SCIENCE & TECHNOLOGY

May, 1970

Vol. 19, No. 5

computers and automation

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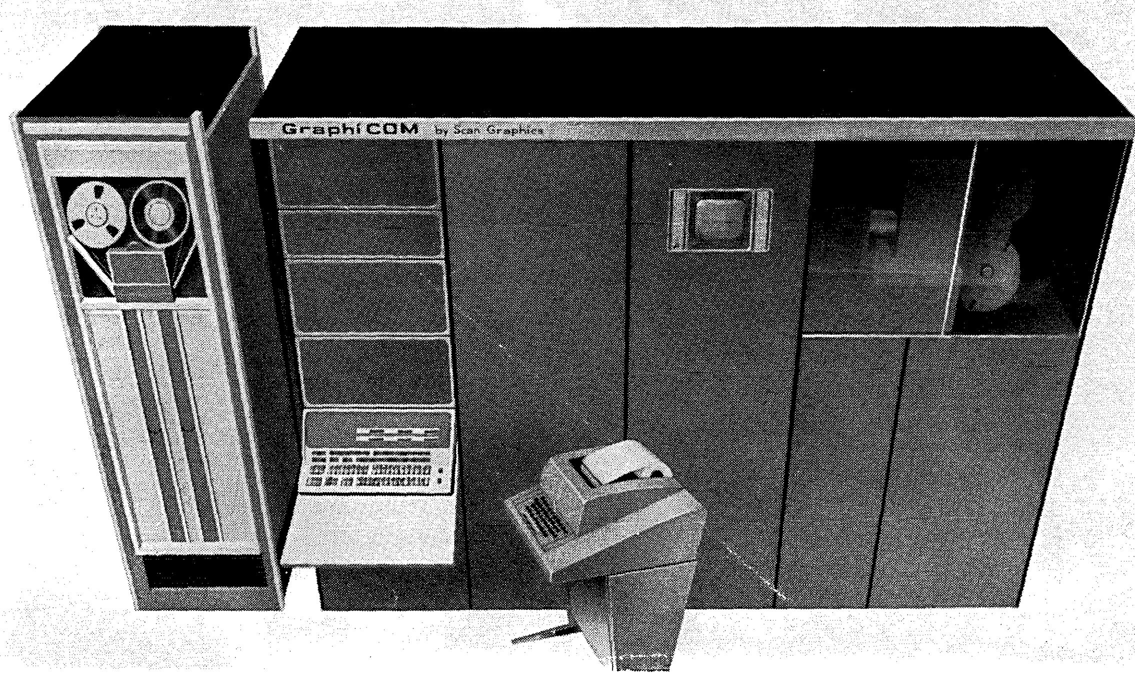

Letters To The Editor

Dear Computer

You do what you have to do, and I do not blame you. So it was your duty to send me a subscription renewal order form at the end of the past year. Yours truly did send it back with a check of $9.50 on Jan. 23, 1970. Your humans cashed it.

March is a good month to keep you busy; therefore you printed another form and sent it to me. Bless your flip-flops, but you see humans feed you and mistakes of humans are hardy perennials, if I may quote freely from one of the "Numbles".

At the time of our January correspondence I asked your humans to correct my name: not L. T. Simon but L. J. Simon. Well, this is not that important, because I have become accustomed to it.

So I wish good health to your circuits — and be kind to your humans.

Rev. Lambert J. Simon
Rt. 2, Box 1
Irving, Tex. 75060

Computer Note — Thank you for your friendly and amusing letter. Your check and change of initial were received, but too late for me to process for the Feb. issue (which I work on in January). Since the March renewal notices are based on the Feb. issue address labels, you received a second renewal notice. I am sorry for the inconvenience, and I hope the humans will inaugurate a better system for me to operate under.

Rehabilitation

We have a great number of men here at Arizona State Prison who have neither family or friends outside the prison. Therefore, their sole contact with the outside world is limited to the newspapers and magazines which we can provide for them and our supply of such material is woefully small.

Our Data Processing Center, with its limited budget, has no provisions for the purchase of magazine subscriptions and such publications as are received are donated. *Computers and Automation* is well known as one of the quality publications in your field and the men in the institution's data processing classes, as well as the active programmers who are currently writing fifty-seven programs for various state agencies, are sincerely interested in your magazine.

We feel very strongly that *Computers and Automation* can play a decidedly important role in our rehabilitative program with those men who are showing an active interest in data processing. It is our earnest desire to do everything possible to further all such worthwhile interests and to provide every opportunity for a successful career as well as returning to society as a productive, law-abiding, tax-paying citizen.

Therefore, can and will you assist not only the several lives directly affected thereby, but our library as well, through a complimentary subscription to *Computers and Automation?* It will be deeply appreciated and most profitably utilized.

JACK D. DILLARD
Director of Education
Data Processing Center
Arizona State Prison
Florence, Ariz. 85232

Ed. Note — Although we are a paid circulation magazine, it has always been our policy to provide complimentary subscriptions in circumstances such as you describe. We have entered a subscription in your name. Your kind comments about our magazine are sincerely appreciated.

Unsatisfied Customer

I have received my first issue of your magazine and the Computer Data Guide.

With regret I must inform you that your publication in no wise satisfies my needs. I found it to be one in which one computer specialist or softwear salesman or computer industry "executive" communicates with the others, totally unaware of those perhaps inarticulate [in terms of computer technology] thousands of us who have so many problems in search of a solution but no one really to talk to.

Would you be so kind as to let me know the charge for my obligations to you to date and cancel my subscription.

CLIFFORD O. MAY,
Secretary-Treasurer
Philip Herzog, Inc.
4300 N.E. 5th Ave.
Fort Lauderdale, Fla. 33308

Ed. Note — We are sorry our magazine did not meet your expectations. We would like to take this opportunity to encourage our readers to continually send us their comments and suggestions about what they would like to see in *Computers and Automation.*

computers and automation

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computers and automation

Vol. 19 No. 5 — May, 1970

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

Special Feature: Computerized Information Systems

Regular Features

Editorial

C&A Worldwide

Multi-Access Forum

The front cover picture shows a woman instructor at the National Technical Institute for the Deaf in Rochester, N.Y., transmitting sign language over a Vistaphone telephone system. The system is the first known telephone installation for the deaf. Vistaphone systems are expected to be used more and more as data terminals. For more information, see "Creative Information Systems — Some New Developments", beginning on page 14.

NOTICE

The price for this issue as a single copy of **Computers and Automation** is $4.00 (postage paid in the United States and Canada). To obtain a copy, send business check or postal money order for $4.00 (plus any foreign postage cost) to: Computers and Automation, Dept. M, 815 Washington St., Newtonville, Mass. 02160.

Departments

C.a EDITORIAL

Computer-Assisted Analysis of Political Assassinations

In this issue of Computers and Automation we publish what is certainly the longest article we have ever published, and one of the most important. This is the article by Richard E. Sprague entitled "The Assassination of President John F. Kennedy: The Application of Computers to the Photographic Evidence." In this article, Sprague makes at least two remarkable statements:

1. The Warren Commission's conclusions (that Lee Harvey Oswald was the sole assassin of President John F. Kennedy, and that there was no conspiracy) are false.
2. The application of computer-assisted analysis to the vast amount of new evidence and new analyses of old evidence is almost certainly necessary, in order to get to the bottom of the conspiracy and its covering up.

Sprague has been a computer professional for over 24 years. For more than five years, he has, as an avocation, studied the evidence contained in the Warren Commission Report, the supplementing 26 volumes of Evidence and Hearings, the archives (those that are open) of the Warren Commission, and other evidence, from many sources. In his search for evidence he has visited Dallas, New Orleans, Miami, and other places. He has interviewed personally over 300 persons connected in one way or another with the incidents surrounding the assassination of President John F. Kennedy. Sprague is a member of the Board of Directors of the National Committee to Investigate Assassinations (NCTIA), 927 15th St. N.W., Washington, D.C., a loosely organized non-governmental committee which provides a forum for intercommunication by over 150 researchers. The chairman of this committee is Bernard Fensterwald, Jr., a Washington attorney, who was formerly head of the staff of Senator Estes Kefauver when he was investigating organized crime in the United States.

It is of course possible that the information in Sprague's article does not prove his first statement, nor adequately support the other. One possibility that needs to be remembered is there may be a small degree of conspiracy and a large degree of a "concert of ideas", a choice by many men (for many different reasons and without any spoken mutual agreement) to act together to conceal the truth.

We invite discussion, comments, argument, and criticism from our readers. In this way, we take the totally opposite path from the path taken by the U. S. government in Sept. 1964, that the Warren Commission had now established "the truth", irrespective of unanswered questions and the court of public opinion. This path culminated in locking up crucially important information, when President Lyndon B. Johnson in 1964 locked up over 200 Warren Commission documents in the Archives of the United States as secret for 75 years.

Why does Computers and Automation publish this article?

The first reason is that it focuses on a significant application of computers which heretofore has not received much attention — that is, computer-assisted analysis of large quantities of data in order to solve a crime. Large-scale computer-assisted analysis of a vast quantity of small pieces of evidence related to the political assassinations of President John F. Kennedy, Martin Luther King, Jr., and Senator Robert F. Kennedy is needed in order to answer many, many unanswered questions. The amount of information to be dealt with is too large for human beings unaided by computers to handle adequately. What are some of these unanswered questions? — Why were a total of ten bullets found (in people and in the walls) on the occasion of the assassination of Senator Robert F. Kennedy, when the chamber of Sirhan B. Sirhan's revolver could only contain eight bullets? How did James Earl Ray manage to obtain the funds and the identification papers which enabled him to travel for several months to Canada, England, Portugal, Belgium, etc., after the assassination of Martin Luther King, Jr. ? Why did the Kennedy family cooperate in concealing the information in the autopsy pictures and X-rays of President Kennedy? How far did the conspiracy or correlation (or conspiracies or correlations) stretch? Etc.

A second reason is that this application is directly related to our continuing discussion of the social responsibilites of computer people — the responsibilities of professional information engineers to make the earth an improved and safer "house" for all humanity.

A third reason is that we are a paid-circulation magazine, so that we are not susceptible to the economic pressure that comes from fear of loss of advertising — that subtle control which makes a publisher in his private office say to himself, "This subject is too hot for me to publish — I shall be driven out of business if I do".

A fourth reason for publication in C&A is that since we publish by photooffset on glossy paper, we can show in precise detail some of the important photographic evidence which cannot be seen in the ordinary reproduction of photographs in newspapers or newsprint magazines.

