISUSES

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"If we are to successfully apply computer science and technology to the problems of change in society, it is necessary to be more than mere technicians. We must understand the subtle and complex nature of social processes."

It sometimes seems as if our society is willing to do almost anything about its problems – except take the definitive action necessary to solve them. Consider the crime issue, for example. In our uproar over the crime rate, we are doing everything from conducting research to new anticrime technologies – to enacting repressive new laws which will weaken and eventually destroy the Constitution. Consideration has even been given to the frantic and totalitarian idea of imposing psychological tests on all 6-year-olds in order to predict future criminal behavior.[1] But all of this is totally unnecessary. We know what the primary "causes" of crime are, and have known for some time. The relationship between poverty and crime has been shown through years of solid research. To reduce crime, reduce poverty. But it is precisely this that we have been unwilling to do.

Technological Panaceas vs. Structural Change

What is the point? Just that in times of crisis many people look for technological panaceas rather than make the structural changes that are really necessary. (I am using technology here in a broad sense – thus, psychological testing is a technology as well as engineering.) It seems that people would rather have a problem solved in an incomprehensible manner by a specialist than to have to adjust their *own* belief systems to do something concrete and rational about it.

Computers are vulnerable to this kind of misuse, as are all technologies. Properly used, they have a very great part to play in social change and improvement. But there is a significant danger that they will be misused – as the social sciences have been – as placebos, as expensive toys, to give the appearance of change while actually everything remains the same. There are an incredible number of studies and analyses conducted in our society, but there are relatively few sustained and directed programs for implementing change. Read through the hundreds of research articles published yearly in educational journals, then go into almost any high school and watch the kids being taught by the same inadequate methods that were imposed on you and your father and grandfather. Dr. Martin Luther King once pointed out that all too often, in attempts at social change, "the recording of the law in itself is treated as the reality of the reform."[2] What we are dealing with here is an even worse phenomenon, in which the mere *study* of a social problem substitutes for attempts to do anything about it. We have had the Kerner Report, the Walker Report, the Eisenhower Report – none of which led to any action. We must insure that, as computers come to play a prominent part in the study of social problems, they are used for the actual *implementation of change,* not as one more distracting influence.

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The Problem of the Narrow Criteria

Related to the danger of the distracting influence is the *problem of the narrow criterion.* Selecting some small area and optimizing it within the given social framework will not necessarily lead to improvement. A university selecting students for admission, for example, is only rarely concerned with what happens to the students who are *not* admitted. Thus, it develops elaborate statistical techniques to optimize the predictability of student success or failure. What actually happens when the efficiency of this prediction is increased? It makes the university look better, of course. But in a broader context, it could as easily lead to overall social *harm* as to overall improvement. (What happens to the students who are not admitted?) In a complex system, purely local optimization can lead to global inefficiency.

These considerations of criteria – which are at base ethical considerations – apply of course to any technology. But they are especially significant in the case of computers, for two reasons:

First, computers are so powerful that merely fitting them into existing frameworks, without changing the framework, is wasteful of their potential. As many have discovered, trying to computerize pre-computer systems and procedures without change can be drastically inefficient. One current example of this problem occurs in the area of computer-assisted instruction (CAI), where advanced computer and display systems are being used to teach the same old trite concepts in the same old trite ways. The slogan "Columbus discovered America in 1492" is no more intellectually insightful – and no less ethnocentric – when displayed on a CRT than when written on a blackboard. Far better to develop new teaching methods based on the unique capabilities of the computer, than to attempt to fit the old ones on a Procrustean bed.

"The slogan, 'Columbus discovered America in 1492', is no more intellectually insightful – and no less ethnocentric – when displayed on a CRT than when written on a blackboard."

Second, the nature of computer-based systems tends to lead to a requirement for very explicit criteria. As Norbert Wiener liked to point out, when you tell a computer to do something you'd best be sure that that's what you *really* want done.[3] This very explicitness can mean that where criteria are set narrowly and are not kept in mind and questioned continuously, the system will be worthless, or worse. Merely letting the criteria be determined by the current thinking of the authorities is certainly not sufficient – just a century ago leading authorities in all fields justified slavery.[4] Furthermore, many of the people who make policy decisions are accustomed to non-computer systems in which a certain amount of "slippage" in criterion occurs according to the judgment of those involved, and so these people tend not to realize the full importance of the criterion. Computer people cannot abdicate responsibility in this area.

I have discussed above two of the possible misuses of computers in their application to social change – the problem of the distracting influence, and the problem of the narrow criterion. I would now like to discuss some of the ways in which computer science and technology can be consciously applied to social change, with hopefully beneficial and effective results.

Bringing Criteria Out in the Open

In most discourse, including political discourse, questions of fact and questions of ethical principle are usually inextricably tangled up. The explicitness and power of Operational Research analysis methods tends to bring criteria out into the open (provided that the people involved are sufficiently insightful). Consider, for example, a purely hypothetical highway design study. Simulation is used to investigate the effects of various speed limits on both mean trip time for commuters and the accident death rate, yeilding the following two relationships:

We evidently cannot optimize these two factors at once; they must be combined into a single objective function, probably a weighted sum. Who decides on the weights? Analysts? Politicians? A referendum? Such questions of criteria are at base ethical. How many lives is a 10-minute faster trip worth? Implicitly or explicitly, the choice will be made – and the use of OR techniques forces it to be explicit.[5] (Lest this example seem too fanciful, I should point out that there have been cost-benefit studies of highway safety conducted, and "cost" has in some instances been regarded as the purely economic cost of accidents.)

Performance Monitoring for Institutions

There exists an enormous range of variation in quality of performance among the various public institutions of our society – schools, colleges, prisons, mental hospitals, etc. Yet it is difficult to compare these institutions with one another because of the wide fluctuations in the "input" to them. One high school may be dealing with children whose fathers make $18,000 a year and have Ph.D's; another may be dealing with slum children. One prison may have a much higher proportion of hardened recidivists in its input than another. Thus, direct comparison is difficult. Yet it is vitally important to monitor performance of these institutions, since they affect so many people and are so frequently unresponsive to their constituencies. The development of management information systems can make a substantial contribution. Using statistical methods such as regression analysis, it is possible to factor out the input variance and evaluate the institution on the basis of "value added" (or subtracted) to the people it deals with. As George Leonard, an editor of *LOOK* magazine, has pointed out, if schools were to be evaluated through a "value added" concept, Harvard might turn up looking worse than Podunk Community College, because Harvard pre-selects its input to the degree that it is questionable whether the quality of its output is due to value added, or merely to the pre-selection.

Modelling Social Interaction

Considerable work has been done in developing dynamic, computerized models of society at various levels. There exists considerable doubt as to whether really good prediction can ever be achieved by such models, due to a number of factors. However, the developing and appreciation of social models can greatly improve our understanding of the dynamics of society. Even participating in relatively simple

exercises like the *Northwestern University Inter-Nation Simulation* has been said to substantially increase student understanding of the dynamics of international relations. Exposure to a variety of social models – their internal structure as well as their behavior – might well be an excellent way to raise the level of social self-consciousness. Further, dealing with models probably encourages a tentative, exploratory approach to society – an ability to envision how things might be different than they are – which should be most conducive to future social change. Along these lines, it should be most instructive to follow the progress of the model of the society and politics of the entire world currently under design by Simulation Councils.[6]

"The developing and appreciation of social models can greatly improve our understanding of the dynamics of society."

Implicit Effects

The three possibilities cited above – and there are, of course, many more – are ways of managing the complexity inherent in social change by the conscious application of computers. However, as scholars from Sapir and Whorf to Marshall McLuhan have pointed out, the implicit and unintentional effects of any technology are likely to be at least as great as those effects which were consciously intended. To appreciate this, one need only consider the effect that Newtonian physics and Darwinian biology had on the entire social outlooks of their respective times. Any sufficiently powerful conceptual system is likely to have a significant effect on the way people look at the world. It is worth speculating on the effects that computer science and technology will have on the world-view of our society. Some possibilities are suggested below:

Will computer technology lead to a change in the concept and definition of which traits are the essential human ones? Workers in artificial intelligence have frequently pointed out that as soon as a computer program reproduces some activity which was previously thought of as a purely human activity (e.g., proving geometry theorems or playing chess), people tend to react, "yes, but that's not *really* what intelligence is". Perhaps whatever can be done by a machine is no longer considered an archtypal human quality. Then, just as John Henry lost his identity when his physical strength was matched by that of the steam drill, perhaps people whose forte is the kind of tedious rote work done better by computers will lose theirs. As computers play better and better chess, perhaps we will decide that playing chess is not what being human is all about, anyhow. Could the belief, considerably exaggerated in the popular mind, that computers are better than human beings at logical thought, have anything to do with the rejection of traditional logic by some of the young and the "Age of Aquarius"? That is, will the increasing intellectual capabilities of computers tend to lead to man being defined less in terms of his mind, and more in terms of his emotional capabilities?

"The implicit and unintentional effects of any technology are likely to be at least as great as those effects which were consciously intended."

Will computer science lead to changes in the nature of intellectual inquiry? For a long time now, the dominant mode of Western thought has been reductionist – the dividing of fields of knowledge and of systems to be studied into smaller and smaller entities. Despite all the blather about "the systems approach", the fact remains that it does represent a significant change – a reversal, almost – in the methodology of inquiry and technology.

Throughout our society, there is a new interest in "total systems". This is reflected in such diverse ways as the demand for "relevance" on campuses and in the new interest in ecology. (It appears to me likely that a primary reason why "ecology" is so much more popular than "conservation" ever was is the total-systems approach implicit in the concept of ecology.) Some aspects of computer science can provide – and in some cases already have provided – a sound intellectual base for the integrated study of total systems.

What happens if the rate of technological progress slows? For two decades, all our assumptions about American society have been based on an ever-increasing economic growth rate, powered by technological progress. "The affluent society", "the leisure society" are phrases accepted by almost everyone as indicating the direction we are heading. What if we aren't? As *Fortune* magazine pointed out recently, the present techniques of automation are inapplicable to many jobs and industries. Continued increases in productivity – which are, in the long run, contingent upon advances in computer science (especially artificial intelligence) – are being extrapolated into the future on the basis of the past. If this growth slows, the result might be severe social dislocation – especially so since unfulfilled expectations are a leading cause of disruption. What if the people who are now being conditioned to expect "the leisure society" don't get it?

"Will the increasing intellectual capabilities of computers tend to lead to man being defined less in terms of his mind, and more in terms of his emotional capabilities?"

If we are to successfully apply computer science and technology to the problems of change in society, it is necessary to be more than mere technicians. We must understand the subtle and complex nature of social processes. We must be sufficiently radical to realize that the current social frameworks and assumptions are not fixed and immutable. And finally, we must constantly interrelate, to a degree rarely achieved in technology, the work we are doing with its ultimate objectives. □

References

1. *The Washington Post*, April 5, 1970.
2. *Where Do We Go From Here: Chaos or Community?* Martin Luther King, Jr.
3. *The Human Use of Human Beings.* Norbert Wiener.
4. King, *Chaos or Community*.
5. It should be noted in fairness that some political scientists feel that the presence of too large an ethical factor in political struggles can lead to ideological infighting and eventual social chaos.
6. *Simulation*, April, 1970.

THE DILEMMA OF THE SYSTEMS ANALYST

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"The systems analyst has supervisors, not colleagues. He has neither exclusive nor final responsibility for his task, and his work can be expanded, tapered off, or terminated."

For two decades we have been observing the growth of the EDP industry (now the third largest industry in the nation). The executive has looked more and more to experts for aid in solving critical business problems. The systems analyst is one such expert. The demand for his services stems partly from the steady growth of the computer industry, and partly from the inadequate supply of systems analysts. But the demand for systems analysts is further complicated because there exists a high rate of turnover (which suggest poor organizational loyalty) which is a result of the professional orientation of this new breed of professional.

Tension Between Commitments

The theme of this article hinges on the notion that systems analysts, whose skills and expertise are their primary contribution, are likely to encounter tension between their organizational and professional commitments. The systems analyst wants to grow; and, because of his drive for continued professional growth, he tends to feel less interested in becoming company oriented. He makes lateral moves at no significant increase in salary, seeking new challenge. Loyalty to the employing organization and to its plans is a necessary condition for its survival and growth. Whether a company has satisfactory relations with the systems analyst depends on its point of view and philosophy. The analyst will have certain needs and motivations. How long he will stay on a company payroll will depend on how well the

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company recognizes these needs, and how long it continues to provide appropriate challenge.

To the systems analyst, the demand for his unique services and talent, and his identification with outside colleagues who give him motivation and strength are gratifying. These factors help to offset the traditional vulnerability of an employee doing a routine task. However, being a salaried professional, his autonomy is likely to be threatened by the bureaucracy (the employing organization) because it develops its own controls. He has supervisors, not colleagues. He has neither exclusive nor final responsibility for his task. His work can be expanded, tapered off, or terminated and his salary is generally lower than the salary of the supervisor he serves.

Thus tension is caused by the conflict between the values and standards of the professional, project-oriented analyst, on the one hand, and the apparently divergent values of the organization, on the other. The analyst seeks status through expertise, since he is oriented to look at his task as a professional task; and he is concerned with competent performance in a highly skilled area. Because of this orientation, he tends to work within the framework of his specialized field; and he proceeds systematically in working out various assigned problems. Management, on the other hand, operates within the framework of business and, of necessity, proceeds in a more opportunistic way to meet the changing demands of the market upon the business. When that way does not fulfill the needs of the systems analyst, he becomes dissatisfied and has an inclination to move. His outlook on his current job as temporary shelter and his willingness to go elsewhere in an attempt to grow professionally and seek new challenge indicate lack of organizational loyalty and low commitment to the employing organization's goals and needs.

Primary Observations

An organization cannot survive long without an appropriate degree of loyalty or commitment from its employees. Employee commitment takes two forms: (1) commitment to the organization as a whole, and (2) commitment to certain values related to the job. Although commitment to various tasks makes it difficult to expect a uniform set of needs across the systems analysis profession, systems analysts generally categorize the following needs as important:

Independence on the job
Fair and objective evaluation of work accomplished
Financial needs
Acknowledgment by the group supervisor of a job well done
Professional guidance on the job including advice on patterns succession in management

Some findings derived from a recent study by the author include the following:

1. Systems analysts with strong professional orientation expressed frustration and dissatisfaction on the job, attributing it to management's indifference to their needs and expectations.

2. One group of systems analysts was upset over management's bypassing a group member to fill the vacancy left by their former supervisor. Yet they accepted a new supervisor hired from outside. (The new supervisor's democratic style of leadership and relaxed form of supervision contributed directly to their attainment of flexible working hours and independence on the job. It allowed the systems analysts to pursue required tasks and to take the initiative in meeting deadlines, thus the change was in their interest.)

3. Systems analysts interpreted certain organizational adjustments as a defection from professional standards. This led them to be more critical of the organization's practices. They felt that the organization was not quite open in acknowledging and appreciating quality work, and that any organizational adjustment would not be a strong contributing factor to stability and efficiency. The majority of the members threatened to resign if they were asked to join a different group or to relocate under a different style of supervision. In expressing such feelings, they were frequently critical of the organization's policies and procedures on matters related to the manner of handling systems projects and relations with users.

"Tension is caused by the conflict between the values and standards of the professional, project-oriented systems analyst on the one hand, and the apparently divergent values of the organization on the other."

Measuring Professional Orientation

Professional orientation here refers to relations between systems analysts that cut across individual organizations (including the current employer).

An index for measuring the professional orientation of an analyst has been constructed. The index was based on the amount and degree of training of the analyst, types of outside systems analysis reference groups he was associated with, the number of professional journals he read regularly, the associations (related to systems analysis) in which he was actively involved, and the extent of his attendance at professional conferences.

With regard to training, it was assumed that a systems analyst who pursues advanced study in systems analysis (either through his employer, with a computer manufacturer, or at a local university) indicates his serious commitment to systems analysis and design. In the study,

Table 1
LOCATION OF REFERENCE GROUPS AND SOURCES OF PROFESSIONAL STIMULATION

Title	Outside colleagues contacted	Colleagues inside the organization	No. of journals read regularly	No. of prof. books read	Prof. conferences attended	No. & level of activity in a systems-related assn.	
						no.	level*
Jr. Sys. Anal.	6	3	3	5	2	2	LO
Sys. Analyst	7	3	3	4	1	1	MED
Sr. Sys. Anal.	6	4	4	7	2	1	MED-HI

*LO = member only, MED = member and involved in committee activity
HI = member, on a committee, and holds a key office in the association

the mean college education was found to be only 2.5 years. Emphasis was placed, however, on the extent of a group member's advanced education and training in systems analysis, and his exposure to the systems analysis subculture where he might acquire certain norms and values (independent of those acquired in his current organization).

A Sample Group

In a sample group, each member had had at least six months of basic training in systems analysis and systems design, and had already started advanced training. Those holding the title "systems analyst" had had regular advanced training through the organization's education department and/or a computer manufacturer's home study course.

Orientation to outside systems analyst reference groups was reported by the majority of systems analysts. They knew and interacted with colleagues from other companies, deriving professional stimulation and satisfaction from such association. They listed professional books, journals, and associations as other sources from which they obtained professional stimulation. Table 1 is a condensed tabulation of the response of a selected sample of systems analysts to a questionnaire administered in July 1969.

Research Method

Much of the data included in this paper have been derived from: direct observation of the activities and behavior of a selected group of systems analysts in an industrial setting; more than seventy hours of interviews; and the responses to a questionnaire.

In the technique of participant observation, the researcher generally "lives" with the members of a group every day for an extended period, observes and interprets their daily behavior and routines, finds out who talks to whom and why, accompanies group members to lunch and to various social functions, and otherwise gets to understand their makeup in a professional setting. Given an appropriate attitude of both the researchers and the group members, mutual trust eventually develops. This allows the true feelings of the members of the group to be expressed and more information to come out than would be possible through interviews and a questionnaire alone. In this way, information is gathered regarding the needs and expectations of group members, and their attitudes toward the job, their supervisor, and other people connected with the work they do.

Technical Orientation

Systems analysts appear to be professionally oriented. This attitude is manifested in an inadequate loyalty to their employing organization and in a readiness to move elsewhere. From the study it is evident how their decisions and strategies are based on a specialized, but universal body of knowledge, and how they apply various principles with adequate skill to the particular projects they undertake. The type and duration of their advanced training (as reported by both administrators and systems analysts) are rugged and intensive.

"Systems analysts exhibit specific professional expertness, but have limited knowledge in other areas involving the organization."

Systems analysts also exhibit specific professional expertness, but have limited knowledge in other areas involving the organization. When they talk with one another, their questions and answers are specific, technical, and within a range geared directly to solving highly technical problems. The reputation and status which each member maintains among his colleagues are the result of his achievement, and not of any ascribed status bestowed upon him by the organization.

Although they are traditionally considered salaried employees, systems analysts appear to enter the industrial organization with a professional self-image built by their achievement and resulting status among their peers and, in this respect, should be looked on as salaried professionals. With few exceptions, they show various signs of cosmopolitanism. They are not close to one another and do not know many systems analysts in other groups (Table 1). Most of them in the study expressed little excitement (and are known to have limited knowledge) regarding management succession within the organization. Most complained that their salaries were painfully low and raises slow.

In relating the systems analyst to the traditional cosmopolitan, few similarities can be suggested. Given his advanced systems education, experience, and age, the systems analyst is believed to be strongly oriented to his profession. In terms of his perception of the importance of his role in the organization, he identifies with it (especially outside reference groups) on a relatively active basis and is active in one or more systems associations (Table 1). He is willing to

move to another organization, allowing a relatively short time to properly establish himself with a given employer.

Minimizing Turnover

Because of the high rate of mobility in systems analysis, the employer competes for and attracts young aspirants into filling vacancies so that critical and other required tasks are performed on time. While the organization accomplishes its short-term objectives, it faces the danger of irritating the incumbent systems analysts, especially if the salaries of the newcomers are comparable to theirs. Thus, the long-term organizational objective of minimizing systems analysts turnover (through increase in their loyalty and avoiding costly documentation filing requirements) is likely to fail.

Most administrative officials blame this problem on the competitive market for systems analysts and on budget constraints. The systems analysts deny the accusation of lack of loyalty and blame the organization for neglect of their needs.

In other words, while the systems analyst tries to maintain the image of a professional taking advantage of opportunities elsewhere, he (at the same time) would expect the organization to provide the very things that would be given to loyal, long standing "locals". Thus, he faces a situation where he tries to satisfy himself on the job, but is not quite willing to identify with and become loyal to the employing organization.

While it is unlikely to happen, systems analysts express a desire for increased group autonomy which would be clear of direct administrative control. As professionals, they dislike being "bugged" by their supervisor. Furthermore, they have relatively limited participation and influence in the formal hierarchy of their systems planning division. When asked if they desire more influence, they express little need for more. Thus, it appears that the systems group members are *in* but not *of* the employing organization. Although they complain about what the organization has failed to provide, they show weak loyalty to the department by indicating that they do not plan on "growing" with it. Few offer suggestions to improve the work place, work flow, or the organization.

Voicing Dissatisfaction

During interviews, many systems analysts voiced frustrations and made remarks that indicated bitter feelings toward the organization and toward their supervisors, in particular. When asked of their opinion regarding the resignation of one of their members, remarks such as the following were strong:

"I'd do the same thing if I were in his shoes. You can't be stale in any organization."

"He is smart and his move promotes the image of systems analysts so they won't be taken for granted. You can't be company oriented."

"This kid is intelligent and the organization apparently is not rewarding him properly for what he really is. His capacity to contribute to varied projects can be applied more readily with his new employer."

During the observational study, in the midst of a project review, one member would often call another to his cubicle and point out an ad in the paper or a section in a professional journal soliciting systems analyst talent. They would spend a considerable amount of time assessing their position with the company and wondering when they themselves should begin looking for an opportunity elsewhere. Table 2 summarizes the percent of time devoted to task and nontask related activities.

"While the systems analyst changing his job tries to maintain the image of a professional taking advantage of opportunities elsewhere, he (at the same time) expects his employer to provide the very things that would be given to loyal, long standing "locals".