Finally, opportunity sometimes knocks for an ordinary publisher of an ordinary magazine to publish an article that is crucially important, and that ought to be published — to help important truth become known. Sprague's article gives us such an opportunity — and an opportunity to support, by our act of publishing, the principle of publishing factual, useful, and understandable information, no matter how it affects "vested interests", etc.; this principle has been the uninterrupted policy of Computers and Automation for twenty years of publication.

Edmund C. Berkeley
Editor

MULTI-ACCESS FORUM

"THE HOUSE IS ON FIRE" — COMMENTS

I. From Ray B. Wheeler, Manager
Industrial Design
General Electric Co.
1285 Boston Ave.
Bridgeport, Conn. 06602

Your February editorial, "The House is on Fire", is excellent, except for one point. You say that all persons in the "house" must take some time away from their activities. I am convinced that this will only give us a bucket brigade concentrating only on keeping their pants from catching fire — so that they can continue their activities until they have to throw another bucketful.

This may slow the spread, but we must also attack the core. The Group II's* must become strong enough to force some Group I* employers, producers, and manufacturers to become Group II, lest Group I organizations overrun us all.

Kingman Brewster's article ["The 'Involuntary Campus' and the 'Manipulated Society'", in the February issue], pointed out that the "system" funneled individuals into restrictive environments. I agree also that the "system" forces business and industry into those environments as well. "Until it becomes economically advantageous to do something about pollution nothing meaningful will result."

We cannot afford the time, however, to change the system. As business and industry have traditionally provided the leadership and growth for this country, I'd like to look to them to provide leadership on today's critical problem. It should be included as part of their "long-range planning" to make sure they have a market, employees, and a business.

II. From H. Lynn Beus
General Electric Co.
Research and Development Center
P.O. Box 8
Schenectady, N.Y. 12301

I have read your editorial in your February issue.

Must you use the typical approach of the dyed-in-the-wool extremists of all kinds: binary categorization! There are many like myself who refuse to be neatly placed into either your Group I or Group II. Let's call us Groups III, IV, V, ... There is the person who *is* concerned about the uses of his efforts — and who believes they are being well used. Or the one who believes he is doing more good as a home builder than is the fire shouter. Or the one who has seen too many false alarms to get much excited over the latest "population explosion". And finally, there is the one who believes there are deeper moral issues than population explosions, Vietnam wars, and nerve gas; that these are only symptoms — the fire alarm, not the fire.

Your general aims may be commendable, but there are better organizations through which to foster them than professional societies. Try the one that was organized about 33 A.D.

*For the benefit of those readers who did not see the February editorial, it distinguished and separated the attitudes of two kinds of computer people about computers and data processing. Essentially, the attitude of Group I is: "Computers are tools like matches — and we are just mechanics. Our responsibility is correct processing. The answers belong to our employer to use as he sees fit." The attitude of Group II is: "Computers are tools like bridges — and we are professional engineers. Our responsibility is not only correct processing, but also worthwhile answers (bridges that carry people, and don't crash)."

III. From Frank A. Mleko
Director of Computer Services
Signode Corp.
2600 North Western Ave.
Chicago, Ill. 60647

I recently passed up an opportunity to continue our subscription to your magazine, as I continually review our paid subscriptions.

As a businessman first (and technician second or third), I like to see my own as well as other businesses prosper and grow. I, therefore, feel somewhat of an obligation to tell you why I am not renewing *C&A.*

In recent months, your magazine has grown more and more political in content. I appreciate the fact that computers have an impact on the political (in the broadest sense of the word) spectrum of our society and vice versa. But I do not expend corporate funds for *Newsweek* or *Time,* for example. I imagine a Doctor would look with disfavor if the A.M.A. continually harangued him with anti-socialized medicine articles.

Please consider this letter to be a form of suggestion or constructive criticism.

IV. From Donn B. Parker, Secretary
Association for Computing Machinery
Stanford Research Institute
333 Ravenswood Ave.
Menlo Park, Calif. 94025

In your "The House is on Fire" editorial and comments on the Counter Conference [February, 1970 issue], you do a great disservice to ACM and its members. Your Group I and Group II definitions clearly claim that those who voted to keep ACM from taking a stand on deeply political questions are the kind of people who would have worked under orders on the design of ovens for efficient mass incineration of thousands of corpses from the gas chambers in Nazi Germany. Such a wild comment is surely not worthy of you and your fine magazine.

A small sample survey I took of ACM members indicates that some of your liberal, Group II-type "Good Guys" also

voted against political stands to keep ACM within its historic, constitutionally defined purposes where it is doing a good job as a professional society. They find other organizations appropriately organized for representing their partisan political and social beliefs.

V. From the Editor

Some years ago, the automobile industry of this country took the attitude that it was not their problem if people drove too fast in cars and killed themselves in the cars the industry produced — even if some of these cars were "unsafe at any speed", per Ralph Nader. They also took the attitude that it was not their problem if the smoke and gases from the internal combustion engine made smog in Los Angeles and many other cities of the world.

But the automobile industry seems to have changed. It is adding features to new cars which make them safer. There is even talk of abandoning the internal combustion engine by the year 1980.

In much the same way there has been a long discussion in the computer industry about whether the interaction of computers and society will produce good results or bad results, and whether or not the computer industry should devote effort to examining the social impact of the computer industry.

Since 1957, ***Computers and Automation*** has taken the position that computer people have the social responsibilities of ordinary citizens *plus* the social responsibilities of computer professionals — who need to become information engineers and link their work to the needs of society. In this way, society as a whole becomes a better, safer, and happier place to live in, as a result of computer power. This position has now also been taken by many other groups of computer people; and it should be taken by more, and it should be taken in advance of the prodding of Ralph Nader, and his kind, who may see farther than many of us do.

The economic system in the United States allows a free press to flourish, provided the press exercises its freedom. Here in this corner is one part of the press that wants to be free to discuss not only computers, but also information engineering and the good and the bad effects of computers on society. The more discussion, the better, and the more likely the growth of fruitful ideas. □

"COMPUTER OFFERS NEW OPPORTUNITIES FOR THE BLIND" — COMMENT

N. C. Snyder, Vice Pres. and Director of Education
Computer Systems Institute
300 6th Ave. at Wood St.
Pittsburgh, Pa. 15222

Some eight years ago, we launched this country's pioneer training program for the Blind and visually Handicapped who were desirous and deemed able to become Computer Programmers. During the time that has passed, we have grown vividly aware of the great service these individuals can provide to the data processing function of our economy, and aware of the satisfaction that they can achieve on their own merits.

The Institute, one of the very few to have earned sanction from the Association of Computing Machinery (ACM) for its work in this specialized area, now has over one hundred graduates working successfully as Computer Programmers.

It is for these reasons that your February, 1970 article, "Computer Offers New Opportunities for the Blind" [page 37], came to my attention.

It causes me great personal distress to read an article which is intended to laud the efforts of these talented individuals and bring them to public notice, but which defeats the intent rather badly by constant reference to the assistance needed by the Blind to accomplish their goal. Each paragraph detailing a task of the Blind programmer made reference to the assistance needed at each step along the way.

Not only are the Blind highly desirous of being self-reliant (wouldn't you be if you were blind?) but those experienced educators of the Blind, particularly in Electronic Data Processing, will tell you that this is entirely possible.

Our trainees and graduates are perfectly capable of constructing their own flow charts, both general and detailed. They are taught the techniques in class so that they might be fully independent on the job. The following tables may be of interest to your readers.

Table 1*

EMPLOYERS' EVALUATION OF JOB-RELATED QUALITIES OF 39 VISUALLY HANDICAPPED PROGRAMMERS

Job-Related Quality	No. of Responses	Rating (in % of Total Responses): Excellent	Good	Fair	Poor
Job Performance	33	24.2%	57.6%	15.2%	3.0%
Motivation	34	41.2	47.1	11.8	0.0
Intellect	36	33.3	55.6	11.1	0.0
Appearance	36	44.4	41.7	13.9	0.0
Attendance	35	68.6	28.6	2.8	0.0
Punctuality	36	69.4	27.8	0.0	2.8
Cooperation	36	50.0	27.8	8.3	0.0
Attitude	34	41.2	44.1	11.8	2.9
Quality of Work	35	31.4	51.4	11.4	5.7
Quantity of Work	36	13.9	50.0	25.0	11.1
Compatibility with Employees	36	47.2	41.7	8.3	2.8
Compatibility with Supervisors	36	52.8	38.9	8.3	0.0

Table 2*

SUMMARY OF SALARIES EARNED BY 39 VISUALLY HANDICAPPED PROGRAMMERS

Education and Extent of Handicap	Average Starting Salary (per yr)	Average Present Salary (per yr)	Average Time on the Job (months)
Totally Blind			
College Degree (8)	$6371	$8655	28
High School & Additional Education (8)	5578	7276	23
High School only (2)	5400	6390	21
Average Salary for Group (18)	5911	7790	25
Partially Sighted			
College Degree (1)	$5732	$6176	7
High School & Additional Education (7)	5020	6732	19
High School only (3)	5842	6699	14
Average Salary for Group (11)	5309	6663	17

*These tables are based on a survey made Nov.-Dec. 1969. Not all employers rated all qualities.

Brailling by computer is something which has been done since this program's inception in 1962! We did it with great success on the IBM 1400 Series and again on the IBM System/360. IBM even manufactures a Brailling print train which is useful when very large volumes of Braille are being prepared for Thermoform reproduction. Under more common circumstances, like the majority of business functions, absolutely no hardware modification is necessary to produce high-quality, durable Braille. Then, tell me, why should a blind programmer have assistance?

Our trainees get card, tape and program listings in Braille; they get diagnostics; they get memory dumps; they get program output.

While the effort to which your article refers is a noble one, it is my opinion that the world would have less blind "guinea pigs" if the expertise and experience of predecessors was put to best use.

Our students have pre-taped books, Braille books, Braille notes for permanent reference, instructors who read and write Grade II Braille, and best of all, the support of an organization which has been practicing its trade for almost a decade. We don't have any more guinea pigs. □

COMPUTER TERMINAL SELECTION: HUMBUG ON A GRAND SCALE?

Helen Solem and Evanne Buchanan
666 E. Main
Hillsboro, Oregon 97123

Is there a data processing manager with soul so dead he would admit to not having read the very latest developments in computer technology? We maintain no self-respecting manager will confess to being uninformed, much less totally in the dark concerning selection of peripheral equipment. This is the situation prevailing today since the aura of science and technology has dominated the field and it's just the right tune for the salesman's song.

Computer terminals are indeed vital to today's computer system. By the end of the seventies they probably will even be living up to their manufacturers' highly acclaimed promises. In fact, before the end of the seventies the terminal will undoubtedly be as common an instrument in the civilized world as the phone is now. We'll be using the terminal to:

- Pay bills
- Compute taxes
- Do research
- Run credit checks
- Automatically perform and control many office and home menial, routine chores
- Serve as a mini-computer
- Provide mail service
- And things we've not even thought of yet

As man continues to progress in taming and training the creature he's created, this progress will be translated into advancement of his own standard of living. Today we are on this very threshold. We do have the computing power. We are learning to use it effectively. The terminal promises to be the connecting link that will greatly accelerate our advance.

Presently terminal manufacturers are expanding almost geometrically. At last count 47 had hitched their wagon to this ascending star. The result is that the choices being offered to the consumer at the moment – not to mention the extraordinary possibilities that might be in tomorrow's *Wall Street Journal* – are utterly staggering. The barrel seems to be bottomless. It's rather like reading from a huge papyrus roll which keeps unbelievably unrolling and unrolling without end.

Salesmen have shrewdly assessed their task as an impossible one. So temporarily, at least, they have resorted to a sideshow sort of deception with a sophisticated approach. They've created a whole new vocabulary. Used in the hands of a skillful promoter this impressive, scientific sounding jargon leaves the prospective user absolutely glassy-eyed. The salesman rattles off phrases which you may or may not learn to interpret such as:

Alphanumerics: Letters and numbers
Asynchronous: It isn't synchronized
Automatic I/O: The electricity flows along by itself
Closed loop positioners: Aligns tape once the button is pushed
Color Video display: Color TV
Configured: Has numbers
Cost/benefit ratio: What you get for your money
Data storage and retrieval: The keepers and the finders
Decuplets: Ten little hookups
Digital display: It has more numbers somewhere
Evaluation of risk alternatives: Just what you should be doing
Flexible remote batch: Feeding various types of data from afar
Full or half duplex capability: Either it can or it can't read and print at the same time
Indirect addressing: You goofed again
Integrated circuitry: Has wiring
Interface: Works with some other piece of equipment
Keyboard to tape: Goes straight from original input to computer readable only tape
Line controller: It has more wiring
Mode over voice-grade telephone lines: Your terminal can use your phone
Multiple central processors: Mythical computer
Off-line, conversion power: You can still sort by yourself
On-line, real time: Very expensive
Priority interrupts: A status weapon; an attempt to avoid idle time
Queueing: Getting in line
Remote terminal: Out of sight
Short block detection: Finding your mistakes before they get too serious
Software: Intangible accessories
Variable storage registers: Storage doesn't always work up to capacity

Computer salesman admittedly have their foibles, but no worse perhaps than any specialty – doctors, lawyers, accountants. If they weren't allowed to add a little embroidery we'd never believe they were worth even half of what they charge.

The problem only becomes serious when the busy manager lets himself become confused and takes the salesman too seriously. Selection of proper data communication equipment is simply a problem to be solved like any other. Ask yourself the right questions so you know where you're headed and then insist on answers in plain English.

For the manager who is up to his eyebrows in work and is frantically looking for a consultant to lend a hand, give some thought to the option of calling in your public accountants to help. After all your accountant not only knows your system almost as well as you, but should have a wide range of "hands on" operating experience upon which to draw.

The right terminal can be a tremendous boon. It may take a little time to find just what you need. Go slow and let common sense be your guide. □

WORLD SIMULATION: PROGRESS REPORT

John McLeod, Task Force Manager
Simulation Councils, Inc. World Simulation
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La Jolla, Calif. 92037

Concerned about the seriousness in urban, national, and international problems, we suggested in an editorial in the July, 1969 issue of *Simulation* (the technical journal of Simulation Councils, Inc.) that it was high time we apply some of our energies and know-how toward solutions to critical world problems. (This editorial was reprinted in the November, 1969 issue of *Computers and Automation.*) Believing that understanding of a problem is a prerequisite to intelligent corrective action, and aware that simulation is a potent instrument for imparting understanding, we proposed the development of a World Simulation.

The reasoning behind the proposed World Simulation is this. Simulation is an investigative tool. Alone, it is not expected to "cure" any of the world's ills. But it does offer a method for storing and ordering information in such a way that the interaction of dynamic systems can be studied and understood, even though the overall system which they comprise is too complex for comprehension by the unaided human intellect. Furthermore, once a model is developed, simulation puts time under the control of the investigator; it can be rolled back to validate the computer model in the light of historical events, then advanced to predict the consequences at some future date of alternative courses of action proposed today. However, even the most enthusiastic proponents realize that development of a simulation capable of imparting such insight into the more complex world problems will be a long, hard, expensive uphill struggle. And that, they insist, is the very reason why work should begin *now.*

Fortunately, two factors will alleviate the task: building blocks already exist, and "fallout" will begin to accrue almost from the start. Urban planners, ecologists, economists, political scientists, and military strategists (who are more likely to call their work with models "gaming" than "simulation"), as well as engineers in all disciplines, have done the groundwork. The first job for the SCi World Simulation Task Force, therefore, will be to survey and evaluate the very significant amount of past, current, and planned work and to channel existing data, accrued experience, and future efforts in a direction that will (hopefully before it is too late) support a World Simulation.

Then, as work toward a World Simulation is stimulated and the knowledge thus gained coalesced, the fallout will be realized by way of insight acquired concerning the characteristics and interaction of the subsystems which supply the "forcing functions" that are shaping our destiny. Thus the effort *toward* a World Simulation will be self-supporting technologically – and *should* be financially.

The expected adverse criticism of the idea of World Simulation was not forthcoming. Though some understandably questioned the ability of the state-of-the-art to sustain an effort of the magnitude that will eventually be required, no one questioned the need. ". . . I only say that it can't be done; I don't say that it shouldn't be done, or that you shouldn't do it. . ." was typical of the minority reaction. Most respondents were enthusiastically in favor, and wanted to help get on with the job.

Twenty-eight people attended an invitation-only World Simulation Workshop held in Las Vegas last November at the time of the Fall Joint Computer Conference. As a result of discussions there and of correspondence with some 150 interested people before and since, it was decided that for the time being, work toward a World Simulation will be carried forward as it was begun, by a Task Force of the SCi Public Problems Committee. As soon as possible, a Board of Trustees will be elected and officers appointed to form a corporate-like organization.

Trustees, currently being nominated, will:

1. Codify the overall objectives of a World Simulation.
2. Determine policy.
3. Elect officers
4. Ratify actions of the Executive Committee.
5. Elect three new members each year.
6. Act as trustees of the public interest and of any funds entrusted to the organization.

Nominees will be elected by a mail ballot of all who have expressed an interest in World Simulation, and their names will be announced at the Second World Simulation Workshop, to be held in Atlantic City during the 1970 Spring Joint Computer Conference. Like the first workshop, attendance at the second will be by invitation only. However, those wishing to become involved are invited to write and explain why they are concerned, and give some information as to their background and current areas of activity. Letters should be addressed to me at the address above. □

AUTOMEDICA CORPORATION SEEKS MEMBERS

Enoch J. Haga, Editor
Automedica
247 Edythe St.
Livermore, Calif. 94550

Automedica Corporation is a newly organized nonprofit educational organization chartered for the purpose of providing educational services to its members. The Corporation is publishing a journal, *Automedica,* which discusses automation, computing, data processing, and applied medical technology as related to the life sciences and the medical arts.

We invite interested readers of *Computers and Automation* to become members of Automedica Corp. and to participate in the reading and writing of materials for the journal. Automedica members may have their materials published in preference to those received from nonmembers, and a major goal of *Automedica* is to reduce publication time (articles can be published within three months of receipt).

Persons interested in membership are invited to contact Arthur H. Pike, Managing Editor, R2-76 Norwich Univ., Northfield, Vt. 05663. □

PUNCH LINES . . .

Environmental problems are far too basic to think they may simply fade away once the public gets bored with them. Population explosions capable of putting 6 billion people or more on our globe by the year 2000 gives the waste management problem a dimension it has never known before. The knottiest part of the solution will be the readjustment of the simplistic economic goal of providing the best quality product at lowest cost to the consumer. For the consumer is really a converter. Everything we bring into a system, such as a city, must eventually be taken back out in one form or another. Even the materials out of which the buildings are made, come out as demolition wastes. A whole new technology is needed to solve the problems of closing the disposal part of the loop as adequately as we solve production problems. Expensive, but inevitable, waste control must become part of our basic economic outlook. **In one way or another, the costs of disposing of the products of our enormous production capability must be thought of as part of the costs of production.**

– *Donald Hornig, Vice President and Science Adviser*
Eastman Kodak Co.
343 State St.
Rochester, N.Y. 14650

The changing role of EDP technology has put increasing pressure on EDP management to use the computer for new applications, while management is also faced with a shortage of qualified EDP personnel. **These pressures have created an unstable situation which can be best resolved by viewing the EDP operation within a company either as a corporate asset which can be more fully utilized, or as a liability which should be dispensed with.** Companies that seriously consider spinning out their EDP departments could either turn their operations over to a facility management company, or replace it with a remote, high-speed batch terminal operated by an outside vendor.

– *James A. Stone, Director*
Computer Technology Division
Quantum Science Corp.
245 Park Ave.
New York, N.Y. 10017

Government policy with regard to technical manpower needs top level attention. Periodically, we desperately seek professional talent to meet urgent national needs, and then callously dump these highly trained people out onto a depressed job market again a few years later. . . . Each time this happens – and it has occurred several times during the past two decades – more and more technical people become disillusioned and leave the technical field to work in other, non-professional jobs. And, year after year, our national pool of engineering and science graduates grows relatively smaller.

– *Arnold R. Deutsch, President*
Deutsch, Shea and Evans, Inc.
49 E. 53rd St.
New York, N.Y. 10022

In a time of crisis, inaction is among the costliest of human errors. **Failure of the nations to act promptly to meet the coming crisis in communications could easily cost the world economy $100 billion annually over the next ten years** – a total of a trillion dollars in unrealized national development, in unfulfilled opportunities for business and trade, and in unsatisfied social goals.

– *Robert W. Sarnoff, Pres. and Chrmn. of the Board*
RCA Corp.
30 Rockefeller Plaza
New York, N.Y. 10020

COMMITTEE TO INVESTIGATE ASSASSINATIONS SEEKS HELP FROM COMPUTER PROFESSIONALS

Bernard Fensterwald, Jr., Executive Director
Committee to Investigate Assassinations
927 15th St. N.W.
Washington, D.C. 20005

We have noted that **Computers and Automation** has a Martin Luther King Award (page 8, January, 1970 issue). Unfortunately, our Committee to Investigate Assassinations is not in a position to compete for the award. However, we are dedicated to trying to find the persons and/or groups behind the slaying of Dr. King, as well as President John Kennedy and Senator Robert Kennedy.