Further dissatisfaction was brought up during gossip sessions, when complaints were made regarding lack of acknowledgment from officials for a job well done. The hiring of a new supervisor from outside made them cognizant of their own precarious position with the organization. It was also reported that the former group supervisor gave the more challenging and rewarding projects to the "trusted good guys", leaving others to "fill in". Thus, while the organization's objective might be one of promoting intragroup interaction and group identity, the assignment of selected projects to certain group members accentuated the feeling of insecurity and mistrust of management in the mind of group members. This feeling contributed greatly to the dilemma of the systems analyst in terms of satisfying himself on the job and looking elsewhere to obtain more and better rewards.

Lack of Group Cohesion

Like other professionals, systems analysts identify with

Table 2
PERCENTAGE OF TIME DEVOTED TO TASK AND NONTASK RELATED ACTIVITIES

Title	*Av. time devoted individually to task*		*% of total time*	*Av. time spent in conf. with others regarding task*		*% of total time*	*Av. time spent on non-task related activities*		*% of total time*
	hr.	*min.*		*hr.*	*min.*		*hr.*	*min.*	
Jr. Sys. Anal.	3	30	50.0	1	10	16.8	2	20	33.2
Sys. Analyst	3	20	47.7	1	20	19.1	2	20	33.2
Sr. Sys. Anal.	4	15	60.5	1	35	22.7	1	10	16.8

members of their profession (inside the group to some degree, but more so with professional members in other organizations) from whom they gain professional stimulation (Table 2). When it came to task performance during the study, everyone seemed to be on his own, except at times when the project leader called for an informal meeting of his two or three colleagues to clear up the status of the work each member was assigned to do. These meetings lasted between ten and twenty-five minutes, once or twice a week. From them, lack of group cohesion could be deduced, due especially to the analysts' apparent focus on occupational specialization which contributed to a clearly divisive effect on the group.

"For an organization to enhance the loyalty of its analysts, it needs to reconsider its attitude toward them as subordinates."

With regard to reference group identification and interaction, one characteristic of professional orientation – control structure – is lacking among systems analysts. By contrast, in the case of doctors, long training gives them time to acquire and internalize a code of ethics, and their performance is indirectly monitored by external surveillance of their conduct by their peers. But in the case of systems analysts, the control function is based on a superior-subordinate relationship, along traditional hierarchical lines, and their performance is monitored by their supervisors (a step in the hierarchy of authority). This is clearly a friction point, since systems analysts work as "senior" and "junior" rather than "supervisor" and "subordinate". They also think of their activity as a "group project" with each member having independent responsibility (see Table 2). This suggests that the role of the supervisor should be more of a coordinator than of a superior.

For an organization to enhance the loyalty of its analysts, it needs to reconsider its attitude toward them as subordinates. Thus, in acknowledging the high mobility rate of, and demand for, systems analysts, the organization should be expected to narrow whatever gap exists between its needs and expectations and those of systems analysts. In doing so, organizations should see a leveling off of cultural conflict – that is, the institutional subculture which is built on loyalty to and belief in the organization and the professional subculture of the systems analysts which is geared to commitment to his profession.

Steps to Increasing Loyalty

Some of the steps that an organization can take to increase the loyalty of systems analysts include:

1. Promoting from within, even though such attempts may stifle venturesomeness and initiative. The social sentiments of the systems group can be encouraged to favor selection from within. Furthermore, it is easier and more economical to appoint someone close at hand. In addition, selecting less qualified men and then training them through formal programs is one way of minimizing the high cost of employee turnover. In the case of hiring highly trained analysts from outside, once they use up their work, they lose challenge and eventually leave.
2. Replacing the junior systems analyst title with a more prestigious one such as associate systems analyst, or acting systems analyst.
3. Compensating systems analysts for overtime hours by giving them time off.
4. Adjusting salary schedules to be competitive with other organizations, implementing shorter intervals between raises, and planning more frequent salary reviews.
5. Freedom from the 8:35 A.M. to 4:50 P.M. time schedule, and the right to decide on one's own time for lunch.
6. Responsibility of the systems analyst needs to be commensurate with adequate authority. Implicit in delegating the analyst authority to attain a preplanned, pronounced objective is that he assumes responsibility for managing the details and achieving the results. Thus, for him to feel a full sense of responsibility for the outcome, he needs to be delegated authority to take full charge of implementing the various aspects of his project. The problem here is that the analyst's authority ends with the completion of the project. His sense of responsibility will take longer to dissipate, making the relationship between the systems analyst and his line supervisor difficult throughout. □

A PROSE GLOSSARY OF APL (A PROGRAMMING LANGUAGE)

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INTRODUCTION

The APL concept has evolved from a notation developed by Harvard Professor Kenneth Iverson (he has long since been with IBM) to an internationally known system for programming, analysis, and systems design. In short, APL allows the user to define a problem and then to verify the model and obtain a solution on a digital computer using time-sharing facilities. APL is also used for information retrieval, for text editing, and for data processing.

The capabilities inherent in APL are not new. APL simply makes them available to the user in an unambiguous and efficient manner. The notation of APL is patterned after the notation of ordinary mathematics; thus it is easy to learn and natural for human use. APL achieves its power through a multiplicity of functions defined on scalar and array arguments, through a powerful facility for defining functions, and through a wide variety of system commands to interface with the computer system and provide facilities outside the scope of the APL language.

The conciseness of APL notation is demonstrated through a defined function that computes the average of a list of numbers stored as a linear array *X*. Figure 1 gives a FORTRAN version and Figure 2 gives an analogous APL version.

APL is relatively new to the computing community, and anything new is unfamiliar to a great many interested readers. A glossary of terms would ordinarily be useful but its effectiveness is limited because the relationship between concepts is not readily apparent from standard definitions.

THE GLOSSARY

The **APL terminal system** approaches the state of the art in computer technology by combining the concept of time sharing and the power and relevance of Iverson's language* into a single programming system. APL is accessed with a remote terminal device, which may use a **dataset** or an **acoustical coupler** to prepare information for transmission over ordinary telephone lines.

The user instructs the computer in two ways: by system commands and with APL statements. A **system command**, such as *)ERASE ABC*, is used to have a function performed by the computer which is outside of the scope of the language. A **system command** always begins with a right parenthesis. Two system commands are used to **initiate** and **terminate** a work session and are especially important; they are: *)XXXXXXX* and *)OFF*, respectively. (Here *XXXXXXX* is an installation-defined account number.) A user indicates the processing that he wants performed by entering a statement, which is executed immediately or is stored as part of a defined function. A **statement** can be either of two types: specification or branching. A **specification statement** is of the form $X \leftarrow EXP$ where X is a scalar variable, array variable, or a subscripted array variable and EXP is a mathematical expression. The value of X is replaced by the value of EXP. Example: $T \leftarrow 5*2$. If the specification operator $\leftarrow$ is not the last operation in the statement, then the result is printed at the terminal. The **branch statement**, which uses the operator $\rightarrow$, is normally used in defined functions to depart from the sequential order of execution. The operand to the branch operator $\rightarrow$ is the number of a statement. If it is zero or does not exist, then an exit is made from the function.

Numeric constants are of two forms: decimal and exponential. The decimal form uses the characters 0 1 2 3 4 5 6 7 8 9. and ¯; a number expressed in decimal form may be negative and possess integral or fractional parts as required. Examples ¯1 173 45.678 ¯.3. The exponential form involves a power of 10 and uses the character *E* to indicate a positive or negative exponent. Examples: 13 *E*7 ¯13.638 *E*17 25.1*E*¯4. Numeric constants may not contain embedded spaces. Data may be organized as scalars or arrays and be named. A scalar has a rank of 0; a vector has a rank of 1; a matrix has a rank of 2; etc. A **name** is a sequence of letters, digits, or the character Δ. Moreover, a letter of a name may be underlined for clarity. The first character of a name must not be a digit; the initial sequences *S*Δ and *T*Δ and embedded spaces are not permitted. Sample names are *I AB*12 *XPRIME ALL*Δ*DONE*. A variable associates a name and a value in an active workspace, which may be saved and loaded by the user. A **workspace** contains variables, functions, and control information for a terminal session.

The ordinary dyadic arithmetic **operators** are: **addition** (+), **subtraction** (−), **Multiplication** (×), **division** (÷), and **exponentiation** (*). The monadic counterparts of the above operators are: − for **negation** so that $-B \equiv 0-B$; + for **identity** so that $+B \equiv 0+B$; × for the **signum** function so that $\times B \equiv -1$, 0, or +1 if $B<0$, $B=0$ or $B>0$ respectively; ÷ for **reciprocal** so that $\div B \equiv 1 \div B$; and * for **exponential** so that $*B \equiv e^B$ where $e=2.718281828459045$. Other primitive arithmetic operators are a part of the language and are mo-

*K. E. Iverson, *A Programming Language*, New York, John Wiley and Sons, Inc., 1962.

```
      FUNCTION AVER(X,N)
      REAL X(N)
      SUM=0.0
      DO 10 I=1,N
   10 SUM=SUM+X(I)
      AVER=SUM/FLOAT(N)
      RETURN
      END
```

Figure 1

FORTRAN function to compute the average of a list of values

```
      ∇R←AVER X
[1]   R←(+/X)÷⍴X
[2]   ∇
```

Figure 2

APL function to compute the average of a list of values

tions. The purpose of this *prose glossary,* then, is to put the important terms in a familiar context so that they are more meaningful to the reader. Key words are set in boldface type and are indexed by line number. The index is presented adjacent to the text portion of the glossary.

INDEX TO GLOSSARY

nadic or dyadic as indicated. For all operations, operands may be constants, variables, or expressions. **Maximum,** $A \lceil B$, selects the algebraic largest of its operands: $5=3\lceil 5$. **Minimum,** $A \lfloor B$, selects the algebraic smallest of its operands: $3=3\lfloor 5$. **Floor,** $\lfloor A$, gives the largest integer not exceeding the operand: $3=\lfloor 3.14$. **Ceiling,** $\lceil A$, gives the smallest integer not exceeded by the operand: $4=\lceil 3.14$. **Absolute value,** $|A$, produces the magnitude of the operand: $5=|{}^{-}5$. **Residue,** $A \mid B$, provides the remainder after dividing B by A and is always positive: $1=3 \mid 7$, $1.6=5 \mid {}^{-}13.4$. **Comparison operations** assume their normal meaning and use the following symbols: **less than** ($<$), **less than or equal to** ($\leq$), **equal to** ($=$), **greater than or equal to** ($\geq$), **greater than** ($>$), and **not equal to** ($\neq$). How close is equal is of importance, and a tolerance of approximately $1.0E^{-}13$ is used and is termed **fuzz.** Fuzz is used with all of the comparison operations, which produce the result 1 for true and 0 for false. Thus, the result of a comparison operation can be used in an arithmetic or logical expression. The APL language contains five primitive **connectives** whose domain and range is the set $\{0,1\}$. **And,** $U \wedge V$, returns the value 1 if both operands are 1. **Or,** $U \vee V$, returns the value 1 if either or both of the operands is 1. **Not,** $\sim U$, returns the value 0 if its operand is 1 and returns 1 if its operand is 0. **Nand,** $U \uparrow V$, returns the value 0 if both operands are 0 and returns 1 otherwise. **Nor,** $U \downarrow V$, returns the value 1 if both operands are 0 and returns a 0 otherwise.

Several basic mathematical functions are also included in the language. The **generalized combination,** $K!N$, gives the number of combinations of N things taken K at a time: $3=2!3$. **Factorial,** $!N$, gives the number of distinct arrangements of N things: $24=!4$. **Roll,** $?N$, selects an integer pseudo-randomly from the first N positive integers: $1=?5$. Roll uses a starting number termed the **seed** which is set initially to 16807 or 7*5 and is stored with a workspace. The **natural logarithm,** $\circledast N$, computes $\log_e N$. The **common logarithm,** $M \circledast N$, computes $\log_M N$: $10 \circledast 2 \equiv 0.3010299957$. **Pi times,** $\circ N$, computes the mathematical value π times the operand: $3.141592654=\circ 1$. The **circular functions** are expressed as $I \circ X$ where: $\sin X \equiv 1 \circ X$; $\cos X \equiv 2 \circ X$; $\tan X \equiv 3 \circ X$; $\arcsin X \equiv {}^{-}1 \circ X$; $\arccos X \equiv {}^{-}2 \circ X$; and $\arctan X \equiv {}^{-}3 \circ X$. For example: $0.5=1 \circ 0 \div 6$.

Operators and operands can be combined to form **compound expressions,** such as $2+3\times 4$, which has the value 14. Because of the multiplicity of operators in APL, a strict right-to-left order of execution is adopted. For example, $3\times 4+5$ produces the value 27. **Parentheses** can be used to depart from the normal order of execution so that $(3\times 4)+5$ would produce a result of 17.

Most operator symbols have monadic and dyadic counterparts. An operator is assumed to be **monadic** if the symbol to its immediate left is another operator symbol. The operand to the left of a **dyadic** operator can be a variable, a constant, or an expression in parentheses. The **right operand** to either type of operator is the value of the entire expression to its right.

Arrays can have numeric or character components that cannot be mixed within any one array. **A numeric vector** is specified as $V \leftarrow v_1\ v_2\ v_3\ \ldots\ v_n$, where the v_i are numeric constants: $A \leftarrow {}^{-}7\ 3\ 9\ 6$. The monadic form of the **iota** symbol, ιN, is called the **index generator** and generates a vector of the integers 1 through N (in 1-origin indexing) and 0 through $N-1$ (in 0-origin indexing). A **character vector** is specified as $C \leftarrow 'c_1 c_2 \ldots c_n'$, where the c_i are characters from the APL alphabet including composite symbols: $C \leftarrow 'ABC-12\phi'$. Each character is one component of a character array and a series of characters in quote symbols is termed a **literal.** A quote within a literal is denoted by **two quote marks. Arrays of higher dimension** are generated with the **reshape function,** $M \rho N$, where M specifies the size of the result and N specifies the components. If N contains less than the required number of components, it is used cyclically. If it contains more, only the required number are used. For example, $M \leftarrow 3\ 4 \rho 1$ specifies a matrix with 3 rows and 4 columns, all components of which are 1. A component of an array may be selected or specified with a subscript. A **subscript** is enclosed in brackets and follows the array name. A **single component** is indicated by an **index** for each coordinate of an array; indices, which may be scalars or arrays, are separated by a semicolon. If $A \leftarrow 2\ 3 \rho \iota 6$, then $A[1;2]=2$ and $A[2;\ \iota 3]=4\ 5\ 6$. If an index is omitted, then an entire coordinate is selected: $A[;2]=2\ 5$. Thus, $A[1\ 2;2]=A[;2]$.

Primitive operations and mathematical functions, defined on scalars, are extended to arrays on an **element-by-element basis.** If $V \leftarrow \iota 6$ and $W \leftarrow 6\rho 2$, then $(V*W) = 1\ 4\ 9\ 16\ 25\ 36$. If either operand is a scalar, then it is extended to apply to all components of the other operand: $(V+1) = 2\ 3\ 4\ 5\ 6\ 7$.

The monadic form of ρ gives the **size** of an array and always produces a vector result. Applied to a vector, ρN produces a vector with one component—the magnitude of which is the **dimension** of N. Applied to a **matrix**, ρN produces a vector where each component gives the dimension of one of the coordinates of the array. The concept is extended to higher-dimensioned arrays systematically. Thus, if $V \leftarrow {}^{-}7\ 3\ 9\ 6\ 5\ 4$, then $(\rho V) = 6$. Also, if $A \leftarrow 2\ 3\rho\ \iota 6$, then $(\rho A) = 2\ 3$.

The vectors can be catenated with the **catenation operation:** V,W where $(\rho(V,W)) = (\rho V) + \rho W$.

When arrays are generated from a vector using the **reshape function**, the array is formed by lexicographic order of its subscripts. Similarly, an array is **raveled** with the monadic form of the operator (,). If $A \leftarrow 2\ 3\rho\ \iota 6$, then $(,A) = 1\ 2\ 3\ 4\ 5\ 6$. Also, if $X \leftarrow 5$, then ρX produces a null value. However, $(\rho,X) = 1$. Thus, **ravel** produces a vector result.

Dyadic operations are applied to the components of a single array with the **reduction** operator: $\oplus/X = X[1] \oplus X[2] \oplus \ldots \oplus X[(\rho X)-1] \oplus X[\rho X]$. For example: $(+/\iota 6) = 21$. Here, the **right-to-left rule** is also applied. Reduction is also applied to the Ith coordinate of an array A as follows: $\oplus/[I]A$. The ordinary **matrix multiplication** is a special case of the **inner product** expressed as: $C[I;J] = f/A[I;]gB[;J]$, where f and g are scalar dyadic operators. It is denoted in APL as $A f.g B$ so that a matrix multiply of matrices A and B is specified as $A +.\times B$. A and B can be vectors, matrices, or higher-dimensioned arrays. The familiar **cartesian product** is termed the **outer product** in APL and expressed as: $A \circ .fB$, where A and B are arrays and f is a scalar dyadic operation. **Transposition** exists in two forms. Monadic transposition, $\lozenge M$, interchanges the last two coordinates of the operand. Dyadic transposition, $N \lozenge M$, utilizes a left operand which specifies the coordinates that are to be interchanged.

Components of a vector V are **reversed** with the monadic operation ϕV; the operation is extended to higher-dimensioned arrays by specifying a coordinate index: $\phi[I]V$. The operation $K\phi V$ rotates the vector left K places if K is positive and right K places if K is negative. Applied to higher-dimensioned arrays, $K\phi[I]A$ also specifies the coordinate index; K may be a scalar (and is extended to all dimensions or A) or an array (where each component of K specifies the rotation to be applied to the respective coordinate of A).

Compression, U/V, uses a logical vector U and suppresses from V those components that correspond to 0 components in U. When applied to a higher-dimensioned array, an index, $U/[I]A$, specifies along which coordinate compression is applied. **Expansion** provides the converse of compression and is expressed as $U\backslash V$ and $U\backslash[I]A$ to correspond with the forms of compression.

The function $T\uparrow V$, called **take**, selects the first T components of V if T is positive and the last T if T is negative. Similarly, **drop**, $T\downarrow V$, drops the first T components or the last T components of V if T is positive or negative, respectively.

The **index of** the first occurrence of a scalar S in a vector V is expressed as $V\iota S$. The concept is extended to right operands which are arrays and the result assumes the size of the right operand. The **membership** function, $S\epsilon V$, produces a value 1 if a scalar S is an element of a vector V and produces 0 otherwise. The left operand, in this case, is extended to arrays and produces a result of the same size.

The permutation of indices necessary to order a vector in ascending or descending sequence is provided with the grade up and grade down functions. **Grade up** is expressed as $\grave{\Delta} V$ so that $V[\grave{\Delta}V]$ produces V in ascending order. Similarly, **grade down**, $\grave{\nabla} V$, applied to V, that is $V[\grave{\nabla}V]$, produces V in descending order. The **deal** function, expressed as $A?B$, produces a vector of A components selected pseudo-randomly from B without replacement.

Encode, written $B\perp A$, produces the base ten value of the vector A to the base B. Similarly, **decode**, written $B\top A$, produces the vector of coefficients to the base B necessary to decode the value A.

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In addition to primitive arithmetic operations, mathematical functions, and functions on arrays, APL permits the user to define functions which are not a part of the language and effectively to develop programs in the usual sense. **Function definition** requires that the APL system leave the **execution mode**, which is the normal mode of operation, and enter the definition mode. In the **definition mode**, statements are not executed as they are entered but are stored as part of a **defined function**. The syntax of a function is determined by the **function header**, which is the opening statement and which gives a prototype of the function. Defined functions can be: **dyadic**, *A FCN B*; **monadic**, *FCN A*; or **niladic**, *FCN*—where *FCN* is the function name and *A* and *B* are arguments. Moreover, a function can produce an **explicit result**, so that it can be used in a mathematical expression, or provide an **implicit result** so that it must be invoked in a statement by itself. A **function definition** consists of four kinds of constructs: (1) an opening ∇ (del) symbol; (2) a **function header**, such as *R*←*X PLUS Y*; (3) a **function body** containing the statements that comprise the function; and (4) a final del symbol. Variables may be specified as being **local** to a function by including them in the function header, each preceded by a semicolon.

Within a defined function, statements are numbered so that they may be used as an operand to the monadic **branch** operation, written as →*E*. If *E* is a scalar constant or variable, then the next statement executed is the one with that number—if it exists. Otherwise, an **exit** is made from the function. If *E* is a vector, then the statement with the number 1↑*E* is executed next. If *E* is an empty (null) vector, then the next statement in sequence is executed —that is, control drops through the branch statement. Given variables *X* and *Y* and relation r, the following statements branch to *S* or drop through if *X*r*Y are true or false respectively:* →(*X*r*Y*)/*S*, →(*X*r*Y*)ρ*S*, and →*S*×ι*X*r*Y*. Branching is facilitated through use of **statement labels**, which precede the body of a statement and are separated from it with a colon and which are local to the function definition.

Function modification is achieved in a variety of ways. Statements can be **deleted, inserted,** and **replaced.** The function header may be modified and an entire function or parts of it can be displayed with one of several display operations.

Program checkout is enhanced by a trace function and a stop control function. The **trace function** is invoked by a statement of the form: *T*Δ*FCN*←*V* where *FCN* is the function to be traced and *V* is a vector of statement numbers in *FCN*. The explicit value of designated statements is displayed and identified as they are executed. The **stop control function** is invoked by: *S*Δ*FCN*←*V*, where the *FCN* and *V* are defined above. Execution of an invoked function is stopped prior to the execution of designated statements. When a function is stopped, facilities ordinarily available in the execution mode are available to the user.

Halted functions arise in three ways: (1) as a result of a statement error detected by the computer; (2) by pressing the ATTN key to halt execution; and (3) by the stop control function. Execution may be resumed by branching, →*S*, to the next statement to be executed. Defined functions can invoke other defined functions and the process is extended to as many levels as required. A halted (or stopped) function is said to be a **suspended function** and the functions that invoked the suspended function are termed **pendent functions.** Pendent functions may not be modified. Suspended functions can be modified and execution may proceed with the statement that was modified.