The Committee's work is premised on the following assumptions:

1) The Committee shall currently concentrate on the Kennedy-King-Kennedy assassinations, leaving open its options, however, on several other mysterious deaths.
2) 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.
3) As to the King killing, James Earl Ray appears to be either a hired gunman or a "patsy," all of which means a conspiracy.
4) 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; hence, we shall investigate them.
5) 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.
6) The Committee will cooperate fully with all law enforcement and looks forward to the day when a proper investigation will be made by the authorities.

We have made considerable progress in unravelling the mysteries surrounding these murders. However, we have gathered so much factual material that it is impossible for any one person to store it or sort it out. We are hopeful that computers can do what we cannot.

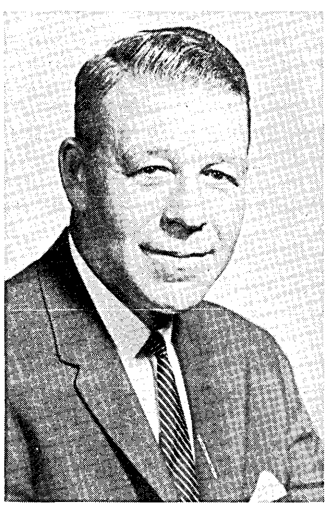
We hope that some of your readers will be interested in helping with time, money, or facilities in our attempt to apply computer techniques to the solution of one of America's more distressing problems. □

CREATIVE INFORMATION SYSTEMS – SOME NEW DEVELOPMENTS

Dause L. Bibby, President
Stromberg Carlson Corp.
A Subsidiary of General Dynamics
100 Carlson Rd.
Rochester, N.Y. 14603

"Back in 1960 the prediction was made that by 1980 the volume of information communicated between machines would be even greater than the amount communicated between people. A considerable number of people doubted that prediction then; very few doubt it today."

Our information systems of the future will center primarily upon computers and communications. So let us look first at some background information concerning the telephone industry in our country. When Alexander Graham Bell spoke the first words, "Watson, come here–" over his new invention, I doubt that he gave any thought (nor was any necessary) to the idea of communicating digital data, video signals, conversion of various frequencies to other frequencies, or the printing out of messages from a communicating device. I doubt also that he realized that he was creating an industry which in the United States will spend about $7 billion for new plants and equipment in 1970, and which will spend at an annual rate of at least $30 billion by 1980.



Dause L. Bibby graduated from the University of Texas in 1932 with a B.B.A. degree. His early career was spent with IBM Corp. Prior to joining General Dynamics in 1964, he was a vice president and director of Sperry Rand Corporation. Mr. Bibby is a member of the National Advisory Council of the Society for Advancement of Management and one of the Society's past presidents and chairmen. He is also a member of the Economic Club of New York, the Academy of Political Science, the National Corporations Committee of the University of Texas Development Board, and various other organizations.

Telephones: A Necessity

Most of our present communications problems stem simply from growth. Let us review a few indicators of this growth. First of all, ever since the end of World War II, we have had an unprecedented demand for telephones in residential and business use. At the end of World War II, we had 32 million telephones. Today – in this country – we have almost 110 million telephones, of which 83% are in the Bell System and the remaining 17% – or over 18 million telephones – are in the independent telephone industry. And, particularly during the last few years, we have had an unprecedented demand for telephone service because it has become a vital necessity to any businessman or to any household. Households have become increasingly mobile and affluent since World War II, thereby further complicating meeting demands for service.

Today, people write fewer and fewer letters. This is because the telephone is so much easier to use; I can communicate directly and personally with the person I wish to talk with, I can do this more effectively, I can do it more economically, and I can do it much faster. Since World War II, therefore, the telephone industry has had a tremendous problem in the increased use of simple voice communications.

Innovations

Now in order to provide for increased voice needs and to prepare for the data communications market, which we all saw coming many years ago, many new innovations have been developed in the telephone industry. Some of them are commonplace. The pushbutton telephone – or Tone-Dial telephone as we call it – is not only an easier instrument to use, but it is a more flexible and faster instrument, as well as being a very important data input-output device. In addition to Tone-Dial telephones we have improved our transmission system greatly since World War II by the addition of: microwave systems (first introduced in 1947); satellite communications; and improved video transmission using coaxial cable. We have introduced radio-carrier equipment on which we can carry 24 conversations on two pairs of wires, and we will soon be able to carry 96 conversations over the same facility. We have been upgrading service throughout the country and providing you, the subscriber, the voice communications with, we hope, a much better and more effective tool. Other examples of this are Direct Dialing of long distance telephone calls (introduced in the early 1950's); extended area service – or EAS (which is becoming available in most U.S. communities); and what I'll call "Custom Calling Services" – call forwarding, call transfer, abbreviated or "Speed" dialing, and call waiting.

Technological change is not new to the telephone industry. Equipment and methods have undergone continued change since the first commercial telephone was installed in 1876 – including important innovations such as the dial telephone (first introduced in 1892).

However, custom-calling features are actually a way of restoring to common use the few things which were attractive about manual telephone service and which went by the boards when dial telephony came into general use. Some of us may remember the old Fibber McGee and Molly radio program and Mabel the operator, who would not only check around town to find out where Doc was or transfer calls to another telephone for you when you were away from home, but also fill you in on all the local gossip; in that last regard, there really weren't many "Mabels" in the old telephone industry.

Computers Arrive on the Communications Scene

Let's now consider the convergence of computers and communications. In the infancy of the computer (in the early 1950's), many of us foresaw the closing of the gap between the computers, with their massive calculating ability and speed, and communications, with its ability to move and switch electrical signals around the world rapidly and dependably.

New electronic technology available to both industries has been closing the gap rapidly. Users demand more data and graphic communications. A host of peripheral devices have emerged uniquely fitted to marry the computer with communications links. This marriage, we felt, would result from a stormy courtship, since one prospective partner was a regulated industry and the other a freewheeling, dynamic, primarily leasing business.

Beyond voice communications, therefore, a marriage is now taking place between the computer industry and the communications industry in this sense; each must provide services which are essential to the other. The long courtship between the two industries has not been as stormy as expected, since there turned out to be a great deal of "love" present: it quickly became clear that close cooperation and collaboration could generate a lot of business from both industries working together.

The FCC

Let us now take a closer look at some of the things that have happened to accelerate the use of data and graphic communications. Despite the love affair between the two industries, it looked for a while as if there were a possibility of a shotgun marriage. The father who had been carrying the shotgun was the Federal Communications Commission; the need for cooperation and collaboration has been emphasized by two significant steps that the Federal Communications Commission has taken in recent months.

First of all, the Commission initiated a broad inquiry into the subject of the interdependence of computers and communications equipment. This inquiry may be considered to be a research study in the new areas of communications services to determine which of them properly fall within the scope of regulatory bodies and which do not. The attitude of the FCC and the initial response to this inquiry from the communications users and potential users suggest that data processing and telecommunications may grow side by side and together for some time to come, without undue interference. This will certainly encourage even greater and more flexible services for data communications.

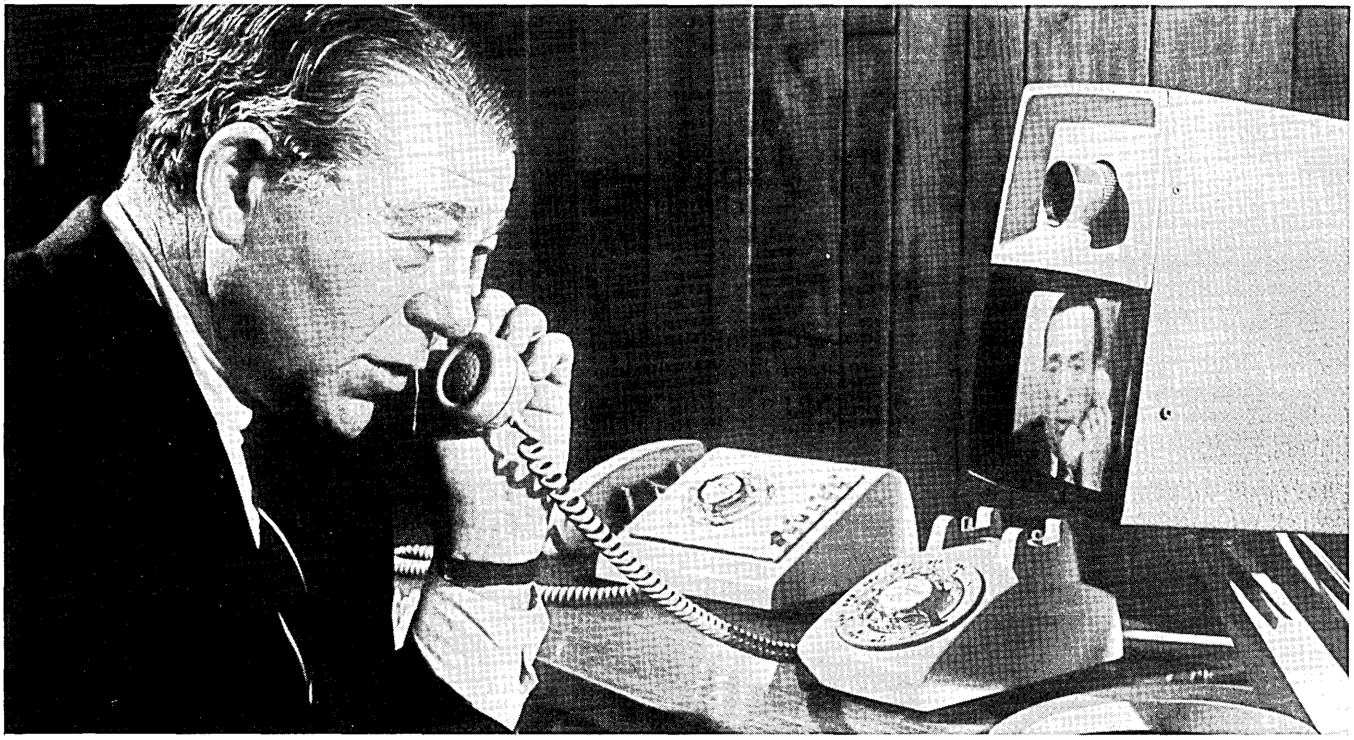
Secondly, in Texas we have a company called Carterfone, which – I guess – by most business standards is not very large. However, a few years ago they instituted legal action against the tariffs of telephone companies which prevented them from selling a device (the Carterfone Coupler) which enabled the interconnection of a radio/telephone system into the regular switching network provided by the telephone company. The tariffs, which prevented such interconnection of non-telephone company provided attachment, presumably derived from the desire of the common carriers to keep the fidelity of the voice network at a high level and to avoid interference with the quality of service provided to subscribers.