The **input** operation can take two forms: evaluated input and character input. **Evaluated input** is denoted by the **quad symbol,** □, and may be used in any context that a constant or variable can be used. The input provided by the user is evaluated as though it were a part of the expression containing the quad symbol. **Character input** uses the **quote-quad symbol,** ⍞, and allows a **literal** to be entered without the enclosing quote symbols. A quad or quote-quad immediately to the left of a specification operator denotes **output** and is frequently used to display partial results of a complex expression.

APL achieves its greatest utility in three ways: (1) as an interactive desk calculator; (2) as a programming system; and (3) as a means of describing complex discrete systems. In the last case, the system description can be verified with the APL system.

"The House is on Fire" — THE PROFESSION OF INFORMATION ENGINEER

Computers and Automation believes that the profession of information engineer includes not only competence in handling information using computers and other means, but also a broad responsibility, in a professional and engineering sense, for:

- The reliability and social significance of pertinent input data;
- The social value of the output results.

In the same way, a bridge engineer takes a professional responsibility for the reliability and significance of the data he uses, and the safety and efficiency of the bridge he builds, for human beings to risk their lives on.

Accordingly, this department of *Computers and Automation* will publish from time to time articles and other information related to socially useful input and output of data systems in a broad sense. To this end we shall seek to publish here what is unsettling, disturbing, critical – but productive of thought and an improved and safer "house" for all humanity, an earth in which our children and later generations may have a future, instead of facing extinction.

The professional information engineer needs to relate his engineering to the most important and most serious problems in the world today: war, nuclear weapons, pollution, the population explosion, and many more.

In this issue, we are publishing: (1) a statement presented to the Senate Foreign Relations Committee by Thomas J. Watson, Jr., Chairman of the Board of IBM Corp.; (2) a letter written to Mr. Watson in response to that statement and Mr. Watson's reply to that letter; and (3) a report on a group of engineering professors who have joined together to petition for a prompt end to the war in Southeast Asia. We think these items are important and thought-provoking; we hope they are an indication of an increasing awareness of their social responsibilities on the part of information engineers.

The Crossroads of Decision

*Thomas J. Watson, Jr.**
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"We stand at a crossroads of decision, with all comfortable routes closed off. We must end the tragedy in Southeast Asia before it overwhelms us."

Increasingly over the past four years, I have been concerned about our nation's course in Southeast Asia, and its effect on our country – especially young people. The key fact, as I see it, is this: 50 percent of the population of this country is under age 25; and the longer the war continues, the more it broadens the gap between the elder generation, sometimes called the establishment, and our young men and women, who will soon be responsible for the leadership and destiny of this country. Indeed, the prolongation of the war may well set up a continuing revolution of our youth through which they may become sufficiently demoralized so that the progress of our country will be appreciably slowed.

The Cost of War

So I have two main points for wanting a prompt end to the Vietnam undertaking. First, I don't think we can afford not to heed the dissatisfaction of our youth. Second, it seems certain to me that continuing the war produces unacceptable costs: in the lives of our fighting men, in weakening of our institutions, and in the undermining of our national morale.

Furthermore, our actions in Vietnam are losing us valuable and traditional friends in the West. We present a picture of a terribly powerful, awe-inspiring nation unable to manage itself in a disciplined fashion.

Our prestige is suffering abroad. Let me illustrate the point concretely by giving you a rundown of actions against IBM properties in various parts of the world during the last six weeks. In West Berlin, nearly all the windows in one of our buildings were broken by young rioters. Then gasoline was poured about and it was set on fire. The windows in one of our Dutch facilities were broken by students. Our branch office in Cologne was attacked by protesters against the Vietnam War and the windows smashed. A powerful bomb was discovered just before it was timed to explode in an IBM Argentina office. Just a few days ago, we received bomb threats at our Amsterdam and Paris Data Centers.

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*This article is based on a personal statement presented by Mr. Watson to the Senate Foreign Relations Committee on June 2, 1970.

And here at home, we've had many bomb threats and one actual bombing at 425 Park Avenue in New York City – our Eastern Regional Headquarters. It happened in the middle of the night and, fortunately, no one was hurt.

"We present a picture of a terribly powerful, awe-inspiring nation unable to manage itself in a disciplined fashion."

While I don't want to draw strong conclusions from random acts of unhappy young people around the world, I do think that if we don't draw some kind of conclusion from all of these things, we will be casting away facts which, if used correctly, can lead us to do intelligent things in the future to ameliorate the situation.

The President found this country in Vietnam and has pledged us to withdraw. I know, of course, of the deep concern and commitment he has to ending the bloodshed and the suffering. I applauded his decision for paced withdrawal as opposed to the earlier open-ended commitment. It is very important, I think, to recognize that once this policy of the President was announced to the country, the youth became quieter than at any time in the previous four years. It is significant that a plan for withdrawal brought about immediate calming; it is significant, too, that as soon as this timetable seemed to be interfered with by the Cambodian campaign, the violence flared up more strongly than ever before.

To continue as a great nation, our country must be drawn together again. I doubt that this can be done while we're in Vietnam. Once this is thoroughly understood, we can plan our strategy around this point.

A Crisis of Confidence

Speaking first on the economic side, I want to make it clear that I see this country as the strongest country economically and in every other way that has ever been known to man. This is fundamentally as true today as it was a year ago or five years ago. We are just a bit out of gear. We have a crisis of confidence in ourselves. We wonder not only why we can't get out of Vietnam with dispatch, but how we ever got into it and stayed in it so long. Our children wonder about our leadership, and we wonder about their ideals.

"The war in Vietnam is the major factor which has turned our healthy economy into an unhealthy one."

The war in Vietnam is the major factor which has turned our healthy economy into an unhealthy one. Some years ago, many thought the United States could contain and support anti-Communist movements wherever they arose throughout the world and, at the same time, have an economy back here at home that would be almost unaffected. Obviously, this hasn't worked. The present economic prospects are discouraging. Inflation may be slowing down – though very slowly – but unemployment is up and rising, and businessmen are showing great caution and concern about the future.

Inflation always accompanies war and distorts an economy. Inevitably it must be corrected; and this brings about some difficulties for all and disasters for those of the labor force who lose their jobs and don't quickly find new ones. During the first two years of escalation in Vietnam (1965-1966), we were in a period of rising prosperity. Sales and profits were strong, and the country was reaching full employment. The war and a very strong consumer market base at home combined to overcommit us economically. This overcommitment fueled inflationary pressures, and distortions began to occur. In short, we simply overtaxed our ability to produce, and since the supply of goods could not be increased sufficiently to avoid inflation, a way of cutting down on demand had to be found. Therefore, the Administration took courageous and very necessary fiscal and monetary steps – parts of the inevitable correction process. Nevertheless, as long as the demands on our economy from the Vietnam involvement remain, it will be difficult to contain inflation fully.

"The intensity of youth's current great dissatisfaction is a fact – one as real as body counts and defense budgets and the GNP."

When we are completely out of Vietnam, much of our economic problem will be solved. But, in the meantime, inflation may progress, and wage settlements now being made in anticipation of future inflation or in an effort to catch up with the past loss of progress build an uncertainty which is hampering a turnaround. I would, therefore, suggest on the economic side that the Administration give serious consideration to resorting at once to the guideline approach to wages and prices that worked reasonably well in the early years of the Kennedy Administration. I know this method was not successful over the long-term period, but for two or three years, I think the record will show that the approach was helpful, and it has the advantage of being able to be put into effect at once.

In summary on the economic side, as long as our involvement in Vietnam continues, it will be a major obstacle to both the short- and the long-term economic health of the country.

The Dissatisfaction of Young Americans

There are important reasons other than economic for leaving Vietnam. In the past year, I have spent over one hundred hours talking to young people on college campuses and elsewhere. Just recently, I spent a full day on the California Institute of Technology campus, talking first in private with the class officers of the graduating class, and then with students in their dormitories and at various campus gatherings. I've done the same thing at Brown, at Oberlin, and elsewhere. There is absolutely no question about the sincerity and intensity of the dissatisfaction of the vast majority of these young Americans with the direction in which we are going in Southeast Asia. World War II, with which I was intimately connected, welded the large majority of our country – young and old, rich and poor – together. This war has only lukewarm support from

some and varying degrees of dissent from others. Most of it is fairly hot. The dissension is largely between the young and the old, so that it not only fractionates and polarizes, but it does so at one of the fundamental roots of our society, the family.

Earlier this year at Oberlin in an open forum – a give and take session – I attempted to defend the United States, as so many of us do when we're talking to younger people. I said, "You young people are filled with criticism, but where on earth could you find a better country than the United States?" The answer was surprising and in some ways noble. It was simply this: "Of course the United States is the best place in the world, but do you argue with our desire and right to make it even better?"

A young man came into my office the other day to talk to me about a "Pause for Peace." This was an idea for getting people in the United States to stop whatever they were doing for a full hour to emphasize the great desire of most of America to get out of Vietnam rapidly. He spoke with such conviction and intelligence that I asked him to come back and address the whole management committee of IBM. In the course of his discussion, he said one thing that impressed all of us profoundly. He asked us: "How would you like to have a son killed during a paced withdrawal from a war which you had decided was a bad war in the first place?" I think this chap summarizes the reason for youth's current great dissatisfaction.

"It's impossible to find an efficient, orderly and dignified way of getting out of Vietnam."

This intensity of feeling is a fact – one as real as body counts and defense budgets and the GNP. And it means simply this: As long as Vietnam continues, the polarization of youth and the elder generation will undoubtedly increase.

There will be more inevitable accidents which will engender still more violence. To quell this and keep the peace, more and more National Guard and military units will have to be called out. The longer we continue, the more chaotic the nation will become. The damage we have already seen will take decades to repair, and if we continue, I believe we will soon reach a point where much of the damage will be irreparable.

Time is Running Out

For all these reasons I believe we should withdraw all of our military activities, both operational and advisory, from Southeast Asia as soon as possible. I believe that time is running out and that the situation here at home deteriorates as each month goes by. Summer vacations may produce a misleading calm. Next fall the term may open on a cooler note because of the decision of a number of colleges to recess prior to elections to permit students to campaign for the candidates of their choice. And if it looks as though we really were getting out this fall, the situation on the campuses would be a good deal more peaceful. But if we're still there actively next spring, we'll see a heightened replay of this past spring's campus disorders. And if we remain in Vietnam through the fall of 1971, the situation will become more serious.

There's a syndrome in the United States which makes it very difficult for us to cope with a situation like Vietnam – Americans are efficient and orderly; and when those with responsibility try to find strategies and moves for the future, they try to find efficient and orderly ones. We do this same thing in business. It's impossible to figure out an efficient, orderly and dignified way of getting out of Vietnam. And therefore we continue year after year to compound the situation by staying there simply because we can't find a good, orderly way of disengaging.

There isn't any comfortable way to withdraw. It's always going to be easy for the Communists to interrupt our plans, to make us look ridiculous, and to profit through our loss.

Another Look at Paris

Therefore, I believe we must exhaust every possibility – however novel, however imaginative – to disengage and save as many lives as possible in the process. It seems to me that there are two places we can start. We should take a hard look once again at the Paris negotiations to make certain that in our offers we have gone to the absolute outer limit of what we can give. If we can make a compromise there and succeed, we have the possibility of some dignity as we move out. I think it's vital that the Government assure itself that the truce efforts in Paris and the concessions being offered to North Vietnam are compatible with our aims. These concessions must in fact be balanced off against what we have to lose by a continued stay in South Vietnam or by a confused and chaotic withdrawal.

The UN

Combined with our efforts in Paris, we should make major new efforts to get the United Nations involved in the work of ending the war and preserving the peace in Southeast Asia. I think this kind of third party intervention is absolutely essential if we are to have any kind of orderly departure.

We've done a lot of things outside the United Nations in the past decade and so have our opponents. There may come a time when the strength of the U.N. will be directly connected with the survival of the world. So we must help build its strength. Here is a way to let the world know that we continue to believe in the U.N. I recognize, of course, that the Security Council could reject this proposal, but I think we should initiate it.

The Results of Withdrawal

Now, if we find a successful approach which results in real progress towards withdrawal, what will the results be? First, would be the resurgence of faith of our young people.

Second, we would have a better relationship between the Administration and Congress. I am concerned about the various legislative proposals now being considered to restrict the President's ability to move with dispatch for the security of the country. I hope that the Administration and Congress can find a common course of action so that such bills would not be necessary, and we would preserve the President's traditional freedom of action.

Third, the United States would be sufficiently united by these actions so that our governmental processes would receive the support of most of the elements in our society.

Fourth, there would be a renewal of our military flexibility – of our capacity to defend areas critical to our national security, and importantly, a regaining of national respect for our military establishment.

Fifth, there would be a renewed respect and understanding from our oldest and staunchest free world friends and allies.

In conclusion, I do not wish to criticize any of the three presidents – Kennedy, Johnson and Nixon – who have struggled with this immensely difficult problem. I have no doubt that President Nixon – like Presidents Kennedy and Johnson before him – sincerely seeks peace in Southeast Asia. But it is my personal conviction that: we stand at a crossroads of decision, with all comfortable routes closed off; we must end this tragedy before it overwhelms us; and we must therefore face up squarely to a tough decision and see it through with courage and dispatch. □

A PROPOSAL TO WITHHOLD PRODUCTS FROM THE GOVERNMENT – PRO AND CON

I. The following response to Mr. Watson's statement to the Senate Foreign Relations Committee was sent to Mr. Watson by Edward Webster, Manager, Technical Manual Program Office, International Business Forms Industries, 437 Cherry St., West Newton, Mass. 02165.

Dear Mr. Watson,

As data processing consultants, we noted with particular interest your recent remarks before the Senate Foreign Relations Committee. It is heartening that business leaders of your stature are speaking out; but if you really feel the war must be ended, I wonder if there is more that will have to be done.

We have seen both Democratic and Republican administrations make promises about this war, and have seen both unwilling to pay the price of terminating the venture. With all due respect, our current President seems more than his predecessors emotionally entangled in such notions as "victory", "defeat", and "humiliation". Although he sometimes surprises us, he does not seem well equipped to exercise the kind of strong leadership that will be needed for complete disengagement. Nor do I see such a strong leader emerging to oppose him in 1972.

There are increasing numbers of intelligent people who feel the administration must be shown some indication that the more thoughtful citizens at some point simply will not continue to cooperate.

Might you not therefore discuss with your Board the practicality of drafting a letter to the President stating that IBM will be forced to consider refusing to accept further defense contracts unless he shows considerably more enterprise in honoring his campaign promise to end the war? IBM has pioneered in many ways; it would seem appropriate for IBM to take the lead in pioneering this form of social responsibility.

There is a case for the view that whatever our opinions and statements, the war is a reflection of our actions and the roles we play in business and industry, and that this war will continue to plague us until we back our words with our actions; as you concluded in your testimony, "the comfortable routes" have been closed off.

/s/ Edward Webster

II. Mr. Watson's reply to Mr. Webster's letter.

Dear Mr. Webster,

Thank you for your letter concerning my recent testimony before the Senate Foreign Relations Committee.

As frustrating as the problem may be, I simply don't agree that your proposal of withholding products from the government is an appropriate course of action. In the end, my views come down to this: whatever we may think of the war – and I believe it is increasingly troubling us all – a proposal such as yours seems to me contrary to the principles of our democratic system, which is rooted not in corporate power, but in the voting rights of the individual citizen.

If businesses, singly or in concert, were to refuse their products to the government, even for the purpose of ending an undesirable conflict, I could foresee the result as anarchy. If the considerable powers of business were to be exercised in this fashion for what many would consider a good cause, these same powers could also be exercised for causes which might be to the distinct disadvantage of the people.

Therefore, I feel that companies such as ours have an obligation not to use their economic power to try to overturn national policies arrived at through the political process.

/s/ Thomas J. Watson, Jr. □

"ENGINEERING FACULTY FOR A RESPONSIBLE CONGRESS" GROUP IS FORMED

(A report from the Academic and Professional Alliance for a Responsible Congress (APARC), 3041 Broadway, New York, N.Y. 10027)

A group of engineering professors, asserting that their technical knowledge and teaching have been diverted into a "futile military adventure," have joined together to petition for a prompt end to the war in Southeast Asia.

The Petition

In a meeting on June 3 at Columbia University's School of Engineering and Applied Science, faculty delegates from several of the engineering schools in the metropolitan New York area prepared and signed a petition urging Congress to pass the "McGovern-Hatfield Amendment to End the War."

"Because of the historical involvement of engineering in the processes of war," the petition states, "we think it is especially pertinent for us, as engineering teachers, to call for a halt to a futile military adventure."

The professors declared that "the contributions of our teaching, our research and our professional work – intended for the good of all humanity – have been massively pre-empted for the purposes of an intolerable campaign of seemingly endless destruction."

Members of the faculties of Columbia, Brooklyn Polytechnic Institute, Stevens Institute, and City University of New York signed the petition. Among them were representatives of such war-related fields as electrophysics, mechanical engineering, metallurgy, chemical engineering and electrical engineering.

Campaigning

At the meeting, the teachers formed a group called "Engineering Faculty for a Responsible Congress," under the chairmanship of Professor Sheldon Weinbaum of City University. This new group will join the "Academic and Professional Alliance for a Responsible Congress" (APARC), a nationwide organization, based at Columbia, which has been lobbying since early May in support of the Amendment to End the War. APARC has also been mobilizing academic forces to help elect anti-war candidates to Congress in November.

Members of the Engineering Faculty for a Responsible Congress will recruit their colleagues throughout the country to petition, lobby and contribute to the campaign funds of antiwar candidates.

Volunteer Consultants

The Engineering Faculty for a Responsible Congress also plans to organize a roster of consultants in engineering and applied sciences who would volunteer to help congressmen and other government officials understand and appraise Pentagon proposals for weapons systems and components. In the past, such appraisal has often been handicapped by the lack of technical expertise.

Crisis in Education

At the meeting, Professor Milton Ohring of Stevens Institute commented on the developing crises in American undergraduate and graduate engineering education arising from our prolonged military engagement in Southeast Asia. He predicted a continuing long-term reduction in the quality and quantity of engineering talent to deal with mounting economic and social problems. Among the war-derived effects causing the attrition, Professor Ohring cited the following:

- Diminishing interest of high school and college students in engineering due to the evident association of engineering with the military-industrial complex;
- Increased cost of engineering education due to war-induced inflation coupled with sharp reductions in federal financial aid for engineering and science students;
- The demoralizing influence of the draft on the will to study;
- The disproportionate number of foreign students employed as graduate teaching assistants;
- And an apparent emigration of engineering scientists to Canada and Europe. □

Announcement regarding

THE 1970 COMPUTER DIRECTORY AND BUYERS' GUIDE,

the midyear issue of "Computers and Automation",

being published this year jointly with the New York Times:

A portion of the directory is being typeset by computer: the Roster of Organizations, the Roster of Products (or Buyers' Guide), and the six geographic rosters. Because of these changes in production process, the directory this year will be published late. The expected publication date is now early September.

We much regret the lateness.

Edmund C. Berkeley, Editor
Computers and Automation

THE ASSASSINATION OF SENATOR ROBERT F. KENNEDY:

PREFACE

Edmund C. Berkeley, Editor
Computers and Automation

In May 1970, Computers and Automation published a long article by Richard E. Sprague, a computer professional and President of Personal Data Services, Hartsdale, N.Y., entitled: "The Assassination of President John F. Kennedy: the Application of Computers to the Photographic Evidence."

This article was well received — in fact, it has had an overwhelmingly favorable reaction among readers of Computers and Automation.

On June 4, 1970, in Los Angeles, Attorney Godfrey Isaac filed a legal complaint against the Los Angeles Police Department and the Los Angeles District Attorney's Office, on behalf of his client Theodore Charach, a former TV newscaster who was on the scene when Robert Kennedy was murdered, charging them with "deliberately, intentionally, and knowingly" suppressing "fact and evidence" relating to the assassination of Senator Robert F. Kennedy on June 5, 1968.

As a result of these two facts, we are publishing in this issue some important articles and reports, dealing with the assassination of Senator Robert F. Kennedy, and raising three important questions:

- whether or not a second gunman actually killed him (there is no question that Sirhan B. Sirhan tried to, but there is significant evidence that Sirhan missed);
- whether or not there was a conspiracy; and
- whether computers can be used to deal with the large quantities of evidence.

ASSERTIONS

The May article on President John F. Kennedy's assassination flatly asserted the thesis that Lee Harvey Oswald was not the sole assassin, that there was a conspiracy that successfully killed President Kennedy, and that the Warren Commission conclusions were false.

The articles printed in this issue on Senator Robert F. Kennedy's assassination do not charge that there actually was a conspiracy to kill Senator Kennedy. Too many key facts have not yet been ascertained to justify a firm conclusion.

Yet there is very important evidence — and strange silence on the part of the police and other authorities — that indicate:

(1) There was a conspiracy;
(2) There was a second gunman who, in the confusion surrounding the seizing of Sirhan B. Sirhan, also shot Senator Robert Kennedy;
(3) There has been extensive silence about critical questions and extensive suppression of critical evidence.

Of these three statements, the easiest to demonstrate and the most disturbing statement is the third.

We shall show beyond a shadow of a doubt that the Los Angeles Police Department (LAPD) and in particular Mr. Robert A. Houghton, at the time Chief of Detectives, LAPD, have suppressed extremely important information.

But first we will turn to a matter of relevance.

RELEVANCE TO THE COMPUTER FIELD

How does an article about a possible political conspiracy and assassination relate to the computer field and its members — to the audience of readers of Computers and Automation?

We have asked ourselves this question, and carefully considered the answers. There are three fundamental reasons why computer people are significantly concerned. Here are the reasons:

INFORMATION ENGINEERS

1. Computer professionals are essentially professional "information engineers" who have a social responsibility to their country and to its people and to society as a whole. This is true of any professionals such as medical doctors or civil engineers, lawyers or teachers.

The possibility of conspiracies in the major assassinations of the 1960's in the United States has plagued many citizens with doubts about our governmental agencies. These doubts have contributed to the "credibility gap" that now exists in the United States between the citizens and their government. By applying computers to the collective facts of each assassination, computer people can diminish the "credibility gap" and perhaps find a more complete and accurate account of the assassinations of the Kennedy brothers and Martin Luther King, Jr.

RELIABLE INPUT DATA

2. Because of "garbage in, garbage out", computer professionals are intimately concerned with the accuracy and the completeness — the factual truth — of the data entering into an information system. A professional systems analyst cannot successfully maintain "I am not responsible for the data going into my computerized information system" because he is inevitably held responsible.

Consequently, in those areas of political activities where factual truths are being systematically concealed, and factual lies are being more or less systematically told, a computer professional has the responsibility of searching for the truth.

KNOWLEDGE FOR EXERCISING RIGHTS IN A DEMOCRACY

3. We are computer people; but we are also Americans, who need information in order to exercise our democratic powers as citizens of the United States to the fullest extent. But a large amount of the vital information that we need in this role is not published by the established newspapers and magazines, although it sometimes appears in publications that are considered "less reputable" and that often seem to "have an axe to grind". This is unfortunate, but true.

So Computers and Automation is faced with a choice "to publish or not to publish". Our decision is self-evident.

THE OFFICIAL REPORT

In the case of the assassination of Senator Robert F. Kennedy, the investigation was almost entirely carried out by a special task force selected out of the Los Angeles Police Department, and as-

sembled for this purpose. This force was under the direction of the Chief of Detectives, Robert A. Houghton, and was named "Special Unit Senator."

Over a dozen conspiracy theories appeared soon after the assassination. Many of the theories had an abundance of suspicion and a famine of evidence — these were rapidly disproved by Special Unit Senator. Other theories were more difficult to prove or disprove.

However, Special Unit Senator was ostensibly satisfied that no conspiracy existed, and, after 4818 interviews and many other official actions, it officially closed the investigation on July 25, 1969.

The ten-volume report of Robert A. Houghton, Chief of Detectives in charge of Special Unit Senator, to his police chief is entitled: "An Investigation Summary of the Senator Robert F. Kennedy Assassination, June 5, 1968." These ten volumes are the official account of the investigation of the assassination. (Only 3 copies apparently are in existence.)

Houghton also wrote a book (with Theodore Taylor) called "Special Unit Senator", "for the sole purpose of acquainting the American public with the facts of the investigation, and with the evidence, or lack of evidence, as it exists, of conspiracy". This book was published by Random House, New York, in January 1970. In "Special Unit Senator" Houghton concludes:

> "Not one shred of evidence exists, at this date, to indicate any conspiracy in the death of Senator Robert F. Kennedy."

This statement, unfortunately, is false.

The Random House book "Special Unit Senator" by Houghton and Taylor, 305 pages long, unfortunately contains no index. The book, however, is very important for researchers, because it is in the nature of an official and conclusive report to the American people, by a man who supervised the investigation that culminated in the trial of Sirhan and the sentencing of Sirhan to death.

Since the book contains no index, Computers and Automation has made an index, and this index will be published. This will make possible systematic comparison of what the book says did occur with what various witnesses said did occur, and with what apparently did in fact occur.

SIGNIFICANT QUESTIONS

The index makes possible the answering of significant questions, such as:

Question 1: How many bullets were found in people, in walls, etc., when Senator Kennedy was assassinated?

Answer: No answer to this question is found in Houghton's book. Evidence exists that 10 bullets were found, whereas Sirhan's gun contained no more than 8 bullets.

Question 2: What is the list of all the persons with and near Senator Kennedy at the time when he was shot? Which of these persons had guns?

Answer: No answer to these two questions is found in Houghton's book.

Question 3: A temporarily employed hotel guard was accompanying Senator Kennedy, and drew his revolver at the time Sirhan shot at Kennedy. What was his name? What information about him is found in Houghton's book?

Answer: His name was Thane Eugene Cesar. He is mentioned in one sentence on page 174 in Houghton's book. No other information about him is given in Houghton's book. Evidence exists that Cesar could have shot Kennedy, and that all of Sirhan's bullets missed Kennedy.

There are many more questions of great importance, that are neither answered nor even discussed in Houghton's book.

THE PROBLEM OF DEALING WITH LARGE QUANTITIES OF EVIDENCE USING COMPUTERS

It is extremely hard to gather into one's mind and to remember large quantities of facts and evidence, much of them seemingly unrelated, when attempting to discover the precise details of a crime, and those who were engaged in it. For example, there were 4818 interviews by Special Unit Senator with persons who "might" have known something. How in the world can any ordinary human being remember even the essentials of that number of interviews?

In addition, when an official body of investigators comes to one conclusion, and independent researchers come to other conclusions, how are they to be balanced or reconciled? It is a natural human desire to choose the simplest assumption, and a natural human propensity to mold the facts to fit the simplest assumption — and to resent "interference" that shows other assumptions are more plausible.

One of the virtues of the scientific method is that no good scientist maintains he has reached final truth — a good scientist always leaves open the position that his views may be wrong. It is sad that "the demands of justice" compel police investigations to establish what are treated as "final" conclusions.

One solution to the problem of dealing with massive evidence lies in the application of computers to massive files of evidence, and the development and application of computerized methods for searching files to reach at least partial answers to questions. Here is a task that deserves the best efforts of computer professionals.

BULLETS AND BULLET HOLES

One of the most elementary actions in analyzing any assassination within a building is to make a survey of the bullets and the bullet holes found. No such survey exists in the book "Special Unit Senator" by Robert A. Houghton — only an incomplete, conversational report (June 9, 1968; pp 97-98).

In the absence of information from the Los Angeles Police Department and Mr. Houghton, there is a survey which was published in the Los Angeles Free Press (7813 Beverly Blvd., Los Angeles, CA 90036), May 23, 1969, in an article by Floyd B. Nelson, entitled "Truth Committee Releases Conspiracy Evidence". Here is the survey:

"To know there are too many bullets, one only has to count them. Just count the actual bullets — in the places where they were found — not the wounds, nor the bullet holes in the clothing. Just the bullets:

ONE recovered (in fragments) from Kennedy's head. (Good Samaritan)
ONE recovered from the back of Kennedy's neck. (Good Samaritan)
ONE recovered (in fragments) from Paul Schrade's head. (Kaiser)
ONE recovered (in pieces) from Elizabeth Evans' forehead. (Huntington)
ONE recovered from left side of abdomen of William Weisel. (Kaiser)
ONE recovered from left thigh of Ira Goldstein. (Encino)
ONE recovered from lower left leg of Irwin Stroll. (Midway)
TWO recovered from center divider, pantry doors. (Clemente photograph)
ONE recovered from doorframe of door back of stage. (Wire Service photo)

Total: TEN BULLETS from an eight-shot revolver.

TWO MEN WITH GUNS DRAWN

STATEMENT TO THE PRESS

Theodore Charach

Theodore Charach is a free-lance journalist, and was a supporter of Senator Kennedy. He happened to be present at the shooting of Senator Robert Kennedy on June 5, 1968 — see map below. He issued the following statement at a press conference on June 4, 1970, on the occasion of the filing of his suit for disclosure of information against the Los Angeles Police Department. He has spent much of the past two years investigating the assassination of Senator Robert Kennedy.

Sirhan Bishara Sirhan did not — I repeat — did not succeed in his attempt to murder Senator Kennedy within minutes of his California Democratic primary victory in the 1968 presidential campaign. Sirhan tried and failed. In our earnest opinion, Sirhan ... because of the unique circumstances of the case, is unaware even now that he did not fire the weapon that killed Senator Kennedy.

At fifteen minutes past midnight, there were two political extremists inside that kitchen pantry of the Ambassador Hotel on the fifth of June, 1968. At the moment of firing, Sirhan was situated in front of both Senator Kennedy and the former Ambassador Maitre d', Mr. Karl Uecker.

Behind Senator Kennedy, at extremely close range, on the presidential candidate's right side, was Thane Eugene Cesar, a private security man, he was neither working full-time on the staff of the Ambassador nor employed directly by Senator Kennedy's staff. Cesar was part of a small external security force brought into the hotel from the outside. Mr. Cesar is a far right extremist, a George Wallacite, who opposed both President John and Bobby Kennedy, the Kennedy family, the Democratic party and the political philosophical aims of presidential candidate Bobby Kennedy.

Our two year probe conclusively reveals that "Gene" Cesar — as he is commonly known — drew his own gun instantaneously with the gun of Sirhan popping in front of Karl Uecker; there was a significant pause after the second shot. Eyewitness Donald Schulman, formerly affiliated with KNXT news in Hollywood, California — the Columbia Broadcasting System — witnessed this double shooting. Former Deputy District Attorney, David Flynn, informed the jury in the Sirhan trial, that the first bullet probably killed Senator Kennedy. The first bullet, in our opinion probably grazed Senator Kennedy. The second bullet, after the short pause, between the first and second shot, our research concludes, passed harmlessly through the right shoulder pad of Bobby Kennedy's suit striking Paul Schrade, west coast director of the United Automobile workers, who fell to the floor with a head injury.

The next three bullets originated from the rear

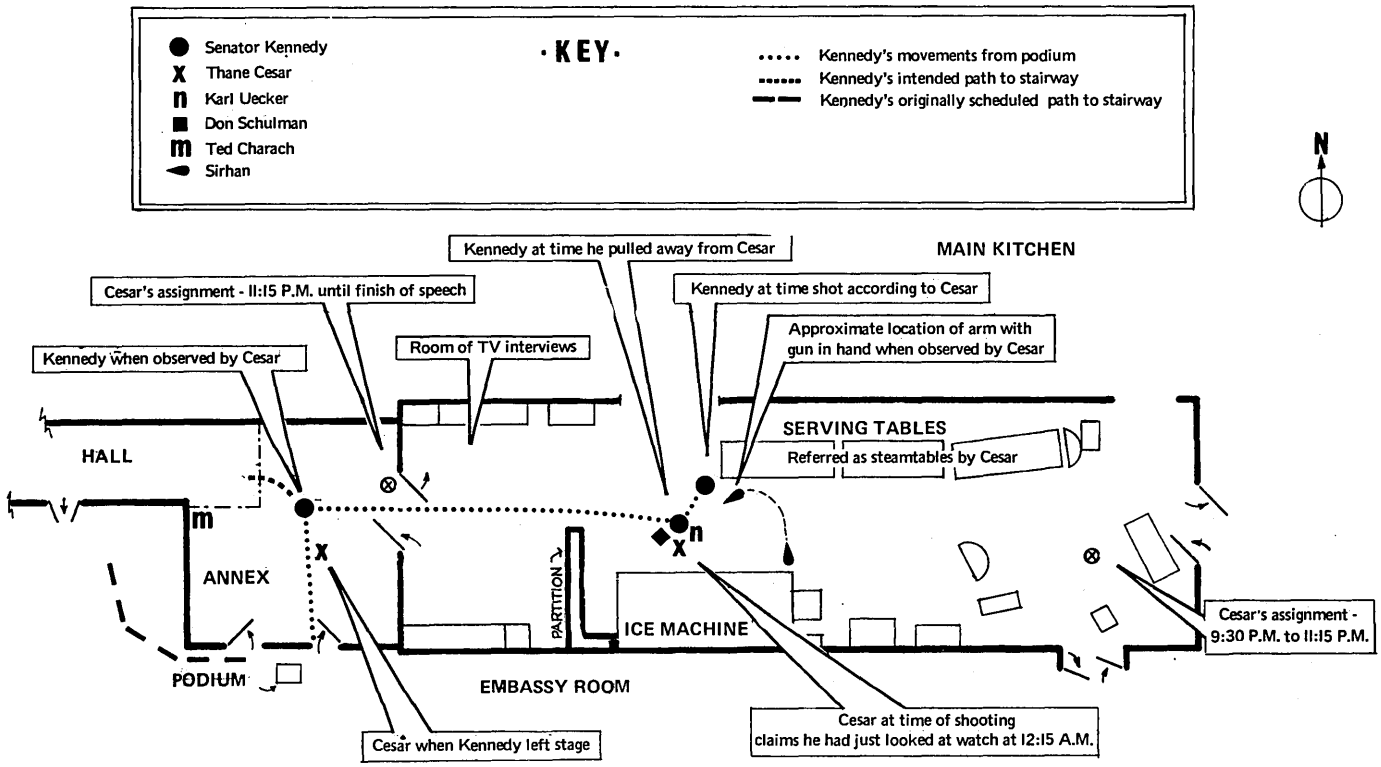


Figure 1

MAP OF THE SCENE OF THE ASSASSINATION OF SENATOR ROBERT KENNEDY

A map of the area in the Ambassador Hotel, Los Angeles, where Senator Robert F. Kennedy was shot to death on June 5, 1968. This map is reprinted from the Los Angeles Free Press, June 12, 1970, where it accompanied the article published about the suit of Theodore Charach against the Los Angeles Police Department. No map of the scene of the assassination appears in the book "Special Unit Senator" by Robert A. Houghton.

— from behind Senator Kennedy. The directions, according to our tapes and documentations last year with Dr. Thomas T. Noguchi, the Chief Los Angeles County Medical Examiner and Coroner, confirmed that the wound path of three bullets not only emanated from back to front, but in a conspicuous upward direction.

Of immense significance to this historic case is the fact, revealed by Dr. Noguchi, that the fatal rear bullet — behind Senator Kennedy's right ear and mastoid (the head wound) — scattered bullet fragments and left deep gun powder burns. The fragmentations were lost within the presidential candidate's brain tissue. Eye-witness Donald Schulman at the time saw a security guard, at close proximity to Senator Kennedy, draw his gun, and fire his gun. He reported to us at the time — my own independent news service, telecommunications, augmented by Continental News Recorders, directed by Jeff Brent — that Senator Kennedy had been hit three times.

Mr. Schulman was certainly one of history's most important eyewitnesses inside that kitchen pantry. Yet District Attorney Younger — in his final public report to the American people in this case, in May, 1969 — does not even list Schulman as a prime witness among the 199 witnesses (including myself), who were not called to testify. To this day, Mr. Schulman has never even had an in-depth interview by the LAPD in an extraordinary case involving the death of a United States Senator. District Attorney Younger, supported by Chief Houghton, informed us all the witnesses were identified inside the Ambassador kitchen. In interviews and re-interviews — almost 5,000 persons were interviewed. Why? Nor does the Los Angeles Police Department acknowledge the fact that my news colleague, Jeff Brent, taped voice actualities inside that kitchen pantry, over the actual sound and fury of the second Kennedy assassination.

It was these tapes which aroused my professional curiosity and journalistic interest and enabled me to reach the heart-breaking conclusions that we are revealing this morning. The Don Schulman interview was recorded on the spot inside the Ambassador Hotel, only ten minutes after the assassination.

It is our sincere belief, after 24 months of continual investigation and probing — with all the

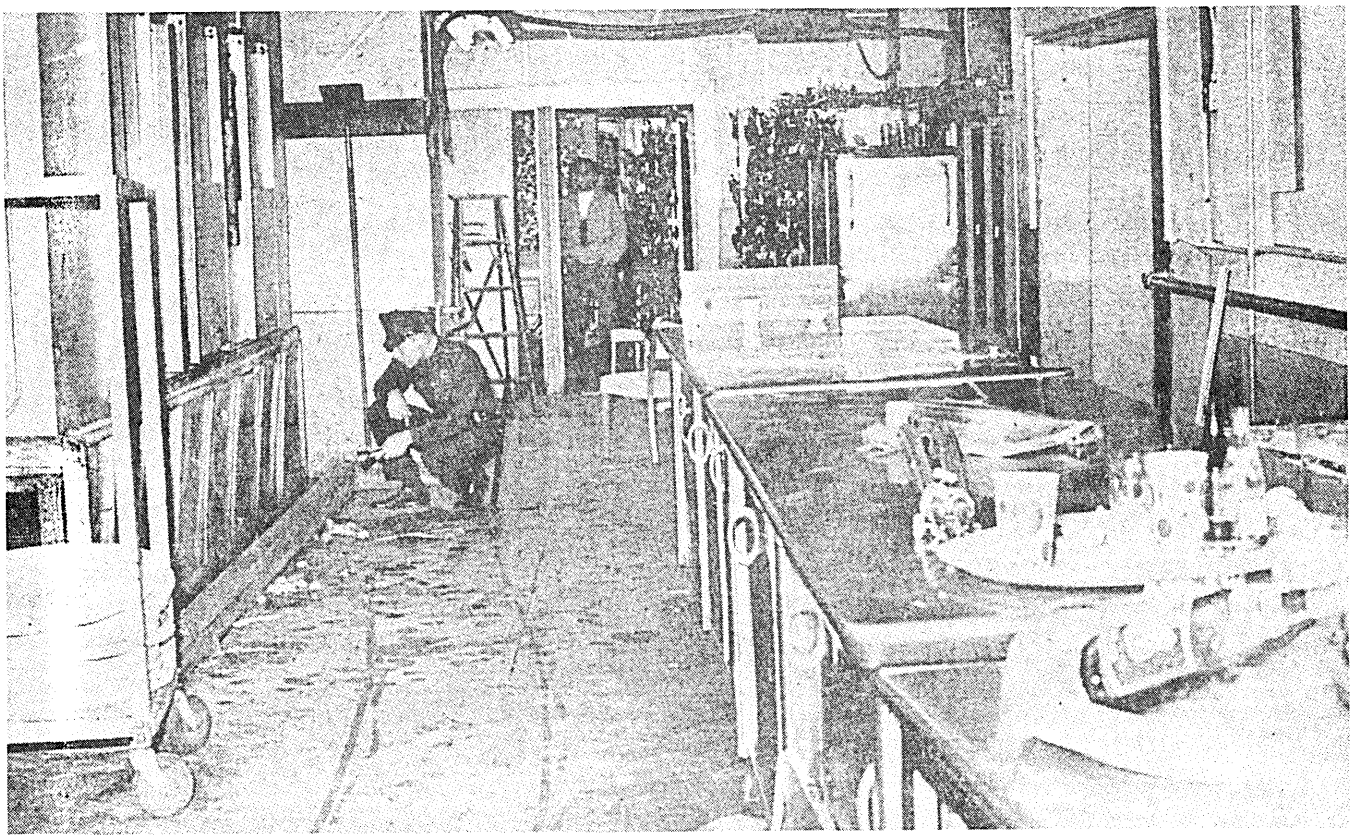


Figure 2

THE PANTRY WHERE SENATOR ROBERT KENNEDY WAS ASSASSINATED

The police officer is kneeling at the spot where Senator Robert Kennedy was shot down after walking through the pantry doors in the rear.

This picture is a copy of a Los Angeles Times photograph by Gene Hackley, and was evidently taken on June 5, 1968, while the police were still investigating in the Ambassador Hotel pantry.

This picture shows the facing of the center divider of the pantry doors to be missing. (Compare with the facing on the top and the side of the door.) This fact is in agreement with the statement in the affidavit regarding the Clemente photograph (Figure 4) of June 6, 1968, that: "It appeared that an attempt had been made to dig the bullets out from the surface. However, the center divider jamb was loose, and it appeared to have been removed from the framework so that the bullets might be extracted from behind. It was then replaced but not firmly affixed."

At the left of the picture is the tray stacker stand, by which, according to witness Di Pierro, Sirhan B. Sirhan stood waiting, with a smile on his face, next to a girl in a polka-dot dress. At the right in the photograph is the entrance to the main kitchen.

No picture of the scene, and no discussion of the recovery of bullets, appears in the book "Special Unit Senator" by Robert A. Houghton.

key witnesses — that the American people have been deceived, duped, and a fraud has been perpetrated upon us by those law enforcement agencies charged with the responsibilities in this matter. Let us not forget that in 1968 we were robbed of a possible choice at the ballot box, an opportunity to vote for or against a potential presidential candidate. The Houghton Report is a conglomeration of official falsehood, distortions, half-truths, discrepancies and suppressed information. The Los Angeles Police Department has been derelict in its duties and performances in the service of the people. An anxious world depends on the integrity, honor and justice of this nation.

The findings and evidence, new discoveries in this sensitive case, demonstrate gross negligence, incompetence and suppression of vital evidence. In some cases, great psychological pressure and intimidation was utilized by members of Special Unit Senator to compel witnesses "to change their personal accounts of the tragedy".

It is our opinion that Karl Uecker's heroic actions saved the life of Senator Robert Francis Kennedy before the intervention of the second weapon.

David Fitts, prosecuting the case in behalf of the people, told the Sirhan trial that Uecker probably reacted after the fourth shot. Mr. Uecker has never deviated from his testimony before the grand jury. He placed Sirhan in a firm headlock and definitely stopped Sirhan's gun from shooting in the direction of Senator Kennedy — positively and unequivocally, after the second shot — during that dramatic pause. There is a reliable witness to back Mr. Uecker in his testimony. From the morning of the assassination until now, I am grateful for Mr. Uecker's generous contribution in the interest of truth, justice and history — and furthering knowledge to the American people. It is my sincere hope that our probe will lead us all to re-examine this cancer of crisis which inflicts our political climate — the American political assassination syndrome — and prevent re-occurring slaughter of our most sensitive, dedicated, moral, spiritual and political leaders.

I congratulate Dr. Noguchi who, in face of an unprecedented assault on his character, integrity and medical professionalism, granted our probe the complete disclosures of the Robert F. Kennedy autopsy during his ouster in 1969. I am deeply indebted to our attorney, Mr. Godfrey Isaac, in his untiring efforts in behalf of this entire probe, for his unselfish dedication throughout the Noguchi hearings, the repudiation of those false and wild charges, and Mr. Isaac's concerned efforts and loyalty to the cause of truth, with justice.

We are the witnesses, and we will not remain silent, lest history judge us with the guilty. A disillusioned society requires that we do care — especially the youth, the blacks, the poor, the disenchanted who gave everything they possibly could give in Senator Kennedy's campaign for change and reconciliation and an end to this mindless menace of senseless killings. To the countless witnesses who gave us their valuable time, their testimony, their evidence — volunteering freely this information so that the entire truth is exposed in this national tragedy — I personally extend my gratitude and thanks. In this spirit we can still arouse the conscience of the American people — for change and for truth.