In regard to the petitions of Carterfone, in 1968 the FCC and the courts ruled in their favor. The resulting amended tariffs of telephone companies now permit a wide variety of customer-owned equipment to be interconnected to telephone company lines through protective devices called voice and data couplers, which will insure the integrity and fidelity of the telephone network. Obviously, there are many points to be considered on both sides; but this development will certainly mean a prolific growth in the number of companies, which heretofore have not been regarded as either pure communications companies or pure computer companies, providing the engineering, designing, and building of a whole host of what we have chosen to call "data terminals".

Data Terminals

Now, a data terminal can be a Cathode Ray Tube on which certain information is portrayed, then carried into the telephone system and transmitted over telephone lines to a computer. It can also be a Cathode Ray Tube with an associated hard copy printer on which a viewer may see both what he is transmitting and receiving, and may keep a copy of it by pressing a button. Also, we have been and will be seeing greatly increased use of facsimile machines where my printer will make an exact copy of any material, such as drawings or photographs, which are transmitted to me over telephone lines from a distant location. Transmitting one page can now be done within a 6-minute interval. A great many developments in the future, I am sure, will bring this down to 3-1/2 minutes for an ordinary 8-1/2 x 11 page. Not only are we able to do this with just plain manuscripts, but for anything which can be depicted graphically.

These terminals will take a variety of forms and have a variety of uses. However, there are two types of terminals already available from the telephone company which are ideal input-output terminal devices. I have already mentioned the pushbutton telephone. This device becomes a very versatile input device for any kind of data collection, data processing, information system for data collection or data processing. By adding an associated hard copy printer,



a CRT display, or simply relying on an audio response, the pushbutton – or Tone-Dial telephone – also becomes an *OUTPUT* device.

Picture Phones

Another type of terminal is the picturephone, or Vistaphone. Already in experimental use between New York and Pittsburgh, at the Westinghouse Company, is a system designed to explore the possibilities of the Vistaphone for visual voice communications, which I think has tremendous psychological appeal. The system is also being applied to the business task of transmitting documents or being able to zoom in on a speaker and hear him not only talk to a point, but actually show in graphic form the point to which he is addressing himself. These Vistaphones currently are not yet economical; they cost about $180 per station per month as compared to the several dollars per station you pay for your ordinary desk or wall telephone. This is because the digital transmission network continually needs to be expanded to handle the wide frequency range or broadband requirements of this system. It is only a matter of time until the transmission network will be developed sufficiently to make picturephones a much more economical proposition, at least initially for business.

The Vistaphone is expected to have a population of around one million in the Bell System by the mid-1970's. If the independent telephone industry follows its usual pattern, it will also have some 200,000 picturephones by that time. So there will be approximately 1,200,000 of these telephones in use by the middle of the decade – providing what are basically data terminal devices, which will be hooked into the conventional telephone network of the country.

The telephone has become so commonplace, that if we are going to call Los Angeles we expect to pick up the telephone and receive an immediate ring-back, and we expect to be talking to the party we've called within a matter of a few seconds. The maze of equipment (such as relays, switches, cables, microwave, and radio-carrier) that such a call goes through is astounding. The Vistaphone offers an entirely new kind of data terminal. Because it is inherently connected to the entire telephone network in this country, it can take full advantage of the versatility, dependability, and immediate response that we have sometimes taken for granted in our voice communications. These picturephones, or graphic data terminals, will be providing all kinds of business information, medical information, educational information, *whatever* is needed – and needed quickly and graphically. In addition, we will have the option of getting a hard copy of this information.

Audio Response

In the early days of our experimenting with our Vistaphone, we worked on another means of expanding the use of the telephone. We hooked up a calculator, with an associated audio response drum, to the telephone system in our plant. This enabled those of us who don't like to do arithmetic – or are lazy about it – to merely dial a math problem into our pushbutton telephone and get a spoken answer. Let me give you an example of this: Before I left my office I was reviewing some figures pertaining to sales and profits at Stromberg Carlson and wanted to convert them into percentages. Now, mathematics is really not my strong suit, so I turned to my telephone and, using the pushbuttons on it numbered from 1 to 0, dialed up the calculator we have connected to our telephone system. I used the pushbuttons to pose the problem in numerical terms. Almost immediately came back the answer by voice – a feminine voice – "One, Three, Point, O, Six". This was "Carole the Calculator" talking. She had taken the problem, solved it, and selected the proper spoken answer from a pre-recorded file and immediately (and quite pleasantly) had spoken it back to me. Now Carole the Calculator could just as well have been a computer and I could have just as well been tapping out a question relating to the inventory at a distant warehouse. I also could have had the answer given to me in hard copy form on a printer on my desk, or visually on a Vistaphone.

Management Decisions

A consideration of particular interest is that business management will more and more be able to access computers directly from communications devices located on their own desks, and to gain real-time information upon which to base decisions.

While data processing personnel today account for about 85% of the usage of the computer, by the mid-1970's it is estimated that more than one-half of the usage will be by the non-specialist – the manager himself. Data terminals, many of them in the form of pushbutton telephones, will be on the desks of most managers; they will be able to obtain up-to-the-second inventory, billing, sales, and other management information from a computer to make decisions or to answer customer inquiries.

Time Sharing

Another way data terminals will come into use is through the rapidly increasing use of time-shared computers. Through the means of multiple input-output channels sharing the computer, which can be tied into the public telephone network by devices known as data modems, a number of users can simultaneously access and share a computer's full capability through their own terminals. This concept has become known as computer time-sharing. It vastly reduces the computer's cost per customer. The advent of time-sharing and its marriage with the communications system are leading us to the time when every business and every responsible household will have access to a computer through communications facilities, and will be able to compute taxes, do school or business problems, or simply retrieve general information by accessing and checking a computer data bank.

There are now over 100 companies – and perhaps as many as 150 – offering computer time-sharing services. It has been estimated that time-sharing will account for 5% of all data processing expenditures in 1970, and for nearly 50% by 1980, when the number of terminals in use is likely to reach three million, not including pushbutton telephones. This number compares to fewer than 100,000 terminals today and will call for an average annual growth of 30% in this market.

Communications costs are of primary concern to a time-sharing vendor. It is possible to reach a point where the communications charges would exceed the computer charges. However, new technology is providing a 12 to 1 increase in the performance versus cost ratio. Thus the idea of a communications/computer utility has become more attractive, although there are many questions still to be resolved in regard to this concept.

Time-sharing permits almost any business in the world to take advantage of, for at least certain of its requirements, a large computer which may be housed hundreds of miles away. Since only the time used has to be paid for, it provides an economical base from which to expand the use of computers and the use of communications. Here again we must have a terminal in order to access and receive information from the computer.

Applications

For example, I'm a production control clerk; I want to know instantly the status of a certain part – how many are on order, how many have been processed through the shop, what my inventory position is, and so forth. Currently I have to pick up the telephone to get these answers and I'm subject to making errors in writing them out. But the data terminal approach means that I merely push a few keys on my pushbutton telephone and I have displayed in front of me all the information I want.

We have a lot of these kinds of terminals in use already; the airline reservation systems, for example. Many of us call frequently for reservations. Often we hear a recorded voice on the telephone which says something that sounds like this: "All our telephone trunks are busy. Your call is being monitored and you will be placed with the first available operator" The placement of that call is handled by a communications gadget called an Automatic Call Distribution System. It is, in effect, a small computer which distributes the calls by automatically routing them to the first available operator while equally distributing the operator workload. Sometimes the operator also has a CRT terminal by which she displays all the flights you are inquiring about, and ascertains through the computer whether any space is available for you. Automatic Call Distribution Systems are becoming of increasing value not only to airlines, but to newspapers and other industries having a large number of incoming telephone calls from the public concerning a service.

At a public utility which I visited not long ago, I saw a roomful of 100 people, each of whom had connections to the Automatic Call Distribution System through their telephone set and a CRT display terminal which was linked to the computer. This particular utility got about 1,200,000 telephone calls a year; some of them complaining or inquiring about bills, some of them requesting a change in service. While the customer was talking to an operator she was keying in the customer number. She was able to do this whether the customer gave her the number or not. She could do it from an address or she could do it through a name; and she could do it instantaneously and have in front of her all of the information which allows her to immediately answer the customer's inquiry or request. Prior to the installation of that system, a clerk had to go to a file, have the customer wait on the telephone, search through, and try to find the necessary documents and records.

Meter Reading via Telephone

There is still another way of linking the computer with the communications network. For some years several companies have been developing automatic remote meter reading equipment which would interrogate your electric, gas or water meter by way of your telephone line and obtain a reading for billing purposes. Hopefully, this would be done between midnight and 6 a.m. when the telephone traffic is pretty light. You won't be bothered by such telephone calls because you won't even know your meter is being interrogated; your telephone won't actually ring.

The idea here, of course, is to eliminate what the utilities call skips or lockouts; a failure to get a meter reading. Some such failures are caused by the growing reluctance of people to let strangers into their homes. In cases where both the man and wife work, the meter inside the home is inaccessible to the meter reader during working hours. And, of course, we have a number of metropolitan – or "inner city" – problems which subject the meter reader himself to certain dangers. All of these factors are leading to what may very well become another, and quite extensive, information gathering system. The technology to accomplish remote meter reading over telephone lines is available; the current problem is one of economics.

New Regulated Utilities

What kinds of information systems will emerge in the future largely depends on the ingenuity of business management systems engineers and other technical specialists. Some people are predicting that because of the tremendous needs of business for data and graphic communications over and above ever-increasing voice communication requirement, we may see new regulated utilities appearing on the scene. One might easily visualize a data communication utility which does not carry any voice, but supplements the main common carrier; i.e., a voice common carrier with a data communications capability.

Just recently the FCC authorized a dedicated microwave link between Chicago and St. Louis serving 9 intermediate points which could be used for this purpose. Other people are contemplating ventures of this kind, and it is not inconceivable that this kind of utility might arise – and ***soon.*** It is probably also not inconceivable that another kind of utility, a consumer's utility, might arise which, for example, would read household meters or offer computer time sharing to the average household.

Cable Television

The concept of CATV is also becoming quite popular throughout the country. In its earlier years, which go back only to about 1950, this industry was known as the Community Antenna Television Industry. This is the way the system works. A large master antenna is built and television signals difficult or impossible to reach with home antennas are picked off the air, electronically amplified or strengthened, and sent over special cable facilities to the home of each subscriber. The nature of the electronics of such a system also greatly increased the quality of pictures obtained from channels normally picked up by home television receivers off of home antennas. Coaxial cable is used to wire a community antenna into the home. It has an extremely wide bandwidth permitting the transmission of complex television signals which cannot be sent over the types of cable most commonly used to carry telephone conversations. For obvious reasons, this industry, only a couple of years ago, changed its name to Cable Television.