I especially hope the many witnesses who have been afraid to come forth ... who have been intimidated, who have something more, and truthful, to add, to this overall case ... will co-operate with us, wholeheartedly co-operate for truth and justice. I know, Mr. Isaac joins me in extending an open door

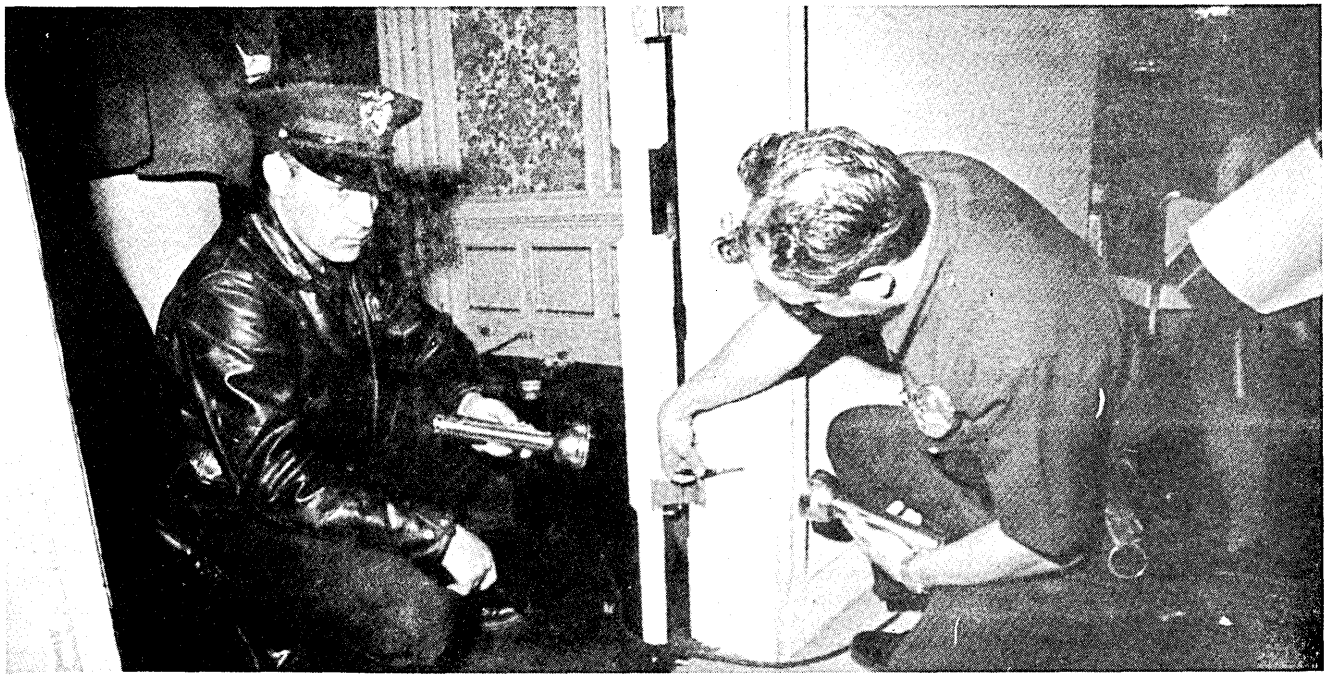


Figure 3

BULLET HOLE IN THE FRAME OF A DOOR

This picture was taken on June 5, 1968, within a short time after Senator Robert Kennedy was shot, and was printed in a Los Angeles newspaper on that day. A police technician is inspecting a bullet hole discovered in the frame of a door between the stage and the kitchen corridor, in the Ambassador Hotel, Los Angeles. The bullet is still in the wood, according to the original caption. The picture was reproduced and issued by the Kennedy Assassination Truth Committee. There is no mention of this bullet or bullet hole in the book "Special Unit Senator" by Robert A. Houghton.

in this continual search for all the facts. His Beverly Hills office invites your calls. The tapes you are hearing today are brief extracts, copies from my original tapes and audio/visual documentation in the Robert Kennedy probe.

Mr. Karl Uecker has a brief statement before questions at this time, because this is a legal matter, a case for the court of law; so he will rest his testimony with our tapes, films, sound recordings and other relevant matter.

Let us join together in this spirit of concern and enlightenment and change — as Bobby Kennedy cried to every American, those who loved him and those who hated him — on the critical issues of our times. In view of the outrageous cover-up, and falsehood in the Houghton Report and the Sirhan trial, we must now ask, as Bobby did, "Why did we permit it to happen? We must ask why, and you and I must ask our consciences ..." □

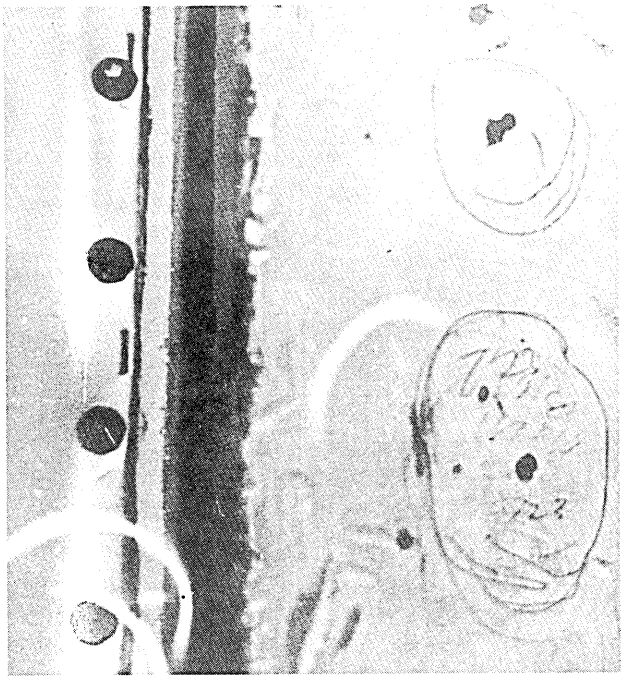


Figure 4
TWO BULLET HOLES IN THE CENTER DIVIDER OF THE PANTRY DOORS

This picture, taken June 6, 1968, shows the wooden jamb of the padded swinging pantry doors in the kitchen area near the Embassy Room of the Ambassador Hotel, Los Angeles. The picture shows circled bullet holes; one of them apparently is marked either 223 or Z 23. This picture was taken by John R. Clemente, an associate of the Kennedy Assassination Truth Committee, (P.O. Box 38524, Los Angeles, Calif.), on the morning of June 6, 1968.

John Shirley, who accompanied Clemente said in an affidavit: "In the wooden jamb of the center divider were two bullet holes surrounded by inked circles which contained some numbers and letters. I remember a manager pointing out these particular marked bullet holes to another person, who appeared to be a press photographer. It appeared that an attempt had been made to dig the bullets out from the surface; however, the center divider was loose, and it appeared to have been removed from its framework so that the bullets might be extracted from behind. It was then replaced but not firmly affixed." There is no mention of these bullet holes in the book "Special Unit Senator" by Robert A. Houghton.

COMPLAINT FOR THE DISCLOSURE OF INFORMATION

SUIT: THEODORE CHARACH VS. THE LOS ANGELES POLICE DEPARTMENT, JUNE 4, 1970

The following is the text of the suit brought by Theodore Charach against the Los Angeles Police Department, June 4, 1970. The news of this suit seeking disclosure of information was apparently omitted from almost all newspapers in the United States. Consequently, Computers and Automation publishes this information for the record.

SUPERIOR COURT OF THE STATE OF CALIFORNIA
FOR THE COUNTY OF LOS ANGELES

No. 978371

COMPLAINT FOR DISCLOSURE OF INFORMATION

(Gov. Code #54950)

THEODORE CHARACH: on behalf of himself, and all other residents of the State of California.

Plaintiff

vs.

THE LOS ANGELES POLICE DEPARTMENT, EDWARD M. DAVIS, individually and as Chief of Police of the City of Los Angeles, and as representative of the class of members of the Los Angeles Police Department, ROBERT A. HOUGHTON: individually and as Deputy Chief of Police of the City of Los Angeles and as author of the published book, Special Unit Senator: EVELLE J. YOUNGER: individually and as District Attorney of the County of Los Angeles, and as representative of the class of members of the Office of the District Attorney of Los Angeles County, and DOES ONE thru FIFTY, inclusive.

Defendants

Plaintiff alleges on behalf of himself and all other residents of the State of California:

I

The subject matter of this action is one of a common or general interest of many persons, who are so numerous that it is impracticable to bring them all before the Court. These other persons are affected in exactly the same manner as plaintiff is affected, and plaintiff brings this action for the benefit of all such persons.

II

This action is brought pursuant to Government Code #54950, which provides as follows:

"In enacting this chapter, the Legislature finds and declares that the public commissions, boards and councils and the other pub-

lic agencies (emphasis added) in this state exist to aid in the conduct of the people's business. It is the intent of the law that their actions be taken openly and that their deliberations be conducted openly.

The people of this state do not yield their sovereignty to the agencies which serve them. The people, in delegating authority, do not give their public servants the right to decide what is good for the people to know and what is not good for them to know. The people insist on remaining informed so that they may retain control over the instruments they have created. (emphasis added)"

III

Defendant LOS ANGELES POLICE DEPARTMENT is the agency and department of the City of Los Angeles, State of California, responsible for the police protection of that City within the State of California, and for the police investigations of all crimes committed within that City. Said defendant does not have the right to decide what is good for the people to know and what is not good for them to know.

IV

Defendant EDWARD M. DAVIS is the Chief of Police of the City of Los Angeles, State of California. He is responsible for the supervision, control, regulation and management of the Police Department and each and every officer thereof, and for the investigation into all crimes committed within the City of Los Angeles, and, in June of 1968 as Deputy Chief of Police, particularly that investigation into the murder of Senator Robert F. Kennedy on June 5, 1968. He is empowered and has the responsibility to set policy for and to make and enforce all necessary and desirable rules and regulations of said Police Department. He is sued individually and in his capacity and as representative of the members of the defendant Police Department, who have carried out, and continue to carry out a course of conduct which has suppressed, and continues to suppress important, valuable and relevant information concerning the investigation into the murder of Senator Robert F. Kennedy by said Police Department, and which has and continues to deprive the citizens and residents of the State of California of the full and uncensored information concerning the assassination of Senator Robert F. Kennedy.

V

Defendant EVELLE J. YOUNGER is, and at all times herein mentioned has been the District Attorney of the County of Los Angeles, State of California. As such, he is its public prosecutor, responsible for the prosecution of all public offenses. He is responsible for the supervision, control, regulation and management of the Office of the District Attorney, and each and every member thereof, and for the trial of all felonies committed within the County of Los Angeles, and particularly that trial known as "The People of the State of California vs. Sirhan Bishara Sirhan," alleging the murder of Senator Robert F. Kennedy. He is empowered and has the responsibility to set policy for and to make and enforce all necessary and desirable rules and regulations of said Office of the District Attorney. He is sued individually and in his capacity as representative of the members of the Office of the District Attorney, who have carried out and continue to carry out a course of conduct which has suppressed and continues to suppress important, valuable and relevant information concerning the investigation of the murder of Senator Robert F. Kennedy, and particularly concerning the prosecution in the trial known as " The People of the State of California vs. Sirhan Bishara Sirhan," and has and continues to deprive the citizens and residents of the State of California of the full and uncensored information concerning said murder.

VI

Defendant ROBERT A. HOUGHTON, in June of 1968, was Chief of Detectives, and is now Deputy Chief of Police of the City of Los Angeles, State of California. During the early part of 1970, said defendant wrote, authored, caused to be copyrighted and released for publication a book entitled "Special Unit Senator" in the foreward of which he said, among other things, "It was written for the sole purpose of acquainting the American public with the facts of the investigation, and with the evidence, or lack of evidence, as it exists, of conspiracy in association with Senator Kennedy's assassination..."

VII

Pursuant to the policies set forth in Government Code #54950, as aforesaid, plaintiff, as a resident of the State of California, and all of the people of the State of California, are entitled to know all the facts and evidence uncovered by the defendant LOS ANGELES POLICE DEPARTMENT and the investigation by its "Special Unit Senator" under the leadership of defendant ROBERT A. HOUGHTON, and all the facts and evidence within the knowledge of EVELLE J. YOUNGER and the Office of the District Attorney in connection with the trial of "People vs. Sirhan," and the murder of Senator Robert F. Kennedy, which facts and evidence disprove that Senator Robert F. Kennedy was killed by a bullet fired from the gun of Sirhan Bishara Sirhan, and disprove that no other guns were brandished or fired at or within seconds of the time that Sirhan B. Sirhan fired his gun, and which disprove that the fatal bullet came from the direction of Sirhan Bishara Sirhan at that time and place.

VIII

Contrary to the policy as set forth in Government Code #54950, as hereinabove set forth, said defendants, and each of them, have deliberately, intentionally and knowingly suppressed facts and evidence within their knowledge and control, and continue to do so, usurping the right of the People to remain informed and on the part of said defendants, and each of them, attempting to decide what is good for the People to know and what is not good for them to know.

IX

The suppressed facts and evidence referred to in paragraph VII above include the following:

A. At the time Sirhan Bishara Sirhan commenced firing of his pistol, Donald Schulman, an employee of Los Angeles television station KNXT, was directly behind Senator Robert F. Kennedy and saw a uniformed security guard fire his hand gun, and said Donald Schulman saw Senator Kennedy hit by three bullets. Defendant EVELLE J. YOUNGER, the District Attorney, did not call Schulman to testify before the grand jury or at the trial of Sirhan Bishara Sirhan, nor did he mention Schulman in his report to the People of this state at his press conference reporting on the Kennedy murder, despite the fact that Schulman was interviewed by television newsmen within minutes

of the shooting, and reported the firing by a security guard, which interview was both broadcast on television and reported in numerous newspapers.

B. KARL UECKER, the maitre de who was escorting Senator Kennedy through the kitchen of the Ambassador Hotel, moved quickly and grabbed Sirhan in an arm and head lock after the second shot fired by Sirhan. Immediately after subduing Sirhan with the help of Roosevelt Grier and Rafer Johnson, UECKER saw a security guard with his gun drawn and in his hand.

Defendants, and each of them, deliberately, intentionally and knowingly suppressed this evidence from the People of the State of California by not presenting it to the grand jury or at the trial of People vs. Sirhan through their questioning of Mr. Uecker.

C. Defendant ROBERT A. HOUGHTON indicates in his book "Special Unit Senator" that the Los Angeles Police Department ascertained that there was no possibility of any person with right-wing connections being in the kitchen or pantry the night of June 4-5, 1968. The facts are that THANE EUGENE CESAR, a part-time employee of Ace Security Guard Service, was assigned to the Ambassador Hotel to augment the hotel's security staff. CESAR was a vocal supporter of George Wallace in the presidential election of 1968, and worked on behalf of the American Independent Party during that election year, and was associated with other right-wing views and activities, and has expressed his hatred for the Kennedy family of which Senator Kennedy was a member, and has expressed his resentment toward liberal views held by said Senator, specifically including the Senator's identification with the black community.

D. THANE EUGENE CESAR was accompanying Senator Kennedy and KARL UECKER through the kitchen after waiting at the swinging doors leading into the room where the Senator was shot. CESAR admits drawing his hand gun at the time Sirhan B. Sirhan began firing, and being on the floor with his back against the ice machine behind and below and to the right of Senator Kennedy, close enough to receive powder burns.

The shot that fatally wounded Senator Robert F. Kennedy came from back to front, from down to up, and from right to left. Sirhan Bishara Sirhan was never in that position, but CESAR was. In addition, CESAR has admitted that he owned a .22 caliber pistol similar to Sirhan's, but does not presently know the whereabouts.

Defendants, and each of them, have deliberately, intentionally and knowingly suppressed this evidence from plaintiff and from the People of the State of California by not calling CESAR to testify before the grand jury or at the trial of People vs. Sirhan. As further suppression of CESAR's part in the tragedy, the police report of the "Special Unit Senator" stated that there were no security guards at the swinging doors prior to the time of the shooting, and that no persons of right-wing connections were in the kitchen at the time of the shooting.

E. The autopsy report prepared by DR. THOMAS T. NOGUCHI, Los Angeles County Chief Medical Examiner and Coroner, conclusively proves that:

1. Senator Kennedy died as a result of a gunshot wound in the head, the wound trajectory being back to front, right to left, and upward.

2. The head wound was inflicted from a distance of from one inch to a maximum of three inches away.

3. Senator Kennedy had two contact gunshot wounds under his right armpit which were inflicted from less than six inches away.

Despite the fact that defendant ROBERT A. HOUGHTON in his book referred to "Special Unit Senator" as "the longest, largest and most expensive criminal investigation ever undertaken by the Los Angeles Police Department, possibly the most extensive investigation ever conducted by any local law enforcement agency," nevertheless, the defendant EVELLE J. YOUNGER, through his deputy district attorneys, intentionally and knowingly suppressed the evidence hereinabove referred to from the People of the State of California by asking only generalities of DR. THOMAS T. NOGUCHI, and not specifics, at the trial of Sirhan Bishara Sirhan and, by the suppression of these facts and this evidence from the People of this State by the defendants, and each of them, the plaintiff and other citizens and residents of the State of California were prohibited from being fully informed and were told only what said defendants decided was good for them to know.

X

Plaintiff is informed and believes, and therefore alleges, that defendants are in the possession of many other facts which disprove the "lone assassin" theory put forth by the defendants at the trial of People vs. Sirhan, but that defendants have repressed these facts from the People of the State of California.

XI

The repression of the facts and evidence set forth herein, but not limited to that set forth herein, is contrary to the policy of the State of California as expressed in Government Code #54950, and is a violation of the public trust.

XII

The true names or capacities, whether individual, corporate, associate or otherwise, of defendants named herein as DOES ONE through FIFTY, inclusive, are unknown to plaintiff, who therefore sues said defendants by such fictitious names, and plaintiff will amend this complaint to show their names and capacities when same have been ascertained.

WHEREFORE, plaintiff, on behalf of himself and all other citizens and residents of the State of California, prays for judgment as follows:

1. That defendants, and each of them, be enjoined from determining what is good for the people to know and what is not good for them to know, and be ordered to disclose and make public all of the facts and evidence revealed by their investigation into the murder of Senator Robert F. Kennedy.

2. That defendant ROBERT A. HOUGHTON, DOE ONE, DOE TWO, DOE THREE and DOE FOUR be enjoined and restrained from further publication, distribution or sale of that book entitled "Special Unit Senator" without revealing and disclosing all of the facts and evidence contained in the investigation headed by ROBERT A. HOUGHTON into the murder of Senator Robert F. Kennedy.

3. That defendants, and each of them, be ordered to fully and fairly report to the People of this State as to the advisability of recommending the establishment of a special federal investigating agency to fully, fairly, dispassionately, openly and diligently investigate and report on the assassinations of federal officials, elected representatives and persons of national prominence to resolve all issues and questions, and help prevent future tragedies.

4. For such other and further relief as to the Court may seem just.

GODFREY ISAAC
Attorney for Plaintiff
THEODORE CHARACH

C.a

REPORT FROM GREAT BRITAIN

I hang my head with the other pollsters and place on record the fact that after five results in our recent election the computers gave Heath and his Tory party a 100 seat lead over Labour. Later this was fined down to 30, but only one opinion poll prior to the event showed there was a rapid swing in progress which might just allow Heath to "scrape" in. The scrape has turned into a comfortable majority.

A New Political Climate

What effect can this change of political climate to the avowed Tory policy of fair competition have in the computer world?

It is significant that IBM already is wooing the new administration as hard as it can. On the day of the poll declaration it already announced plans for a new $25m administrative headquarters and, as I write, we are all expecting it will shortly be disclosed that a major new product will be built in Britain.

The Fate of ICL

On its side ICL is staying very quiet. Heath, when still in opposition, told the company chairman, Sir John Wall, that the Tories wanted out of involvement with industry. This means that ICL will have to find a way of refunding the Government's $25m, if and when it is requested.

This should be no serious problem since the shares of the company have behaved particularly well during the recent sharp declines on the London Stock Exchange. Half-year returns show turnover up by 12 per cent at $160m and pre-tax profits rising 25 per cent to just over $9m. True profit was nearer $12m, but loan and interest payment took the difference.

Reflecting increased work on its new range, research and development spending in the six months went up to nearly $15m or about 20 per cent advance.

ICL's sales growth has lagged behind that of the market for the time being. But this is almost inevitable because of new range talk and the fact that ICL has almost played down the vast improvement made to its existing 1900 series through conversion to integrated circuits. Two machines thus converted, the 1904A and the 1906A, are in the opinion of the few American computer men who know them, first class designs with exceptionally fast logic.

The 4A has sold very well and 15 of the 6A have been placed for a total of $41m. The first 6A is scheduled for delivery in September, and will have immediately available for it most of the software from the very large machines of the earlier 1900 series as well as Atlas.

ICL's Repayment Alternatives

So, not a serious problem to repay in a "between ranges" trough, but a problem nevertheless.

It could be solved in one of two ways. The first, and most likely to my mind would be for the Plessey Company, holders of 18 per cent of the ICL equity, to take a majority shareholding. The only obstacle is the current Plessey $140m bid for the U.S. Alloys component group.

With that out of the way, and having found, say, another $72m, Plessey could go ahead and take control of ICL, thus buying an extremely valuable outlet for its UK component production lines, which are not all that healthy at the moment. There is good reason to believe Plessey has already tried to move in this direction before the election, and at least twice, but came up against the determined opposition of the former Minister of Technology, Wedgwood Benn. Benn clearly preferred to have his man on the ICL board in a position of primus inter pares – not from the actual Ministry shareholding, but because of the bounty of the Ministry is in a position to dole out in the form of research support and backing of ICL bids for Government-owned machines.

I think the new administration would thank anyone who took ICL problems out of its hair.

The Plessey involvement in this way would not run counter to ICL/CDC arrangements. Indeed there is the making of a joint venture in which CDC would provide big machines and big peripherals and ICL small to medium equipment, with Plessey supplying advanced peripheral ideas and the new circuits to back them.

ICL and CDC

This makes more good international sense, bearing in mind the many Plessey outlets all over the world, than the second possible solution – a straight merger of ICL and CDC.

For CDC, any further capital outlay at the moment is likely to make stockholders faint. For ICL, after years in an extremely jingoistic position, to rush into the arms of a transatlantic wooer could cause serious internal traumas.

What this sort of move would do to the tenuous links ICL has set up with suspicious and unwilling European partners is not hard to guess.

Indeed, the only European company which would not frown on such a deal is Philips of Eindhoven which – so far – has not been mentioned in any possible European link-up with ICL.

Maybe there is yet another possibility – an ICL, CDC, Philips "tripod". This would have the advantage of even more outlets than a Plessey merger, but the grave disadvantage the Philips has its own ideas on computers.

Come what may, however, ICL must grow much faster than it has been, since it is only just over the technology threshold which ensures survival – but survival in the computer world is not synonymous with prosperity.

Ted Schoeters
Stanmore, Middlesex
England

PUNCH LINES . . .

Practically every day newspaper and magazine headlines talk about new computer accomplishments. And still, never before have so many understood so little about an industry which is already affecting everyone's life and which is ultimately going to impact every human activity in a way that no invention ever has.

– *Sam Matsa*
IBM Corp.
New York Scientific Center
410 E. 62nd St.
New York, N.Y. 10021

It has often been said that a computer is properly considered an extension of man's mind. If this is so, the computer must be considered as an extension of all aspects of man's mental capabilities. This, in turn, implies that **if man's major efforts are to be directed toward improving the conditions of human life, the computer will find its major applications in these areas in the coming decades.** The real challenge, then, is to apply the computer to such broad social problems as education, health, population growth, pollution control, resource analysis, and transportation. Can we meet that challenge?

– *George Fierheller, Pres.*
Systems Dimensions Ltd.
770 Brookfield Rd.
Ottawa 8, Ontario, Can.

Designers of computer software have demonstrated little or no understanding of the fundamental principles of human factors engineering, and have ignored the requirements of man-computer interaction. Nearly all systems involve human operators in a complex interaction with a computer, yet operators continue to complain about operating difficulties directly traceable to software. Over the next few years, systems users will become increasingly sophisticated in their expectations, and will become more aware that two software designs that appear to be functionally equivalent can be completely different in their contribution to the effectiveness of a computer system.

– *Joseph G. Wohl,*
Vice Pres. for Information Sciences
INFOTON, Inc.
Second Ave.
Burlington, Mass. 01803

Certainly one development of our evolving society in the last century is that the somewhat puritanical relationship between toil and income is going to disappear, and therefore one has to think in wider terms of activity than work alone. Certainly we must ponder education, not only as job preparation which is the present concern, but ponder education consciously for its contribution to what one might call nonwork. **We must find the moral equivalent for work.**

– *John Hargreaves, Director*
Public Affairs
IBM United Kingdom, Ltd.

Technology has completely changed the marketplace in ways that are sometimes good and sometimes bad, but nearly always frustrating. **The faceless anonymity of the marketplace is the supreme source of consumer frustration.** We live in an age where the things we want to buy are too complicated for us to fix, and it costs too much to have things fixed by somebody else. We don't know what performance to expect from our purchases. We may see the man we buy it from only once, or infrequently at best, and he has never seen the man who designed or made the product, and neither has the man who is supposed to fix it. The solution to this problem lies in the adoption of a more rational process for setting standards – and the adoption of performance standards rather than design standards.

– *Lewis M. Branscomb, Director*
National Bureau of Standards
U.S. Dept. of Commerce
Washington, D.C. 20230

The quality of the scientists we hire today determine the quality of our research five, ten or twenty years from now. **Because 65% of our research expenditures are either for salaries, or are controlled by salary costs, research and development managers should realize that they can help technical personnel achieve much more than they might otherwise.** To do so, such managers must keep up with both technical and business changes and must be concerned with salary and position status for their people. In addition, they should provide those working with them with opportunities to keep current through seminars, to participate in technical society meetings, and to publish results of their research.

– *Charles M. Brelsford*
Business Manager
Kodak Research Laboratories
343 State St.
Rochester, N.Y. 14650

Presently computer hardware represents 80 to 85% of the purchasing dollars in the computer field. Software represents approximately 10 to 15%, and services represent about 5%. In the next ten years, we are going to see a complete reversal of this ranking. **Services are going to become the major segment of the computer industry, representing well over 50% of the purchasing dollar; second will be software, and third will be the hardware.** This shift will be caused by the shift to the external use of computer power through the computer utility and away from internal, in-house computer usage.

– *Joan M. Van Horn, President*
VIP Systems Corp.
1145 19th St. N.W.
Washington, D. C. 20036

C.a NUMBLES

Neil Macdonald
Assistant Editor
Computers and Automation

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. This month's Numble was contributed by:

Stuart Freudberg
Newton High School
Newton, Mass.

NUMBLE 708

```
      T H E Y
    x K N O W                EY = WA
      O L A T D
    L W E O Y
  A N D H Y
W T T N D
= A W T E T W O D
- A W L A E D D T
=     A S W E L L
```

81580 37385 96

Solution to Numble 707

R = 0	P,W = 5
G = 1	E = 6
I,L = 2	A = 7
D,S = 3	T = 8
N = 4	O = 9

The message is: A gentle word opens an iron gate.

Our thanks to the following individuals for submitting their solutions to **Numble 706**: A. Sanford Brown, Dallas, Tex.; Murray A. Chayet, Tucson, Ariz.; T. Paul Finn, Indianapolis, Ind.; Henry F. Greene, Durham, N.C.; David C. Niven, Columbus, Ohio; Lambert J. Simon, Irving, Tex.; and Robert R. Weden, Edina, Minn.

PROBLEM CORNER

Walter Penney, CDP
Problem Editor
Computers and Automation

PROBLEM 708: A COIN TOSSING PROGRAM

"I'd like you to write a little program for me," said Bill, breezing into the Computer Center. "A coin tossing program."

"Not another program that's supposed to out-think a human in matching pennies, I hope." Al was obviously not very enthusiastic.

"No, I'm pretty sure of the answer to this one – I just want some experimental verification."

"Like what?"

"I'd like you to generate about a million random bits. We'll call 1's heads and 0's tails and see whether my calculations are correct. If they are we may make some coffee money from this."

"O.K. What does the game consist of?" Al was still a little skeptical.

"Well, two people play and each picks some sequence of heads and tails, three long, say H T H and H H H. Then a coin is tossed repeatedly until one of these sequences occurs. The person whose sequence occurs first wins."

"Since the chance of any pattern occurring is 1/8 won't all patterns be equally likely?"

"That's what most of the people around here will think. But there are good patterns and bad patterns. If I've done the arithmetic correctly, the average number of tosses required for H H H is 14, but for H T H is only 10."

Al looked dubious. "I still think they all have probability of occurrence of 1/8 and hence should all have the same average number of tosses."

Who is right?

Solution to Problem 707: Finding the Value of a Smudge

The missing letter must be F, since no other letter will yield a solution. With F in place of the smudge, we have 802539 + 207946 = 1010485.

Our thanks to the following individuals for submitting their solutions to **Problem 705**: Murray Berg, San Francisco, Calif.; Arthur D. Bernstein, Los Angeles, Calif.; Murray A. Chayet, Tucson, Ariz.; Lois G. Dellner, N. Olmsted, Ohio; and William Lasher, Seabrook, Md. – and to **Problem 706**: Murray Berg, Oakland, Calif.

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.

ACROSS THE EDITOR'S DESK

APPLICATIONS

MILLION-DOLLAR SCOREBOARD AT PIRATES NEW STADIUM IS COMPUTER-CONTROLLED

Three Rivers Stadium, new home of the Pittsburgh Pirates baseball team, has installed a million-dollar information display scoreboard in center field. The scoreboard, towering 30 feet high and 274 feet long, was designed and developed by the Stewart-Warner Corp., Chicago, Ill.; it is controlled by a Digital Equipment PDP-8/I computer. The PDP-8/I, located in the press box area, allows a non-technically oriented operator to manipulate a series of push buttons on a keyboard console, which in turn cause words: to move in, up, down, or laterally; to expand or contract; and, to rotate via a series of static and moving light displays.

The master scoreboard is divided into three sections: from left to right as one faces it, there are (1) message centers, 25'H x 30'W, consisting of 19,500 red and white lamps; (2) a section having 3 changeable faces 18'H x 24'W (used to display the American flag, the Three Rivers Stadium emblem, and the Pirates emplem); and (3) a "game in progress" section, 20'H x 60'W, with various lamping arrangements to display current game information. The board, in addition to keeping a running record of the sports events in progress, may flash spot announcements, give newscasts, run commercials, conduct sing-alongs, and even lead cheers. Relying on techniques from the movie industry, the scoreboard also uses cartoon animation.

COMPUTER AIDS DOCTORS SEEKING CAUSE OF STROKES

The Capital Stroke Project of the Iowa Heart Association has launched a pioneer program to gather information on stroke patients over a 3-year period and analyze it on an IBM computer. The project, sponsored by the Iowa Heart Association in cooperation with the Iowa Regional Medical Program, covers four Iowa counties — Polk, Dallas, Madison and Warren. The project is expected to allow correlation of many facts (impossible to relate without a computer) to assist in diagnosis, treatment and rehabilitation of stroke patients.

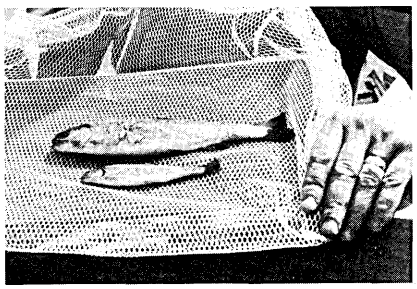
Private physicians refer patients to the Stroke Unit located at Mercy Hospital in Des Moines. One hundred and thirty-three stroke patients were admitted during the first year of operation for an average stay of 12.5 days in the Unit. Data is obtained on each patient in such categories as physical therapy, occupational therapy, social service, internal medicine, nursing and neurology. A doctor codes the information for an IBM 1230 optical page reader which prepares the information for processing on the IBM System/360 Model 25 at Mercy Hospital.

Dr. Paul From, chairman of the project, said, "The IBM computer summary enables us to determine what factors stroke patients have in common. We will be able to set up mathematical models to answer such questions as: How important is blood pressure? Are lower or higher economic backgrounds a factor in strokes? Is race, sex or age a factor?" If the most important factors can be isolated, in addition to contributing to the doctor's knowledge of stroke diagnosis and treatment, the public can be educated on action for prevention.

Stroke, the third leading cause of death in the United States after heart disease and cancer, claimed more than 225,000 lives in 1968; an estimated million Americans are disabled to some extent by stroke.

IDAHO HATCHERY CONTROLS FISH FEEDING BY COMPUTER

The larger of these steelhead trout (shown below) was raised in closely controlled breeding ponds at Dworshak Dam Fish hatchery near Orofino, Idaho. The smaller, of the same age and type, was raised under ordinary river conditions. Army



engineers at the fish hatchery use an IBM 1800 system to control feeding and monitor water conditions in the special ponds where millions of newly hatched fish spend the first months of their lives.

The control system automatically delivers feed (selecting from three sizes of food pellets) to 84 ponds each hour in amounts precise to within a fraction of an ounce. The system is controlled to increase or diminish the food supply according to the size, the age of the fish and the water temperature. (Fish don't eat when the water temperature varies from the optimum, and the food supply is diminished accordingly.) The food pellets are carried by vibratory conveyors from storage hoppers to a blower-powered delivery system. Streams of air then push the pellets through pipes to the proper ponds.

The hatchery (which is operated by the U.S. Department of the Interior) eventually releases the young trout into the Clearwater River. From there they migrate to the Pacific Ocean, then return in two years to lay their eggs in the Clearwater's gravel shoals. In time, experts say, fish from the Dworshak hatchery will increase the supply of steelhead trout in the Clearwater, Snake and Columbia rivers all the way to the Pacific Ocean.

COMPUTER PROGRAM IDENTIFIES PLANTS

A computerized key may completely change the traditional methods of plant identification. A unique package of programs developed at Michigan State University (MSU), in East Lansing, now makes identifying that weed or flower a matter for the computer. Data containing characteristics are stored in a computer and can be constantly updated and expanded. (The MSU system is linked with a time-shared computer in Detroit.) The computerized key was originated by a botany senior, Larry E. Morse.

Identification programs can be programmed to allow the computer to lead a student to make an identification. In operation, the student lists the unknown plant's characteristics on the sending unit (a teletype connected by telephone lines to the computer). When enough information is received, the computer responds with a suggested identification; if insufficient data is received, the computer suggests that certain characteristics be added or rechecked. The sender can start with any plant characteristic and still receive the identification. In the old textbook key method, identification requires the botanist to supply specific characteristics in a definite order from beginning to end.

MSU presently has three courses for introducing graduate students to computer methods in plant identification and the organization of taxonomic data. "To our knowledge," says Dr. John H. Beaman, MSU botanist, "there are no other formal university courses in which the computer is used in the identification of a plant or animal."

PDP-8 PLAYS STEREO MUSIC

At Carleton University Faculty of Engineering (Ottawa, Ontario), a DEC PDP-8 plays stereophonic music. The music program was developed by former graduate students Reid Smith and David Harrison during 1968 and 1969 as a matter of interest on their own time. Two programs were developed: a coding program and a playing program.

The coding program is a symbolic tape of the music to be played, whereas the playing program plays the music by generating square waves of variable amplitude, frequency, length, and damping factor (each note described by one 12-bit word).

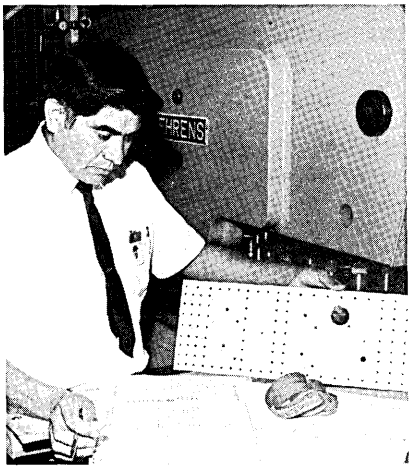
The digital music from the PDP-8 is converted to two analog signals via two channels of a D/A converter (each channel has a separate damping factor). The analog signals are amplified by a stereophonic amplifier and played on a separate speaker for each channel.

According to Professor David Coll in the Division of Computing, Communications, Control and Power Systems, two copies of an L.P. (long play) record called "Pieces of Eight" were recorded. A program library of Christmas carols also has been developed which they call "The 12 Bits of Christmas."

COMPUTER VERIFIES ACCURACY OF MANUFACTURING PROCESS

Sylvania's electronic systems manufacturing plant (Santa Cruz, Calif.), through computer simulation, is verifying the accuracy of tapes which operate numerically-controlled punch presses. The presses automatically punch holes of specific size, location and number in metal parts for electro-optical, security, law enforcement, and electronic defense systems and equipment.

The new technique, called Computer Aided Manufacturing, simulates operation of the production equipment to eliminate costly trial operations which require test punching of each part and comparison between it and an original drawing. The computer plots a drawing of the piece that would be produced from the tape. By comparing the original and computer-produced drawings (below), an engineer verifies the accuracy of the tape.



At present production rates, the new technique developed by Sylvania Electric Products Inc., could result in annual savings up to $100,000 in manufacturing costs, according to Jackson S. Kolp, Plant Manager. The process is part of an overall system being developed to computerize cost estimating, print generation, tool requirements, work planning, and production scheduling.

EDUCATION NEWS

CERTIFICATE IN DATA EDUCATION (CDE) PROGRAM

The Society of Data Educators has announced the first phase of its CERTIFICATE IN DATA EDUCATION (CDE) program. The CDE will be awarded in several categories (Basic and Advanced) in recognition of demonstrated academic proficiency, professional experience, and professional stature. To attain Certificates in the various advanced categories, proficiency must first be demonstrated in basic knowledge of introductory concepts of automation, computing, and data processing (including social and user implications). Programming knowledge will not be stressed in the Basic examination.

The first validating examination for the CERTIFICATE IN DATA EDUCATION — BASIC will be given free (except for a nominal Certificate fee) to any data educator having a knowledge of the content of basic or introductory data processing material gained through teaching experience, course design, textbook authorship, or similar competency. Those passing the initial validation examination will be certified. The examination then will be offered to qualified applicants by mail at a regular testing fee of $15. When the advanced tests are offered, it is expected that they will be given at designated locations throughout the nation on specified dates.

Teachers of introductory courses in data processing, as well as textbook authors, are invited to submit questions of the multiple choice variety for use in the validating test to Arthur H. Pike, R2-76 Union, Northfield, VT 05663. Those who believe that they are qualified to take the initial validating examination, to be given in November 1970, are invited to write to Enoch Haga, Executive Director, SDE, 247 Edythe St., Livermore, CA 94550.

ACM SPECIAL INTEREST GROUP ON COMPUTER USES IN EDUCATION

A new professional group is promoting effective uses of computers in education. One of about twenty special interest groups formed by members of the ACM (Assocation for Computing Machinery), it was established in 1967 as a special interest committee testing the interest in computer-assisted instruction within ACM. In 1969, under chairman Karl Zinn, the scope was broadened to include all computer uses in education. With this new direction, it converted successfully from temporary committee status to a permanent group.

The emphasis of group activities is presently on design and application of languages and systems to aid in the process of instruction and learning. A bulletin, INTERFACE, is distributed five times a year with supplements as needed in support of program activities (an August supplement will cover the education sector of the ACM 1970 Convention). INTERFACE features reports, technical notes, group news, a calendar of conferences, and abstracts of recent publications.

Memberships, subscriptions, and special orders are handled by the Association's headquarters: ACM, 1133 Avenue of the Americas, New York, NY 10036

FILM ON CDP EXAMINATION PRODUCED BY DPMA

The Certificate on Data Processing (CDP) examination program sponsored by the Data Processing Management Association (DPMA) is the subject of a 16mm color-sound film recently produced by the DPMA. The 25-minute film, entitled "THE KEY...," is intended to create interest in the program through an authoritative

explanation of the exam's purpose and objectives.

Points covered in the film include all the essential facts a person interested in taking the exam needs to know about it, such as eligibility requirements, where and when it is held, how it is scored, etc. Prints of the film will be distributed to DPMA division vice presidents from whom it will be available free of charge for viewing by local DPMA chapters and other interested groups, corporations and EDP-oriented associations. More information may be obtained by writing to: Data Processing Management Association., International Headquarters, 505 Busse Highway, Park Ridge, IL 60068.

RESEARCH FRONTIER

SOLUTION TO AIR TRAFFIC JAMS DEVELOPED BY GOODYEAR AEROSPACE CORPORATION

The Staran IV system developed by Goodyear Aerospace Corporation, Akron, Ohio, may provide the solution to the nation's air traffic jams and a method to drastically reduce the possibility of mid-air collisions. The new system can perform more than 40-million mathematical operations per second in predicting which planes are on collision courses and determining evasive maneuvers.

One feature of the system is its ability to single out planes on collision courses and show them to air traffic controllers on a viewing screen as if they were the only planes in the air. Thirty seconds is the minimum time the Federal Aviation Administration (FAA) has established as needed for pilots to be warned and to take evasive action — the processor could project much further ahead.

Additionally, its speed and vast capability also would allow a reduction in aircraft separation distances in airport landing and takeoff patterns — one of the main causes of air traffic tie-ups and long waiting and circling periods for airline passengers.

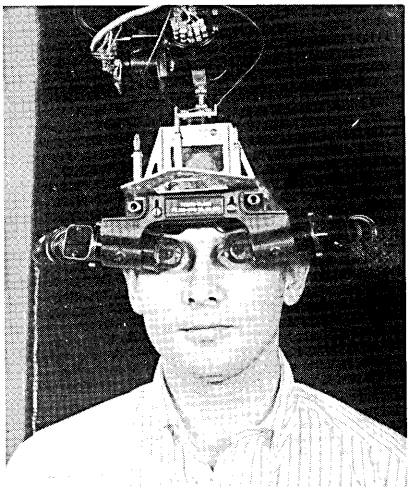
Thirty-six midair collisions and 2,230 "near misses" were reported to the FAA in 1968. The agency estimates that four hazardous near-misses occurred for each one reported. Meanwhile, passenger traffic is expected to grow at an average rate of 12% annually starting in 1972, the FAA has reported.

Goodyear Aerospace estimated that four times as many planes could be safely accommodated in the same amount of air space by using Staran IV in the air traffic control system. Use of the system has been proposed to the FAA and the proposal now is under consideration.

NEW COMPUTER GRAPHICS TECHNIQUES MAY PERMIT ARCHITECTS TO VISUALLY STEP INSIDE THEIR DRAWINGS

New computer graphics techniques being developed at the University of Utah (Salt Lake City) may someday permit architects to draw buildings in three dimensions and then — using an exotic head-mounted display device — visually step inside the drawings and view the interior of the building. The same research may permit prospective homeowners to see the interiors of houses on display screens without leaving the realtor's office. David C. Evans, Chairman of the University's Computer Science Department, said the innovations are part of a research program aimed at simplifying the exchange of information between people and computers by using pictures.

In the research program, a large variety of equipment permits computer-generated perspective images to appear three-dimensional when viewed with a head-mounted device suspended down from the ceiling.



The device, created by Dr. Ivan Sutherland, University of Utah, in effect makes the viewer's head a "camera" and each eye a "lens". In each eyepiece is a tiny cathode ray tube (CRT), like a miniature television screen, on which the computer image is projected. The optical system then projects a virtual image of the object shown on the CRT at a point approximately 18 inches in front of the viewer's eye. The image seems to be suspended in space all around the viewer, and it changes as the viewer moves his head. The coordinated head and image movements create the three-dimension illusion. "The potential applications of such a technique, once commercially feasible, seem limitless," Evans said. "We often can relate much more accurately through visual means than through verbal means. Visual communications surround us constantly, and they usually provide our most vivid experiences."