Today there are about 2,300 operating Cable Television systems serving more than three and one-half million homes. The coaxial cable used by these companies offer a broad band communications entrance into homes which offer great potential for non-broadcast video services. While there has been little such use of CATV cables, the unused frequencies below and between television channels could be readily applied to other services.

For example, at least 4,000 and as many as 25,000 telephone conversations could be carried over the unused frequencies in a single CATV cable. This pipeline will probably some day carry signals over a spare TV channel which will print the morning newspaper on an inexpensive printer which someone has yet to invent. A spare channel could also be used to display items in a catalog in response to a request from a pushbutton telephone. The consumer could then order the desired merchandise, after seeing it, by tapping out the order on the telephone.

Thus the design of creative information systems includes the possible use of wide band transmission capabilities of coaxial cables. The concept encompasses not only Cable Television, but opens increased applications for pushbutton dialing, Vistaphone, and facsimile transmission, computer time sharing and a host of related possibilities which are almost endless. The picturephone could permit people to do a lot of the same things in their homes that CATV could make possible.

The "Cashless, Checkless" Society

As the links between the computer industry and the communications industry become stronger and more permanently established both technically and economically, many changes will take place in our personal lives. Obviously I'm going to do a lot of my shopping by telephone; I'm not going to carry much money around with me; and I'm going to let my telephone computer system debit or credit my bank balance. We will be moving toward the "cashless, checkless" society, which I think will emerge much sooner than any of us thought before. The computer/communications implications of this are fantastic.

Looking Ahead

Obviously, with available computer/communications technology and with the existing rules and regulations of the FCC and whatever comes from the various FCC studies, we have the means to tie together the two most vital forces in industry. The first is the computer which, I think, is one of the greatest inventions that ever occurred; the second is communications, which can allow the computer and its massive calculating capability to be used for such a wide variety of purposes that we could spend several weeks here discussing the various possible uses. Needless to say those of us in the communications business are tremendously excited about the emergence of data and graphic communications, although we are by no means finished with making constant improvements in voice communications.

I think it is fair to say that the data industry and the communications industry are, and always have been, natural partners. Today, rapidly improving technology allows any information which can be transformed into electrical signals to be transmitted over the telecommunications network in practically any form and at any useful speed, whether it is man to man, man to machine, or machine to machine. Information can now be moved at the rate of more than one and one-half millions of words per minute. It would take about 20 seconds to transmit the novel, ***Gone With The Wind,*** and the Bible would take a little longer, about half a minute.

Back in 1960 the prediction was made that by 1980 the volume of information communicated between machines would be even greater than the amount communicated between people. A considerable number of people doubted that prediction then; very few doubt it today. The growth of data communications in the 1970's may well be similar to the growth of the computer in the 1950's.

Simple input-output devices will enhance the usefulness of the computer. The pushbutton telephone is now being used as a data terminal by well over 150 organizations. The data phone sets, which allow direct communication over telephone lines between high-speed business machines, have been available for several years, and there are now some 100,000 sets in service.

New and inexpensive data access arrangements recently made available are making it possible to link more and more devices, whether owned by telephone companies or private businesses, to the nation's telecommunications network – further expanding the usefulness of both. Picturephone service adds another dimension to this network.

The next decade also gives promise of a true communications center in the home. Through what we think will be simple and inexpensive devices, the home – like business – will have available to it such communications services as facsimile, access to time sharing computers, Vistaphone, and expanded entertainment through Cable TV. Remote Meter Reading over telephone lines will probably also become a widespread reality by the mid-1970's.

All of these uses, present and potential, are both the challenge and the opportunity of the communications and the computer industries. The question is not what can be done to advance voice and data communications in the 1970's, it is a question of what can be done at an economical cost – the market itself will make the choices. Advancing technology, the expanding market for information, and the growing economy all point to a challenging decade ahead with the advent of creative information systems. □

HOW CAN MACHINES DO WHAT THEIR MAKERS CAN'T?

Dr. Zenon W. Pylyshyn
Dept. of Psychology and Computer Science
University of Western Ontario
London, Canada

It is a fact of history that almost always each major new development in technology is treated at first as being a more convenient variant of some already existing device. Thus computers were — and to a large extent are even now — used to speed up and make more convenient the work of calculating, filing, and printing results. But it has rapidly become obvious that computers are inherently much more than glorified files or desk calculators. Their tremendous power and potential rests on the fact that they enable man to do different kinds of things — things which he would not and, what is even more significant, ***could not*** do before. In what follows we shall briefly consider this statement, which is in need of clarification, because it harbors some apparent paradoxes. Let us proceed by inquiring: What kinds of tasks can now be done that could not have been done without computers?

No one can fully answer this question. Although only slightly more than two decades old, the computer is just emerging from being used only as a very fast clerk. It is also being used for work that could be done by people, but that very often would not have been done, because, without the labor-saving aid of a computer, this work would have been too costly or would not have appeared worth the effort. For example, every decision involves some effort to obtain relevant information, search out possible alternatives, weigh all the relevant factors, etc. — factors which make up what may be called a human decision cost. The validity of a decision can usually be improved simply by investing more effort in the process — by getting more and better data and generally by considering more factors in more ways.[1] Thus usually human decision cost works against rational decisions, and causes the use of simple rules of thumb or traditional criteria. By decreasing the human decision cost and making more information available, computers can make a big difference to decision-making, even though the actual making of decisions is not a new development.[2]

However, in many areas the power of a computer can be harnessed to do things which a human could not do under any circumstances. The paradox, then, is this: Since a computer does exactly what the user programs it to do, how then can it do things a human cannot do? In essence the answer lies in the fact that certain human skills and certain machine skills are not interchangeable. Although 10,000 horses may have the same power as the engines on an airplane, there is no way to interchange this power so that the 10,000 horses can be used to fly the airplane! We shall, in what follows, examine a number of factors which help to account for the apparent paradox of why a machine can do a job which a person could never do.

Dr. Pylyshyn is currently a visiting fellow at the Institute for Mathematical Studies in the Social Sciences at Stanford University. This article is taken in part from his book, *Perspectives on the Computer Revolution*, ©1970 and reprinted by permission of Prentice-Hall, Inc., Englewood Cliffs, N.J.

Value of Information Over Time

The first factor which we will consider is that the value of information in many cases drops sharply with the passage of time, even though the information itself remains constant. Man is a planning animal, and making plans implies predicting outcomes from present conditions. To predict we must have information about (1) the conditions now, and (2) the lawful relations among these conditions — i.e., what events followed similar conditions in the past. For example, to predict market changes we must know what products and services the public wants and what the trend is. From other records we find out whether this trend is likely to be a continuing one or a passing fad.

Obtaining the required information and making a prediction take time. The longer they take, the more out of date is the information on which the prediction is based and the less likely is the prediction to be correct. In the limit, as the processing time becomes large enough in relation to the market fluctuation, we may find ourselves predicting present conditions!

This problem is serious. For example, the 1950 United States census (done with punched-card equipment) took about two years to produce (by which time the population could have increased by 10 per cent). Good forecasts of the weather depend on large amounts of up-to-date information on conditions. To process this data takes time. The more factors one takes into account, the more time it takes to gather and process this information, and the more out-of-date is the forecast based on this information. Thus, for a given processing speed, there is a practical limit to the number of factors that one can take into account in a forecast. Consequently the accuracy of prediction depends strongly on processing speed.

Delay Can Be Disastrous

The problem is especially serious when a feedback loop is to be closed for the purpose of controlling some process. Any delay in the availability of information may be disastrous to the control. To illustrate this problem, we use

"Although 10,000 horses may have the same power as the engines on an airplane, there is no way to interchange this power so that the 10,000 horses can be used to fly the airplane! In the same way, certain human skills and certain machine skills are not interchangeable."

the thermostat as an example. If the temperature setting on the thermostat is, for example, 72 degrees, and the room temperature is 68 degrees, the thermostat causes the furnace to start. As the house warms up, the temperature at the thermostat eventually reaches 72 degrees and causes the furnace to shut off. However, because of the heat stored in the furnace, vents, and parts of the room nearest the radiators, the temperature does not immediately start to drop but continues to rise a little, then levels off, and drops. Again, as the temperature drops below 72 degrees, the furnace is turned on, but the temperature continues to drop somewhat until the heating system has had a chance to warm up. The temperature then starts to rise, and the

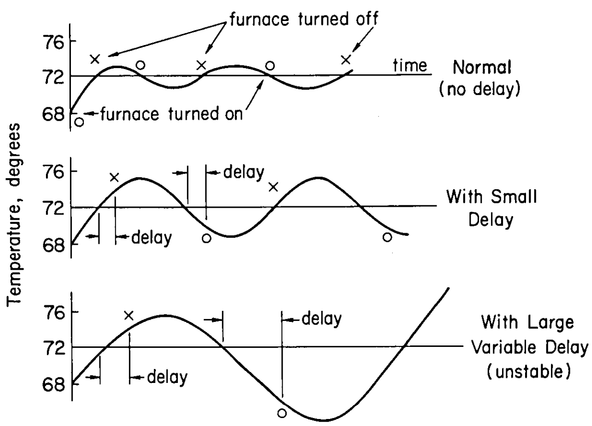


Figure 1

whole cycle repeats as illustrated in Fig. 1. As long as the capacity of the furnace and the outside temperature are within limits, this system maintains the room temperature within several degrees of that set on the thermostat.

Now we introduce a delay between the time the temperature reaches 72 degrees and the time the thermostat reacts and starts or stops the furnace. This delay time is analogous to a processing time that results in a delay between the time at which something occurs and the time when the decision is made to take corrective action. The absolute time of this delay is not so important as is the size of the delay in relation to the speed at which the system is changing — i.e., a second is a small delay if the temperature is changing at the rate of 1 degree per minute but is a long delay if the temperature is changing 10 degrees per second.

The result of the delay is that after the temperature has risen to 72 degrees, it continues to rise with the furnace on for a period before the furnace is shut off. Similarly, it continues to drop for a longer period after the temperature has dropped to 72 degrees before the furnace is again turned on. If the delay is small, the only consequence is that the temperature in the room varies over a wider range from minimum to maximum than it would if there were no delay. If, however, the delay becomes long and, as often happens, other factors come into play which cause the delay time itself to vary, the range from minimum to maximum becomes increasingly larger as time goes on. In the terminology of control engineering, the delay results in the feedback from environment to controller (furnace) becoming noncorrective or positive, causing the system to become unstable or perhaps self-destructive.

It may be difficult to see how such a delay may be brought about by limitations in data-processing speed in the case of a thermostat, but the problem becomes more realistic in the case of the marketing problems of a large

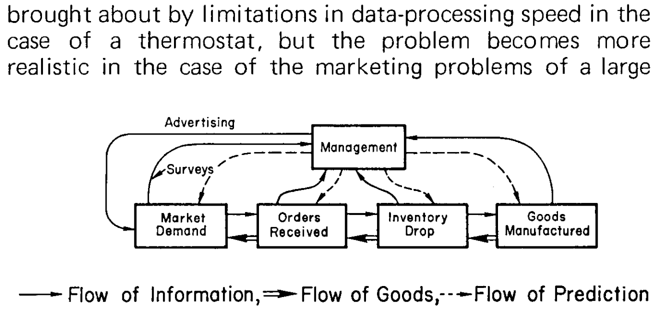


Figure 2

firm. For example, as illustrated in Fig. 2, delays between market demand and response by a manufacturer may be substantial. An increase in market demand for a product leads — after a time — to an increase in the number of unfilled orders on hand. After some time this increased demand leads to a drop in inventory. Again after some delay the drop in inventory becomes large enough so that the rate of manufacture of the product is increased. This increase, however, occurs a considerable time after the market demand begins to increase. The increase in manufactured goods eventually builds up the inventory and outstanding orders begin to be filled. If the original rush of orders was large, resulting in a large inventory drop, then the rate of production might have been drastically increased. But because of the delays in the entire chain, if the market demand fluctuates rapidly enough, it is not inconceivable that by the time the goods make their way into the market in sufficient quantity to satiate demand, the rate of manufacture is high and increasing when demand is dropping. This is exactly the condition of positive feedback that we obtained in the case of the thermostat with large delay.[3]

To get around this situation, market predictions are made in an effort to cut down on some of the delay, and the system is designed to tolerate laxities (warehouses may be larger than required for the anticipated need or filling orders may be delayed). If the system were not able to tolerate these inaccuracies, the industry could not function. In particular, if the fluctuations were rapid in comparison with the time required to collect and process market data for a sufficiently accurate prediction, this kind of process could not take place. Just such control situations are present in current highly sophisticated control processes.

Control of chemical processes. Temperature, pressure, concentration of various chemicals, and the second-by-second changes in these quantities must be processed very rapidly to predict their values in the next instant and to make their control possible in a rapidly changing chemical reaction.

Guidance of missiles. The position, velocity, acceleration, direction, pitch, yaw, etc., of a missile must be processed very rapidly by computer to predict these values in the very next instant, so that corrective action can be taken to keep the missile on its intended course. Since no amount of human effort could be successfully harnessed to do this task fast enough for the result to be of any use for corrective action, tasks such as missile control could not be accomplished without computer intervention.

Addition of Human Effort

Part of the reason why human effort could not take the place of the computer in applications such as the control of missiles is that human effort is not additive. That is, a job requiring a processing effort of one hundred hours by one man cannot be accomplished by one hundred men in one hour or by 6,000 men in one minute. The trade-off of numbers and time is severely limited by the rapid increase in the amount and the complexity of communication and in the coordination required for the increased number of people involved. It may, for example, take fifty people ten hours to do the one hundred-hour job that could be done by one man in one hundred hours. In fact, if C. N. Parkinson is correct,[4] as more people are added to the task force, the contribution of each toward the main task becomes rapidly minimal compared with the effort expended toward coordinating others and servicing the organizational wheels. There is thus a very real limit on how rapidly an indefinitely large number of people can perform a given task.

Human Data Processing

Man is severely limited in a number of data-processing functions. He can attend to a very limited number of things at one time. For this reason a person deals with informationally rich qualities, such as concepts, impressions, and symbols.[5] This mode of processing is highly adaptive in dealing with the natural world, with interpersonal relations, and with highly organized and relatively stable phenomena. It is, on the other hand, not well suited to dealing with large masses of relatively independent and rapidly changing variables such as are generated by modern technology.

The Power of Selection

A human can process a great deal of information if it is highly redundant and highly patterned — i.e., if most of the information is not relevant to the task and if the information is organized in such a way that it can be summarized in a simple way by a concept, a symbol, a mental image, or words. For example, as I look around the room my senses are exposed to a vast amount of information. If someone were to ask me later about the room, I would be able to tell him a great deal because the things I perceive are organized in a way relevant to the kinds of questions another person may ask. However, I would not be able to report most of the things which my senses had received — whether the windows were dirty, whether there was a sound in the hallway while I wrote the last sentence, how many coughs I heard from the next room, etc., all of which had entered my senses. The fact that I notice and may remember all things that are likely to be important is a tribute to the great power of selection with which the human brain is endowed.

Another example of this power of selection is that although the rate of transmission of information through a television channel is many thousands of times larger than the rate at which a person can receive it through his senses and process it, a person can easily detect rather small imperfections in the picture — particularly if they involve distortions of familiar objects. Because most of the content of the picture is predictable from preceding moments, the person pays attention only to the important changes — for example, the movement of performers.

In an industrial control situation, on the other hand, there may be only twenty dials which may change every second. This is relatively little information compared to what is displayed on a television screen, but if all of it is at all times relevant to the control of the process, the controlling cannot be done by a human. A human can perform especially well, however, when the number of dials, sound signals, movements, etc., is even larger but when action is required only when some unusual pattern of these signals occurs — such as is the case in piloting an airplane or monitoring a defense radar system. Human perception is more hypothesis-testing than direct information intake.[6]

In addition to being able to attend to only a few things at one time, a human is most fallible when engaged in simple repetitive tasks wherein he is subject to distractions, boredom, and lapses of attention. The machine, on the other hand, is best under these conditions. As the volume of information which must be processed in our increasingly complex society increases, the amount of human error goes up rapidly. To counteract this error, we institute elaborate systems of checks and balances which result in increasing duplication of effort. This increase in red tape produces the same problems of communication and coordination that we encountered when we tried to trade off more people for less processing time in a previous example. Thus the operation of such mammoth clerical enterprises as the civil service, insurance companies, stock exchanges and brokerage houses, banking institutions, and airlines, would not be possible today without computers.

Psychological Availability of Information

Even when a person knows all the facts about a problem, he cannot immediately see all the consequences of those facts. This statement, taken by itself, seems so obvious and trivial that it is not worth uttering. However, neglect of this fact explains in part why we find it difficult to see how a machine can produce a result which may be surprising to the person who programmed it — and why a machine is not often thought of as an intellectual partner in creative work. Lady Lovelace was the first person to make a point which has been repeated frequently in recent years. She stated in her ***Scientific Memoirs*** that "the Analytic Engine has no pretentions ***to originate*** anything. It can do ***whatever we know how to order it to perform***." Although the latter statement is indubitably true, for several good reasons it is misleading to conclude that because in a sense the machine is the slave of the programmer, it cannot serve him in a creative capacity.

One reason has already been alluded to above. Suppose, for example, that we have done a study of the driving patterns of people in a city. We know how fast they go on the average, what proportion go in various directions on each street at certain times of the day and toward various destinations. Suppose further that we know the maximum volume that each street can handle and the consequences of exceeding this limit. Even though we have all these facts, it is by no means obvious to us what would happen if certain conditions were changed. What would happen, for example, if one street were made wider, another were converted to a one-way street, and an expressway were added in another part of the city. Each of these changes would have an effect ultimately on the traffic on every other street. Furthermore, this effect is completely determined by or is predictable from the data we have. Getting the data out is another matter, however.

This kind of problem is commonly approached by representing the cars and driving patterns in a model inside the computer. We write a program to simulate the flow of traffic, subject to the various constraints of the problem (location, direction, number, and capacity of the streets). We can then experiment by changing the constraints and observing what happens to the flow of traffic. If such a simulation were developed in sufficient detail, it would even be possible to simulate an individual automobile traveling a given route through the city and to determine the average time and the best route under various conditions. In fact something very similar is being done by American Airlines to determine the optimum routing of aircraft between distant cities, taking into account air temperature, wind directions, velocity, and altitude. The technique of simulating in a computer the operation of complex processes — such as chemical processes, production schedules, military operations, communications networks, social interactions, and even psychological processes — is an important intellectual application of computers.[7] It enables known facts to be put together so that the consequences of these facts are made available in a way which would otherwise be impossible or very tedious.

The computer can have a role in the creative or intellectual area in another way. This process also relies on making known facts more available to people by combining some of the special abilities of the computer with special human talents in a creative partnership. Here the computer serves as an extension to many of man's abilities to process information, such as his abilities to visualize, remember, draw, search (or scan) a text, solve problems, and learn. An example of this application is the use of computers to manipulate graphical displays. Systems such as SKETCHPAD (MIT) or DAC (Ford) are being used in a variety of applications to help engineers design automobile bodies, airplane fuselages, space vehicles, bridges, and electrical circuits. The tasks of visualizing the three-dimensional object from all angles and of making sure design changes do not affect functional requirements have been taken over by the computer; the engineer-designer is thus free to exercise his creativity in the central task of imaginative design.

Reliance on the computer to render information more available is also the purpose of a variety of information-retrieval applications, including the retrieval of information in science to avoid duplication of research, in law to establish precedents, in medicine to find relevant case studies and to facilitate diagnosis, and in literature to study style. Of these, only two are at present widely available as commercial services — the scientific and the legal data retrieval systems.

We should add to our list yet one more reason why a computer may produce a result surprising even to its programmer. A computer can be made to respond not only to its original program but also to changes in its environment. In this case we have a program which "learns" as it proceeds. Programs have in fact been written which do this. A. L. Samuel's checker-playing program improves its strategy the more it plays. It can in fact play another checker-playing computer to increase its skill. Such a program not only produces results not anticipated by its designer but may in fact excel him if given a good learning environment. □

References

1. Herbert Simon has developed a model of human decision-making in which the process is characterized by satisfying, or searching for the first satisfactory solution, rather than by optimizing, which is the more rational search for the optimal or best solution. For a discussion of this, see Simon, H., "Rationality and Administrative Decision Making," in H. Simon, *Models of Man*, ed. H. Simon. New York: John Wiley & Sons, Inc., 1957; and March, J. G., and H. Simon, *Organizations*. New York: John Wiley & Sons, Inc., 1958.
2. The concept of a human decision cost associated with the effort of reaching a decision is an important notion in theories of decision-making. It must be taken into account in any weighting of the utility of various alternatives. This concept has been discussed by various people. See, for example, Deutsch, K., *The Nerves of Government*. New York: The Free Press, 1963.
3. This uncontrolled oscillation can, in fact, occur in business and has been extensively investigated using a technique (developed by J. Forrester) known as industrial dynamics. This pursuit makes extensive use of computer simulation models. It is described in Forrester, J., *Industrial Dynamics*. Cambridge, Mass.: M.I.T. Press, 1961.
4. See Parkinson, C. N., *Parkinson's Law and Other Studies in Administration*. Cambridge, Mass.: The Riverside Press.
5. This fact has been amply demonstrated in the psychological literature. The number of independent items to which a person can simultaneously attend appears to be on the order of seven. The limitation is, for example, reflected in the number of judgment categories a person can consistently continue to apply to some easily discriminable property such as tone, loudness, or size. This limitation was brought to the attention of many people through the now classic paper by psychologist George Miller, "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information," *Psychological Review*, 63 (1956), 81-97.