MISCELLANY

NEW BRAILLE DOCUMENT SYSTEM DONATED TO NATIONAL BRAILLE PRESS, INC. BY IBM

A table-top device which moves a tiny conveyor belt of continuously forming Braille characters under the fintertips of the blind was recently demonstrated by National Braille Press, Inc., Boston, Mass. It is part of an experimental Braille Document System donated to NBP — a non-profit publishing house for the blind — by IBM Corporation.

Miss Mary Elliott (above), editor of Our Special Magazine for the blind, uses the new system to prepare and proofread copy destined for her monthly women's magazine. As she types her stories on a modified IBM typewriter, the information is simultaneously punched into paper tape as Braille code. Miss Elliott, who is blind, then feeds the tape into the Braille reader. As the tape passes over the sensing mechanism, six metal "fingers" seek out the punched holes. When a single Braille character has been detected, it raises dome-topped metal pins 30/1000 inch above the Reader's synthetic rubber belt, thus forming that character on the belt's surface (above right). When the pins have passed the "reading station", they are pushed back into the belt.

Using this device, Miss Elliott speedily proofreads the punched paper tape. If it is correct, she knows the typewriter copy also is error-free. The Braille Reader's speed ranges from about 50 words per minute (best for a Braille beginner) to 150 words per minute.

NEW PRODUCTS AND SERVICES

NAME/MODEL NO.	DESCRIPTION	FOR MORE INFORMATION
Digital		
CDC 6200 system	For use either as central computer for batch processing operations, or as nucleus for interactive remote terminal networks / a modular, general-purpose system with central memory sizes 32K, 49K, or 65K of 60-bit words / uses full range of 6000/7000 product line software	Control Data Corp. 8100 34th Ave. So. Minneapolis, Minn. 55420 Attn: A. T. LeAnce
Ceta 1600 Series	To simulate and solve problems for scientist, engineer, or systems analyst / desk-top, real time computer replaces conventional analog and hybrid equipment with an all-digital system / system can be interfaced with general purpose digital computers and teletypes	Ceta Electronics Ltd. 45 Richmond Rd., Poole Dorset BH14 OBS, England Attn: Peter Bowker
IBM System/370 Models 155 and 165	Carries forward compatibility concept of System/360; both models can share input-output equipment and programming systems that transcend specific models / basic machine cycle times of Model 165 and 155 processors are 80 and 115 nsec respectively / each uses a buffer memory	IBM Corporation Data Processing Div. 112 East Post Rd. White Plains, N.Y. 10601 Attn: Ed Nanas
L3000 Series Accounting Computer	For general accounting and management reporting applications / five models, variable amounts of memory and differing degrees of input-output and data communications capability / uses micrologic (firmware) / programs are written in COBOL	Burroughs Corporation Business Machines Group Second Avenue at Burroughs Detroit, Mich. 48232
PDP-8/E Minicomputer	Internal bus system (OMNIBUS®) permits peripherals to be interfaced in any available position in the central processor / peripheral and software compatibility with predecessors makes over 60 options and peripherals immediately available / cycle time is 1.2 usec; add time 2.6 usec / 4,096 12-bit words, expandable	Digital Equipment Corp. 146 Main St. Maynard, Mass. 01754 Attn: Dennis C. Goss
Special Purpose Systems		
Programmable Controller (PC-45)	For any industrial application, including those in severe environments / provides logic, timing, counting; computer monitoring capabilities inherent to the system / random access memory with 1024 capacity, 16 bit words	General Electric Company General Purpose Control Dept. P.O. Box 913 Bloomington, Ill. 61701
RAD-8 system	A computer-based radiation treatment simulation system based on DEC's PDP-8/I computer / cuts radiotherapy planning time by 90%	Digital Equipment Corp. 146 Main St. Maynard, Mass. 01754 Attn: Edgar E. Geithner
Memories		
HP Model 9101A Extended Memory	For additional 248 registers for any HP Model 9100A or 9100B desktop calculator; adds as many as 3472 program steps / attaches to calculator output connector	Inquiries Manager Hewlett-Packard Company 1501 Page Mill Rd. Palo Alto, Calif. 94304
Model 60X8 -H-P Drum System	For interfacing with Hewlett-Packard 2114, 2115 and 2116 computers / four storage capacites of 16-bit words offered: 32K, 64K, 130K or 262K / all systems software-compatible with HP's Drum Operating System	Datum, Inc. 170 East Liberty Ave. Anaheim, Calif. 92801 Attn: Leslie G. Alberts
Model 1101 Disc Memory and Controller System	Interfaces to all existing 8, 12, and 16-bit minicomputers / storage capacity is 1.4 million 8-bit words, 950,000 12-bit words, or 700,000 16-bit words; average access time, 134 msec; data transfer rate, 700 KHz	Dynacoustics, Inc. 1980 National Ave. Hayward, Calif. 94545
SA 7000 Series Drum Memory Systems	Includes eight different single-drum systems with capacities from 10 to 150 million bits, with 256, 512, 1024 and 1536 tracks, each with its own read/write flying head / bit densities to 1800 BPI / average access time is 8.7 msec at 3600 RPM	Systematics/Magne-Head Div. General Instrument Corp. 13040 South Cerise Ave. Hawthorne, Calif. 90250
SSU (Semiconductor Storage Unit)	MOS-LSI memory for plug-compatiblity with System/360s, but adaptable to any large computer / data transfer rate to 16-million bytes per second; storage capacity, 128-million bytes per System/360 selector channel / no record gaps / total system reliability, 5,000 hours	Advanced Memory Systems, Inc. 1276 Hammerwood Ave. Sunnyvale, Calif. 94086

NAME/MODEL NO.	DESCRIPTION	FOR MORE INFORMATION
(Memories, continued)		
10,000 Series Disc Memory Systems	Interfaces with any digital system for extending core storage, for buffer memory applications, or as main storage for special purpose systems / provides capacity to 10 million bits / uses fixed non-positioning flying heads in head-per-track configuration	Information Data Systems, Inc. 8260 E. Eight Mile Rd. Detroit, Mich. 48234 Attn: I. Don Biondo
Software		
Cash Flow Forecaster	Computerized financial forecasting system developed by Philadelphia National Bank / written in FORTRAN, useable on GE and IBM computers either as time-sharing or in-house system / BANKSERV Forecaster available to banking industry on fully installed, warranted basis	Arthur S. Kranzley and Co. 1010 South Kings Hwy. Cherry Hill, N.J. 08034 Attn: John J. Haggerty, Jr.
CIPHER/1	A computerized version of cryptosystem protecting the Washington-Moscow hotline; provides protection for EDP maintained confidential data / available in OS or DOS/TOS orientations / $495	Xanthos Xoftware Inc. 281 Main St. Wilmington, Mass. 01887
Contractors' Integrated Payroll System	For construction and building industries / handles employees working at different pay and overtime rates, on different jobs in same week, calculates taxes for all states / written in COBOL for Honeywell 200 Series, will be available for System/360 mod 30 / $10,000	International Computer Corp. Software Services Div. 818 - 18th Street NW Washington, D.C. 20006 Attn: Morton Tuckman
CUBOL	Commercial language specifically for mini-computers / has report writing, file manipulation, table processing capabilities / offer complete package to support language including stand alone one-pass compiler and run-time monitor / typical system less than $60,000	Computer Usage Co., Inc. 8939 So. Sepulveda Blvd. Los Angeles, Calif. 90045 Attn: R. E. Umbaugh
DUO/360	A set of routines which enables computer users to operate IBM DOS/360 programs under OS/360 systems without re-programming / user has ability to access all features of the OS software by running his DOS programs under OS	Computer Technology Inc. 1507 Pacific Ave. Dallas, Texas 75201 Attn: Dir. Corporate Systems
Gift Information and Fund-raising Tasks System (GIFTS)	For use by fund-raising professionals, educational and other institutions / 7 optional modules to meet differing requirements / employs generalized retrieval and report generating capabilities / no programming required / package includes training and other implementation services	Systemation, Inc. 137 Newbury St. Boston, Mass.
Street Address Matching System (SAMS)	System for matching and merging any two files whose common element is street address / a two-part system, consisting of a Preprocessor and a Matcher / can use any known reference file and address format / 360 DOS/OS, 64K minimum, BAL / $8,000	Urban Data Processing, Inc. 552 Massachusetts Ave. Cambridge, Mass. 02139 Attn: Timothy L. Vaill
X-TEND	Enables System/360 user to extend system's core size without additional core memory / a combination of software and 2311 or 2314 disk space provides "soft-core" whenever "hard-core" is insufficient / needs no special software / $2,400	PDA Systems, Inc. 12 East 86th St. New York, N.Y. 10028 Attn: Charles B. Wang
Peripheral Equipment		
CT-100 Computer Terminal	For entry and printout of fixed and variable alphanumeric data and/or query/response with simultaneous printout of the alphanumeric data / communicates with distant computer in ASCII code and format / contains 12 pushbutton keyboard, reader, strip printer, acoustic coupler	Electronic Arrays, Inc. Systems Division 9060 Winnetka Ave. Northridge, Calif. 91324 Attn: Al Kovalsky
"Flying Spot" Component Recorders	Provide instantly visible 3-D permanent hard copy displays of electronic signals or pulse trains, line-by-line facsimile presentation at 5-10 seconds per frame / wide range of printing widths / engineering and research applications	Alden Electronic & Impulse Recording Eqpm. Co., Inc. Alden Research Center Westboro, Mass. 01581 Attn: John P. Carlson
Matchmaker Series	Series of interfaces linking minicomputers with a variety of peripheral devices, e.g.: link Data Generals' Nova to Litton Model 30 printer; an interface controller for Digital Equipment's PDP-8 and Litton Model 30; link Nova with Potter's 3502A chain printer / offer standard line and custom-design	Automated Information Systems, Inc. 1064 River Road Edgewater, N. J. 07020 Attn: George Weinstock
Multiplus System	New concept in hard copy distribution simultaneously prints and distributes alphanumeric and graphic plot information to several locations / modular design uses firm's Matrix Series printers, plotters, or printer-plotters / systems individually tailored	Versatec, Inc. 10100 Bubb Road Cupertino, Calif. 95014

NAME/MODEL NO.	DESCRIPTION	FOR MORE INFORMATION
(Peripheral Equipment, continued)		
Multiprocessor Communications Adapter	Provides means of connecting as many as 15 Nova and Supernova minicomputers to form a multiprocessor system / permits blocks of data to be transferred through computers' data channel facilities	Data General Corp. Routes 9 & 495 Southboro, Mass. 01772
Printer Subsystem	For small to medium size computers / utilizes Nortec 200 Line Printer (132 characters per line, speeds to 200 cpm) and Daconics Model 2909 Controller (consists of address decoding, control, flag and interrupt logic	Daconics 925 Thompson Place Sunnyvale, Calif. 94806
Repco 120 Printer	Impactless printer for interfacing with all CRT terminals, minicomputers or other remote data terminals / operates to 120 characters per second asynchronously; 80 characters per line, 6 lines per inch vertically	Repco Incorporated Data Communications Dept. 1940 Lockwood Way Orlando, Fla. 32804
SPD® 10/20 CRT Terminal	Self-contained computer allows characteristics of terminal to be defined through software / 2048 words core memory with 1.6 usec cycle time / repertoire of 58 instructions / display functions may be suppressed to allow use as processor only /	Incoterm Corp. Hayes Memorial Drive Marlboro, Mass. 01752
Sanders 622 Stand-Alone Data Display System	Desktop system with 1,024 character memory for applications requiring remote independent terminals / also provides conversational mode of operation and a standard display screen	Sanders Data Systems, Inc. Daniel Webster Hwy., So. Nashua, N.H. 03060
System 23 Random Access Memory (RAM) Controller	Plug-in, micro-programmed device equips any typical minicomputer for direct, high-speed, random-access mass memory / capable of connecting single CPU with from one to eight drives	Cybermation Inc. River Road Washington Crossing, Pa.
Data Processing Accessories		
DWM Series Paper Winder	Automatic wide-roll device takes up printouts of teletypes and data processing and business machines in-plant or office / facilitates repeated checking and review, paper handling, storage and disposal / two standard widths, 6-inch and 8-7/16-inch	Robins Industries Corp. Data Division 15-58 127th Street College Point (Flushing) New York 11356
"Epoch 4 — The Permanent Magnetic Tape"	New tape chemistry using high-performance polymers provides a binder toughness never before available / company claims 8,270% greater toughness than best competitive product available	Graham Magnetics Inc. Highway 24 Graham, Texas 76046
Range Rider Model 1100	For testing both synchronous and asynchronous digital data transmission systems / full duplex, half duplex or simplex operation / repeating 2047 bit pseudo-noise sequence / direct display of error counts to 999 with over-range indicator / self test capability	Int'l. Data Sciences, Inc. 100 Nashua St. Providence, R.I. 02904 Attn: Raymond B. Sepe
New Literature		
All About Minicomputers	Survey report summarizing characteristics of 77 minicomputers from 40 different manufacturers / 16 pp of comparison charts describing data formats, processing facilities, peripheral eqpm, software, pricing, etc. / $10 per copy (quantity discounts on large orders)	Datapro Research Corp. 2204 Walnut St. Philadelphia, Pa. 19103
I.A.C.P. Film Catalog	26-page catalog published by Int'l. Assoc. of Computer Programmers lists over 90 films of interest to data processing community / includes sources, prices, directions for ordering films and sample order forms / I.A.C.P. non-affiliates may purchase catalog for $2	I.A.C.P. (Publications Dept.) P.O. Box 57 Sycamore, Ill. 60178
An Introduction to Data Communications	87-page, paperbound book published by The American Bankers Assoc. to provide general background as aid for bankers in understanding data communications and system requirements / member banks may purchase book for $10 per copy	The American Bankers Assoc. Order Processing Dept. 90 Park Avenue New York, N.Y. 10016
Programming Languages	442-page softcover book containing descriptions of the major programming languages available for DEC's PDP-8 family of small computers / includes FOCAL, BASIC, several assemblers, and 8K FORTRAN / single copies are available free	Digital Equipment Corp. Department P. 146 Main St. Maynard, Mass. 01754
Technical Manual on Numerical Control Systems (SP 9170$1)	76-page manual with brief facts about numerical control . . . what it is today, how it works, and where it is going in the future / produced in 1969, information is still valid and should be useful to management personnel and potential users in evaluating methods as they affect production control today	Friden Division, The Singer Company, Department N 339 East Ave., Suite 300 Rochester, N.Y. 14604

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Control Data Corp., Minneapolis, Minn.	Air Force Cambridge Research Laboratories, L. G. Hanscom Field, Bedford, Mass.	Two 6600 computer systems to be used in the conduct of research and exploratory development programs in the environmental and physical sciences	$13 million
Bull-General Electric, Belfort, France	Burroughs Corp., Detroit, Mich.	Computer peripheral equipment (P-112 keypunches, V-126 verifiers, and spare parts)	$10.5 million
IBM Corporation, White Plains, N.Y.	Tracor Computing Corp. (TCC), Austin, Texas	Three Systems/370 Model 155 and one Systems/370 Model 165 computers and related equipment to be phased into service beginning mid-1971 in place of company's present Systems/360 Model 40 computers	$10 million
Century Data Systems, a subsidiary of California Computer Products, Inc., Anaheim, Calif.	Randolph Computer Corp., Greenwich, Conn.	Purchase of computer disk drive memory systems over a 24-month period; systems will be leased to customers in the U.S.	$9.8 million
Sperry Rand Corp., Univac Federal Systems Div., Washington, D.C.	U.S. Naval Ordnance Systems Command	Production of the Navy's Mark 152 computers (UNIVAC 1219B computer) to modernize fire control systems of the Tartar and Talos missiles	$8.26 million
Recognition Equipment Inc., Dallas, Texas	U.S. Post Office, Bureau of Research and Engineering	Development of an advanced optical character recognition system that will process up to 86,000 letter-sized envelopes an hour, read last two lines of addresses typed or machine printed in most standard font styles; present OCRs read about 43,000 an hour, last line only	$6.9 million
Burroughs Corp., Defense, Space and Special Systems Group, Paoli, Pa.	U.S. Post Office Department	Production and installation of 51 automatic letter sorter machines; completion of current contract (8th in series) will mean over 300 units in service in the U.S. and Canada	$6.1 million
SCM Corporation, Kleinschmidt Telecommunications, New York, N.Y.	U.S. Army	Producing service test models of a new electronic telecommunications system for use in the field or at fixed-station installations throughout the world	$6 million
Philco-Ford Corp., Communications and Technical Services Div., Philadelphia, Pa.	Iranian War Ministry, Iran	A telecommunications system to be linked to a more extensive network now being implemented under terms of last year's $45 million contract	$5.7 million
Sperry Rand Corp., Univac Div., Philadelphia, Pa.	Johnan Savings and Loan Corp., Tokyo, Japan	Two UNIVAC 418-III systems with peripheral equipment for processing savings accounts, time deposits and loan transactions in an on-line, real-time operating mode	$5 million (approximate)
National Cash Register Co., Dayton, Ohio	Societe Generale, Paris, France	Over 600 bank machines for use in creating data for computer processing	$3.9 million
Sperry Rand Corp., Univac Div., Philadelphia, Pa.	Swedish Telecommunications Administration (ATESTO), Stockholm, Sweden	Two UNIVAC 418-III computer systems to be used for public telegraph and meteorological message switching	$3 million
Comcet, Inc., Rockville, Md.	Computer Sciences Corp., Los Angeles, Calif.	Production of remote communications concentrators to be used in CSC's INFONET time-sharing network	$2.9 million
Sylvania Electric Products Inc., a GT&E subsidiary, Mountain View, Calif.	U.S. Department of Defense	Electronic defense communications equipment (two digital receiving/processing systems)	$2.1 million
Burroughs Corp., Detroit, Mich.	Dow Chemical Co., Midland, Mich.	A B6500 computer system to be used primarily in functions related to research activities	$2+ million
Computer Response Corp., Washington, D.C.	Webb Realty Corp., Miami, Fla.	Total data processing services, including staffing, systems design and implementation and computing facilities	$1.4 million
Systems Associates, Inc., Long Beach, Calif.	U.S. Navy	An efficiency and safety study of carrier aircraft recycling operations and support systems	$1,256,617
Raytheon Co., Lexington, Mass.	State of California, Division of Highways	A real-time surveillance system and control center to monitor traffic on three freeways in Los Angeles county	$1,036,000
Computer Automation, Inc., Newport Beach, Calif.	Data Instruments, Inc., Sepulveda, Calif.	100 Models 808 and 208 computers for use in DI's DATAPLEX business data entry systems	$1 million
Informatics Inc., Sherman Oaks, Calif.	Jet Propulsion Laboratory, Pasadena, Calif.	Design and development of programs and systems for various computers used in JPL Space Flight Operations for simulation, tracking, and telemetry monitoring of space missions	$700,000
Dataram Corp., Princeton, N.J.	Clary Datacomp Systems, Inc., San Gabriel, Calif.	For 4K x 16 memory systems which will be used in the Datacomp 404 computer	$645,000
	Digital Equipment Corp., Maynard, Mass.	For 4K x 12 memory stacks	$580,000
Sperry Rand Corp., Univac Federal Systems Div., Washington, D.C.	Federal Aviation Administration	Development of capability and capacity to expand the functions of basic ARTS III (Automated Radar Tracking System); contract includes development of both hardware and software	$500,000
Computing and Software, Inc., Los Angeles, Calif.	U.S. Department of Labor	Providing a computerized employment service for the department (a daily directory of employment possibilities) in the metropolitan Washington, D.C. region	$400,000 (approximate)

NEW INSTALLATIONS

OF	AT	FOR
Burroughs B2500 system	Escambia EDP Management Board, Pensacola City Hall, Fla.	Data processing applications for the city of Pensacola, the Escambia County School Board, University Hospital and Escambia County, in which Pensacola is located (system valued at over $500,000)
Burroughs B3500 system	Consolidated City of Jacksonville, Fla.	Servicing all of the consolidated government's diverse agencies and be the nucleus for a management information system
Control Data 3300 system	Maryland Dept. of Motor Vehicles, Baltimore, Md. (two systems)	Communication needs of the department itself (on an around the clock basis); also will service DMV sub-stations throughout the state, state police headquarters, selected courtrooms and other agencies. The second system will service batch processing needs of DMV and be back-up for system one
Control Data 6500, 6400 and (4) 1700 systems	Federal Institute of Technology, Zurich, Switzerland	A massive computational system for research, student training, library applications and administrative data processing (system valued at $5.6 million)
GE-55 system	Bob's Restaurants of Arizona, Phoenix, Ariz.	Inventory control of food supplies and processing weekly payroll for some 500 employees
Honeywell Model 120 system	Group Health Cooperative of Puget Sound, Seattle, Wash.	Membership accounting and information system for 122,000 members; payroll and inventory reporting
Honeywell Model 200 system	Mansfield Hospital, Mansfield, Ohio	Patient accounting and payroll applications; other applications will be added
Honeywell Model 1250 system and Model 400 system	Mississippi Hospital and Medical Service, Jackson, Miss.	Maintenance of subscriber files for Blue Cross/Blue Shield, Medicare Part A and Mississippi Medicaid (Title XIX). Future applications will include communications to hospitals
IBM System/3	Levinson Bros., Inc., San Francisco, Calif.	Sales forecasting, speeding billing and renewal notices, management reports
	Metron Steel Corp., Chicago, Ill.	Daily inventory and sales reports on a product-by-product basis, order writing, invoicing, accounts receivable, and accounts payable
	Rockingham Memorial Hospital, Harrisonburg, Va.	Automating billing, accounting and payroll at the 330-bed hospital
	City of Superior, Wisconsin	Handling a variety of financial details of city operations (population 33,000)
IBM System/360 Model 30	Fairway Foods, Inc., St. Paul, Minn.	Providing over 350 Midwest retail grocers with a computer analysis of their businesses to show which items are selling best, how to price competitively each of nearly 7,000 items; also provides retailers with bulk case labels and monthly purchase summaries
NCR Century 100 system	Ajax High School (near Toronto)	Relatively sophisticated computer training at the high school level
	Bluffton College, Bluffton, Ohio	Training graduates in all curriculum areas in computer applications for graduate school and jobs; also administrative purposes
NCR Century 200 system	Elektra Birseck (EBM), Zurich, Switzerland	Customer billing (electricity to 47 communities in Switzerland and 12 in Alsace, France), inventory management, payroll, etc.
	Professional Systems, Inc., Chattanooga, Tenn.	Data processing services for physicians, dentists and hospitals in the area
RCA Spectra 70/45 system	Aquila/BST Computer Services, Ltd., Montreal	Processing stock market transactions for the Montreal and Canadian Stock Exchanges; in November, an RCA Spectra 70/46 also will be installed for back up and to service other Aquila customers
	Security Title Insurance Co., Los Angeles, Calif.	Instant real estate title examination; records of over 2 million LA County land parcels in data file
UNIVAC 418-III system	Osakaya Securities, Osaka, Japan	The heart of a message switching, customer information and security order system
UNIVAC 494 system	Daihyaku Mutual Life Insurance Co., Tokyo, Japan	An on-line system handling general accounting applications, answering inquiries (connects 87 branches)
UNIVAC 1106 system	Kommun-Data AB, Stockholm, Sweden (two systems)	Billing electricity, water, garbage collection and rents, as well as other accounting functions (systems valued at about $4 million)
UNIVAC 9200 system	Bross Utilities Service Corp., Bloomfield, Conn.	Construction cost estimating, budget preparation, payroll and general accounting
	Smithtown Central School District, St. James, L.I., N.Y.	Administrative and business applications for a district including 13,000 students and 18 schools
UNIVAC 9300 system	Central Markets, Schenectady, N.Y.	Inventory control, payroll processing, buyers reports and general accounting applications
UNIVAC 9400 system	Hansen Publications, Miami Beach, Fla.	Billing, inventory control, general accounting and sales reporting
	Northern Electric Co., Waynesboro, Miss.	Bill of materials explosion, production scheduling, general accounting, inventory and payroll
	Safety Federal Savings & Loan Association, Kansas City, Mo.	Processing savings accounts, trial balances, dividend checks, mortgage loans, monthly billing, delinquent notices and management reports
XDS Sigma 5 system	Philip Morris USA, Research and Development Center, Richmond, Va.	Serving as an on-line laboratory data processor and general-purpose research computer

MONTHLY COMPUTER CENSUS

Neil Macdonald
Survey Editor
COMPUTERS AND AUTOMATION

The following is a summary made by COMPUTERS AND AUTOMATION of reports and estimates of the number of general purpose electronic digital computers manufactured and installed, or to be manufactured and on order. These figures are mailed to individual computer manufacturers from time to time for their information and review, and for any updating or comments they may care to provide. Please note the variation in dates and reliability of the information. Several important manufacturers refuse to give out, confirm, or comment on any figures.

Our census seeks to include all digital computers manufactured anywhere. We invite all manufacturers located anywhere to submit information for this census. We invite all our readers to submit information that would help make these figures as accurate and complete as possible.

Part I of the Monthly Computer Census contains reports for United States manufacturers. Part II contains reports for manufacturers outside of the United States. The two parts are published in alternate months.

The following abbreviations apply:

(A) -- authoritative figures, derived essentially from information sent by the manufacturer directly to COMPUTERS AND AUTOMATION
C -- figure is combined in a total
(D) -- acknowledgment is given to DP Focus, Marlboro, Mass., for their help in estimating many of these figures
E -- figure estimated by COMPUTERS AND AUTOMATION
(N) -- manufacturer refuses to give any figures on number of installations or of orders, and refuses to comment in any way on those numbers stated here
(R) -- figures derived all or in part from information released indirectly by the manufacturer, or from reports by other sources likely to be informed
(S) -- sale only, and sale (not rental) price is stated
X -- no longer in production
- -- information not obtained at press time

SUMMARY AS OF MAY 15, 1970

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL $(000)	NUMBER OF INSTALLATIONS In U.S.A.	Outside U.S.A.	In World	NUMBER OF UNFILLED ORDERS
Part II. Manufacturers Outside United States							
A/S Norsk Data Elektronikk	NORD 1	8/68	2.0	0	20	20	10
Oslo, Norway	NORD 2	8/69	4.0 (S)	0	2	2	3
(A) (Jan. 1970)							
A/S Regnecentralen	GIER	12/60	2.3-7.5	0	39	39	1
Copenhagen, Denmark	RC 4000	6/67	3.0-20.0	0	8	8	6
(A) (Jan. 1970)							
Elbit Computers Ltd.	Elbit-100	10/67	4.9 (S)	-	-	120	75
Haifa, Israel							
(A) (Jan. 1970)							
GEC-AEI Automation Ltd.	Series 90-2/10/20						
New Parks, Leicester, England	25/30/40/300	1/66	-	-	-	13	X
(R)	S-Two	3/68	-	-	-	1	X
(Jan. 1969)	130	12/64	-	-	-	2	X
	330	3/64	-	-	-	9	X
	959	-/65	-	-	-	1	X
	1010	12/61	-	-	-	8	X
	1040	7/63	-	-	-	1	X
	CON/PAC 4020	-	-	-	-	0	X
	CON/PAC 4040	5/66	-	-	-	9	-
	CON/PAC 4060	12/66	-	-	-	5	-
International Computers, Ltd. (ICL)	Atlas 1 & 2	1/62	65.0	0	6	6	X
London, England	Deuce	4/55	-	0	7	7	X
(A)	KDF 6 - 10	9/61	10-36	0	58	58	X
(March 1970)	KDN 2	4/63	-	0	1	1	X
	Leo 1, 2, 3	-/53	10-24	0	59	59	X
	Mercury	-/57	-	0	13	13	X
	Orion 1 & 2	1/63	20.0	0	17	17	X
	Pegasus	4/55	-	0	30	30	X
	Sirius	-/61	-	0	22	22	X
	503	-/64	-	0	16	16	X
	803 A, B, C	12/60	-	0	83	83	X
	1100/1	-/60	5.0	0	22	22	X
	1200/1/2	-/55	0.9	0	68	68	X
	1300/1/2	-/62	4.0	0	196	196	X
	1500	7/62	6.0	0	110	110	X
	2400	12/61	23.0	0	4	4	X
	1900-1909	12/64	3-54	0	1515	1515	C
	Elliott 4120/4130	10/65	2.4-11.4	0	160	160	C
	System 4-30 to 4-75	10/67	5.2-54	0	130	130	C
							Total: 525
Japanese Mfrs.	Various models	-	-	-	-	4136 E	800 E
(N) (March 1970)-							
Marconi Co., Ltd.	Myriad I	3/66	£36.0-£66.0 (S)	0	37	37	9
Chelmsford, Essex, England	Myriad II	10/67	£22.0-£42.5 (S)	0	17	17	12
(A) (Jan. 1970)							
Saab Aktiebolag	D21	12/62	7.6	0	37	37	-
Linkoping, Sweden	D22	5/68	13.4	0	15	15	10
(A) (Jan. 1970)	D220	4/69	9.8	0	1	1	10
Siemens	301	11/68	0.75	-	-	33	C
Munich, Germany	302	9/67	1.3	-	-	24	C
(A)	303	4/65	2.0	-	-	66	C
(March 1970)	304	5/68	2.8	-	-	50	C
	305	11/67	4.5	-	-	58	C
	306	-	6.5	-	-	-	C
	2002	6/59	13.5	-	-	40	C
	3003	12/63	13.0	-	-	34	C
	4004S	-	4.0	-	-	2	C
	4004/15/16	10/65	5.0	-	-	103	C
	4004/25/26	1/66	8.3	-	-	38	C
	4004/35	2/67	11.8	-	-	154	C

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL $(000)	NUMBER OF INSTALLATIONS In U.S.A.	Outside U.S.A.	In World	NUMBER OF UNFILLED ORDERS
Siemens (cont'd)	4004/45	7/66	19.8	-	-	167	C
	4004/46	4/69	34.0	-	-	6	C
	4004/55	12/66	25.8	-	-	14	C
							Total: 300
USSR	BESM 4	-	-	-	-	C	C
(N)	BESM 6	-	-	-	-	C	C
(May 1969)	MINSK 2	-	-	-	-	C	C
	MINSK 22	-	-	-	-	C	C
	MIR	-	-	-	-	C	C
	NAIR 1	-	-	-	-	C	C
	ONEGA 1	-	-	-	-	C	C
	ONEGA 2	-	-	-	-	C	C
	URAL 11/14/16	-	-	-	-	C	C
	and others	-	-	-	-	C	C
						Total: 6000 E	Total: 2000 E

BOOK REVIEWS

Monsma, James E., and Kenneth F. Powell / An Executive's Guide to Computer Concepts / Pitman Publishing Corp., 6 East 43 St., New York, NY 10017 / 1969, hardbound, 166 pp., $4.95.

This book is designed for executives working in a computer environment. Knowledge of computers and data processing is not assumed, although the reader should be familiar with management and executive functions. The book concentrates on two main themes: what computers may imply for an organization, and what computers imply for those people in an organization who are directly responsible for the computers.

Seven chapters include: "Modern Business and Computers", "A Computer Runs a Program", "Symbolic Programming Languages", "Problem Oriented Languages", "Applications and Simulation", and "The Computer in the Future". There is also a list of selected Readings and References, two appendices on the uses of numbers, a glossary and an index.

James E. Monsma is Vice President of Interactive Sciences, Inc. Kenneth F. Powell is Manager of Executive Presentations for IBM.

Kyburg, Henry E. Jr. and Smokler, Howard E., editors / Studies In Subjective Probability / John Wiley & Sons, Inc., New York / 1964, softbound, 203 pp., $?

This book offers a selection of basic articles on the theory of subjective probability. The chapters include such topics as: The Subjective Side of Probability; Apropos of a Treatise on Probability; The Bases of Probability; and The Foundations of Statistics Reconsidered. There is a selected bibliography and an index.

Henry E. Kyburg, Jr. is with the Department of Philosophy at Wayne State University. Howard E. Smokler is a member of the Technical Staff at the Mitre Corporation.

Price, Wilson T. / Business Programming the IBM 1130 / Holt, Rinehart and Winston, Inc., 383 Madison Ave., New York, NY 10017 / 1970, softbound, 330 pp., $5.00

This book "is intended to be used as a reference and textbook for the individual who is interested in learning and using the IBM 1130 Fortran for business applications via the Commercial Subroutine Package."

The 11 chapters include "Review of the IBM 1130 Fortran, Introduction to the Commercial Subroutine Package"; "Error Detection and Report Generation"; and "Designing File Records". Five appendices, an index, and selected references are included.

The author is at Merritt College, Oakland, Calif.

Farina, Mario V. / Flowcharting / Prentice-Hall, Inc., Englewood Cliffs, N.J. / 1970, hardbound, 120 pp., $6.50

The purpose of the book is to explain every aspect of flowcharting and program techniques. It will aid those who are already programmers and those who are in training to be. The book serves as additional reference material for programmers.

The 14 lessons include Basic Concepts, Basic Data Processing Flowchart, Efficient List Searching and File Maintenance. The book includes an index.

The author is manager of computer communications and training at General Electric and has written several other books.

ADVERTISING INDEX

CALENDAR OF COMING EVENTS

Aug. 18-21, 1970: International Conference on Microelectronics, Circuits & Systems Theory, Univ. of New South Wales, Kensington, Sydney, Australia / contact: Jt. Conf. Secretariat, IREE, Australia, Box 3120, GPO, Sydney, 2001 Australia

Aug. 24-28, 1970: IFIP World Conference on Computer Education, Amsterdam, Netherlands / contact: A. A. M. Veenhuis, Secretary-General, IFIP Conference Computer Education 1970, 6, Stadhouderskade Amsterdam 13, Netherlands

Aug. 25-28, 1970: Western Electronic Show & Convention (WESCON), Biltmore Hotel, Sports Arena, Los Angeles, Calif. / contact: WESCON, 3600 Wilshire Blvd., Los Angeles, Calif. 90005

Aug. 31, 1970: Fifth Annual ACM Urban Symposium, New York Hilton Hotel, New York, N.Y. / contact: Paul R. DeCicco, ACM Urban Symposium Chairman, Polytechnic Institute of Brooklyn, 333 Jay St., New York, N.Y. 11201

Aug. 31-Sept. 2, 1970: American Society of Civil Engineers, Fifth Conference on Electronic Computation, Purdue University, Lafayette, Ind. / contact: Robert E. Fulton, Mail Stop 188-C Structures Research Division, NASA Langley Research Center, Hampton, Va. 23365

Aug. 31-Sept. 4, 1970: 1970 AICA—IFIP Conference on Hybrid Computation, Technical University, Munich, Germany / contact: Prof. Dr. J. Heinhold, Kongressburo AICA-IFIP 1970, Institut fur Angwandte Mathematik, Arcisstr. 21, D-8 Munchen 2, Germany

Sept. 1-3, 1970: 25th National Conference, Association for Computing Machinery, New York Hilton, New York, N.Y. / contact: Sam Matsa, ACM '70 General Chairman, IBM Corp., 410 E. 62nd St., New York, N.Y. 10021

Sept. 2-4, 1970: The Institution of Electrical Engineers (IEE) Conference on Man-Computer Interaction, UK National Physical Laboratory, Teddington, Middlesex, England / contact: Roger Dence, IEE Press Office, Savoy Place, London WC2, England

Sept. 14-15, 1970: Society for Management Information Systems (SMIS) 1970 Conference, The Shoreham Hotel, Washington, D.C. / contact: The Society for Management Systems (SMIS), c/o Prof. John F. McCarthy, Jr., P.O. Box 16, Benjamin Franklin Station, Washington, D.C. 20044

Sept. 14-16, 1970: First Canadian Computer Show, Montreal, Canada / contact: Jack McCaugherty, James Lovick Limited, Vancouver, British Columbia, Canada.

Sept. 14-24, 1970: 1970 FID (International Federation for Documentation) Conference and International Congress on Scientific Information, Buenos Aires, Argentina / contact: U.S. National Committee for FID, National Academy of Sciences, 2101 Constitution Ave., Washington, D.C. 20418

Sept. 16-18, 1970: Digital Equipment Computer Users Society (DECUS) European Branch, Kunsterhaus, Munich, Germany / contact: Martha Ries, DECUS European Secretary, c/o DECUS International Office, 81 Route de L'Aire, 1227 Carouge, Geneva, Switzerland

Sept. 17-18, 1970: Computer Science and Statistics Symposium, sponsored by the Los Angeles Chapter of the ACM, University of California, Irvine, Calif. / contact: Dr. Mitchell O. Locks, C-E-I-R Professional Services Div., Control Data Corp., 6060 W. Manchester, Los Angeles, Calif. 90045; or Dr. Michael E. Tarter, Assoc. Prof., Dept. of Mathematics and Dept. of Medicine, University of California, Irvine, Calif. 92664

Sept. 22-24, 1970: The Computers and Communications Conference (IEEE), The Beeches, Rome, N.Y. / contact: Jerold T. McClure, Conference Chairman, P.O. Box 182, Rome, N.Y. 13440

Sept. 22-24, 1970: Univac Users Association Fall Conference, Roosevelt Hotel, New Orleans, La. / contact: User Group Relations, Univac Division, Sperry Rand Corp., P.O. Box 500, Blue Bell, Pa. 19422

Sept. 28-30, 1970: 6th Annual Meeting of the Association of American Railroads Data Systems Div., Annual Equipment Show, Regency Hyatt House, Atlanta, Ga. / contact: Trade Associates, Inc., 5151 Wisconsin Ave., N.W., Washington, D.C. 20016

Sept. 29, 1970: Symposium on "Present and Future Uses of Computers in the Chemical Industry", sponsored by the Society of Consulting Chemists and Chemical Engineers, White Plains Hotel, White Plains, N.Y. / contact: Association of Consulting Chemists and Chemical Engineers, Inc., 50 East 41st St., New York, N.Y. 10017

Oct. 5-7, 1970: 1970 Symposium on Feature Extraction and Selection in Pattern Recognition, Argonne National Laboratory, Argonne, Ill. / contact: David Jacobsohn, Argonne National Laboratory, Argonne, IL 60440

Oct. 5-9, 1970: Computer 70—International Computer Exhibition, Olympia, London, England / contact: M. F. Webster, Leedex Limited, 100 Whitechapel Road, London, E.1., England

Oct. 7-9, 1970: American Production and Inventory Control Society 13th Annual International Conference, Ohio Convention Exposition Center, Cincinnati, Ohio / contact: APICS National Office, Suite 504, Watergate Bldg., 2600 Virginia Ave., N.W., Washington, D.C. 20037

Oct. 11-14, 1970: 33rd Annual Meeting of the American Society for Information Science (ASIS), Sheraton Hotel, Philadelphia, Pa. / contact: ASIS 1970 Convention Chairman, Dr. Eugene Garfield, Institute for Scientific Information, 325 Chestnut St., Philadelphia, Pa. 19106

Oct. 12-13, 1970: Sixth National Data Processing Conference of the Information Processing Association of Israel, Tel Aviv Hilton Hotel, Tel Aviv, Israel / contact: S. Shalish, Chmn., Information Processing Association of Israel, P.O.B. 3009, Jerusalem, Israel

Oct. 12-14, 1970: SIAM (Society for Industrial and Applied Mathematics) 1970 Fall Meeting, Hotel Lenox, Boston, Mass. / contact: General Chairman, SIAM 1970 Fall Meeting, 33 South 17th St., Philadelphia, Pa. 19103

Oct. 12-16, 1970: USE Fall Conference, Sheraton-Biltmore Hotel, Atlanta, Ga. / contact: User Group Relations, Univac Division, Sperry Rand Corp., P.O. Box 500, Blue Bell, Pa. 19422

Oct. 14-16, 1970: IEEE Systems Science & Cybernetics Conference, Webster Hall Hotel, Pittsburgh, Pa. / contact: Prof. A. Lavi, Carnegie-Mellon Univ., Pittsburgh, Pa. 15213

Oct. 14-16, 1970: International Conference on Management Information Systems, Copenhagen, Denmark / contact: Harald Josefsen, Program Committee Chmn., The Danish EDP Council, Vesterbrogade 1, DK-1620 Copenhagen V, Denmark

Oct. 14-17, 1970: International Symposium on Digital Computer Applications in Engineering Sciences, Technical University of Istanbul, Turkey / contact: F. A. Akyuz, I.T.U. Hesap Merkezi (Computation Center), Taskisla 114, Istanbul, Turkey

Oct. 15-16, 1970: 1970 Atlantic Div. of Assoc. for Systems Management Eighth Annual Atlantic Systems Conference, New York Hilton, New York City, N.Y. / contact: Malcolm B. Foster, A.S.C., Box 461, Pleasantville, N.Y. 10570

Oct. 19-20, 1970: 5th Annual Conference, Digitronics Users Association (DUA), Ambassador Hotel, Chicago, Ill. / contact: Executive Secretary, DUA, Box 113, Albertson, L.I., N.Y. 11507

Oct. 19-21, 1970: 11th National Meeting of The Institute of Management Sciences, Los Angeles Hilton Hotel, Los Angeles, Calif. / contact: Gene Saxby, Security Pacific National Bank, P.O. Box 2097 Terminal Annex, Los Angeles, Calif. 90054

Oct. 20, 1970: Division 11 Fall Conference of the Pittsburgh Chapter of the Data Processing Management Association, Pittsburgh, Pa. / contact: James J. Dean, P.O. Box 2004, Pittsburgh, PA 15230

Oct. 26-28, 1970: Data Processing Supplies Association, Fall General Meeting, The Park Sheraton Hotel, 7th Ave., and 56th St., New York, N.Y. / contact: Data Processing Supplies Association, 1116 Summer St., P.O. Box 1333, Stamford, Conn. 06904

Oct. 26-28, 1970: Forum of Control Data Users (FOCUS) Regional Conference, Statler Hilton Hotel, Washington, D.C. / contact: William I. Rabkin; FOCUS Exec. Sec., c/o Itek Corp., 10 Maguire Rd., Lexington, Mass. 02173

Advertisement

WHO IS KILLING OUR LEADERS?

- President John F. Kennedy
- Reverend Martin Luther King
- Senator Robert F. Kennedy

In the last few years, assassins have wiped out some of our most prominent leaders. And there are the gravest doubts that those who have perpetrated the murders ... and those who have planned them and paid for them .... have ever been uncovered and brought to trial.

COMPUTERS MAY ENABLE US TO FIND THE ANSWERS

Since 1968, a highly responsible National Committee to Investigate Assassinations has been quietly at work investigating the murders. The Committee's work is premised on the following guidelines:

- The Committee is currently concentrating on the Kennedy-King-Kennedy assassinations, leaving open its options, however, on several other mysterious deaths.
- As to the assassination of President Kennedy, there was a conspiracy in Dallas; and the most pressing problem at the moment is to positively identify the several "actors" in Dealey Plaza, as well as those behind the plot.
- As to the King murder, James Earl Ray appears to be either a hired gunman or a "patsy", all of which means a conspiracy.
- As to the Robert Kennedy killing, there are footprints which point toward conspiracy; however, these footprints appear not to be under investigation by law enforcement agencies; hence, we shall investigate them.
- As to a possible inter-connection between the three slayings, the most that can be said at present is that there are a number of parallels in the cases which might indicate a common modus operandi which normally would be subject to official scrutiny.

The members of the Committee have gathered such a mountain of investigative materials that it is essential that the information be computerized if the answers are to be found. This computerization is now in progress .... but the committee needs help ... all kinds of help:

- contributions (see the coupon)
- assistance with key punching
- assistance with programming
- assistance with machine time

If you can help, please write to us:

- (may be copied on any piece of paper) -

To: NATIONAL COMMITTEE TO INVESTIGATE ASSASSINATIONS
927 15th St., NW
Washington, DC 20005

( ) I wish to further the Committee's investigation into the murders of a number of our leaders, by becoming a:

( ) PATRON $100 a year ( ) ASSOCIATE $25 a year ( ) FRIEND $10 a year

My check is enclosed. I understand this contribution is not tax-exempt.

( ) I can make arrangements for providing assistance in:

( ) key punching ( ) computer programming ( ) computer time

( ) in other ways (as follows):_____

( ) I would like my name placed on the Committee's mailing list.

MY NAME AND ADDRESS ARE ATTACHED.