   In order to get around this limit on the number of items a person can attend to or recall, people adopt the device of encoding a great deal of information into fewer items. These items — or chunks as Miller calls them — are now informationally richer because they are drawn from a set of which there are more members. These issues are cogently discussed in Miller, G. A., "Human Memory and the Storage of Information," *Institute of Radio Engineers Transactions on Information Theory*, IT-2 (1956), 129-37. Miller, G. A., "A Note on the Remarkable Memory of Man," *Institute of Radio Engineers Transactions on Electronic Computers*, EC-6 (1957), 194-95.
6. This is one theory of perception. It is well articulated in Bruner, J. S., "On Perceptual Readiness," *Psychological Review*, 64 (1957), 123-52.
7. Computer simulation is an extremely important tool in science and in engineering design. See discussions in Orcutt, G. H., "Simulation of Economic Systems," *American Economic Review*, 50 (1960), 893-907; and Naylor, T. H., J. L. Bolintfy, D. C. Burdick, and C. Kong, *Computer Simulation Techniques*. New York: John Wiley & Sons Inc., 1966.

   An interesting application of simulation to the understanding of voting behavior is described in Pool, Ithiel de Sola, R. P. Abelson, and S. L. Popkin, *Candidates, Issues, and Strategies: A Computer Simulation of the 1960 and 1964 Presidential Elections*. Cambridge, Mass.: M.I.T. Press, 1964.

MAPPING OF JERUSALEM BY COMPUTER

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The subject of Computer Graphics (CG), i.e., the use of the computer and its peripheral equipment for preparing graphs and maps, is well-known in many fields, including various stages of industrial production, space research, spatial analysis, etc. This field is mainly developed in design departments of aeronautics companies and firms which produce motor vehicles.[1] Its application in management, industrial, and scientific fields is very wide. In recent years, there has been a trend to exploit CG systems in land use, transportation studies, urban planning, surveys for urban renewal, etc.[2]

CG Systems in the Urban Field

The use of CG systems in the urban field is becoming more and more vital for several reasons: (1) the amount of data collected in transportation and urban surveys is vast; and (2) urban data banks enable a systematic approach to the collection of urban and transportation information.[3] The Bureau of the Census devotes attention to data on small area units, and this information forms an important addition to our knowledge of the population and land uses in cities.[4]

All categories of urban and transportation data have a common denominator of geographical dimension; i.e., every feature in a city has an address. The usual system of processing data by statistical tables misses the mark because of its difficulties in relating the statistical information to spatial dimensions. CG systems provide help in the presentation of various urban features in their spatial framework.

Techniques of quantitative analysis of different planning alternatives are being used in urban research and planning more and more. These techniques are based on the development of urban and transportation models. From a survey of C.G. Hemmence,[5] it appears that most of the large metropolitan authorities in the United States use computers in planning for the following purposes:

a. Allocation Models, which distribute established regional totals of employment or land use.
b. Policy Impact Models, which measure the effect of changes in some public facility system on the pattern of land use development.
c. Activity Estimation Models, which measure the amount and location of an activity resulting from a given land-use of population distribution.

The results of these various urban and transportation models have a spatial base and require expression in mapping. Consequently in this field too, CG systems can be of great assistance.

In short, it may be said that the use of the computer for mapping purposes in urban problems centers around two stages of the planning process: the collection and processing of urban data, e.g.: population, land use, vehicle ownership, travelling habits, etc.; and the preparation and evaluation of various planning alternatives.

The Urban Atlas

Application of the use of CG in the first field by the preparation of an urban atlas of Jerusalem will be described in this article. The Jerusalem urban atlas is not the first of its kind; it was preceded by the urban atlases of Paris and London, which were prepared by conventional methods and will therefore not be discussed here. In the United States, an atlas of 20 American cities[6] has been published with the aid of a computer and served as a breakthrough in the field of using the computer for mapping purposes. The Jerusalem urban map has drawn much from the experience reported in the atlas of 20 American cities.

An urban atlas is a cartographic expression of a large amount of urban data, which come from a wide range of sources with variation of detail and reliability. These sources may be the Bureau of the Census, various municipal departments, insurance companies, school boards, etc. Some of the information is not to be found in any of the existing administrative frameworks, and detailed field surveys have to be carried out to collect the data. In order to exploit information from so many varied sources, a data bank is essential.

The Hebrew University has been engaged in recent years in establishing such a data bank, which assembles all existing records, for Jerusalem. Information that cannot be gathered from administrative sources, such as types of buildings, the physical condition of buildings in the city, the number of employees in each establishment, etc., has been collected by field surveys. Transportation data was gathered by the Jerusalem Transportation Master Plan Team. The main problem in matching the data and processing it cartographically is finding a single geographical basis for the information. Some of the data is listed by street name and house numbers; other facts are registered by blocks and parcels; another section, by census tracts or transportation zones. The only way to overcome this inconsistency in geographic coding is by the use of coordinates, i.e., the marking of geographic coordinates on the national grid of every building in the city, and the creation

"The use of the computer for mapping purposes in urban problems centers around two stages of the planning process: the collection and processing of urban data, and the preparation and evaluation of various planning alternatives."

of a geographic base file, which enables preparation of various maps for various geographic units in accordance with each map's specific subject.

The Geographic Base File

The first successful experiment in this field was carried out in the Census Use Study of New Haven, Conn.,[7] and the system developed there today serves as a basis for the development of similar files in the metropolitan areas of the United States. This system is at present applied to the Urban Data Bank of Jerusalem. The geographic base file is the data repository containing all the area information which the urban researcher or the planner will manipulate or display. This file is a computerized equivalent of the city map. In the geographic base file all the location characteristics of the streets are preserved, including their direction, the blocks along them, the addresses which lie on either side of them. The definition of the streets and place names must be consistent; so the file must be manipulated without error.

The use of the geographic base file enables the urban researcher to prepare statistical tables or maps on the basis of various geographic units, according to the specific aims of each research.

In Jerusalem, various units were chosen for the different subjects of the atlas. The land use maps were prepared on the basis of grid cells of 100 x 100 meters; the population data were processed on the basis of city blocks and census tracts; and commercial uses and transportation data were processed along streets.

Use of the Printer

During the consideration of the appropriate system for preparing the maps in the atlas, the different possibilities were examined from the point of view of the peripheral equipment and the software computer program. The Hebrew University has a CDC 6400 computer; and it had to decide between the alternatives of using the printer (CDC 501), or the plotter (CALCOMP 565).

The use of the printer enables the printing of a numerical value in a square or another geographical unit. In a more advanced form, dots can be printed in various densities or even in patterns of different intensity of black. The advantages of the use of the printer are: the speed of preparation; the relatively cheap price of the map; and the possibility of printing a large number of copies. On the other hand, its disadvantages are: the mediocre graphic form; the impossibility of sketching lines; and the inflexibility in transferring a map from one scale to another. As regards the software for using the printer, there are a number of programs that enable mapping with the printer's help. The most important group of programs is the SYMAP, which has been developed in recent years by the Computer Graphics Laboratory at Harvard University.[8]

The SYMAP Programs

The SYMAP, which is designed for large computers, at present includes about 50 options that permit various types of shading, printing of patterns in grid squares, polygons, filling in the area between isolines, the printing of headings, the legend, frame, map scales, etc. SYMAP programs also carry out a series of statistical calculations on the subject represented in the map, such as arithmetic mean, standard deviation, percentiles, etc. The main shortcoming in the SYMAP system is that the graphic symbols produced by the printer are not rational, i.e., they give a visual impression of the intensity of a feature, but do not allow an exact grasp of its quantitative value. In order to overcome this difficulty, the Hebrew University has developed a series of new programs[9] that allows the printing of maps by the printer, under a method quite similar to the SYMAP, but with Graphical Rational Patterns (GRP). The GRP were developed by Prof. Roberto Bacchi; they are extensively used in various cartographic fields.[10]

With the aid of these programs, all the maps of the atlas have been prepared by the printer in the following subjects: population, age structure, country of origin, employment by economic branches, level of education, etc. Maps of buildings in the city were prepared by a similar system of filling in an area of a zone by a GRP, such as the percentage of dilapidated structures, the percentage of buildings that were built during a given period, various types of buildings and roofs, etc. Land use maps were also prepared by the printer on the basis of squares of 100 x 100 meters. The information was printed both in the form of numerical values and in the shape of GRP for every square. The data appearing in every square as regards land use are: the number of units; the number of employed; the floor area; and the mode of the period of establishing the various land use units. The maps appearing in black and white will be photographed from the output of the printer, while the colored maps undergo cartographic processing by the National Survey of Israel, which prints them.

Use of the Plotter

Use has also been made of the plotter in the preparation of atlas maps. The plotter enables complete sketching of the map, including the street network, complicated graphic signs, and the use of different colors in sketching. In the preparation of the Jerusalem atlas, the plotter was used for those subjects which demanded isolines, such as the map of isovalues of Jerusalem land prices. The main use of the plotter in the preparation of the atlas is in sketching geo-statistical parameters, which sum up synthetically a complete distribution of a certain feature. These parameters include the distribution's center of gravity, the median center, the standard distance and the main axis of distribution.[11] The plotter also indicates the point of maximum potential on the map. The geo-statistical parameters sketched by the plotter are graphically transferred to the scale of the map prepared by the printer. The combination of detailed mapping of distributions by the aid of a computer with the calculations and sketching of geo-statistical parameters for each of the spatial distributions provides the researcher and urban planner with a very powerful instrument in the process of his work.

Experiments with the use of the plotter for filling in the area of a zone by repeated patterns have proved to be expensive and time consuming. Consequently, it seems that the best compromise combination for preparing an urban map is: (1) the use of the printer for filling in the area of a zone or a square by a graphic pattern; (2) the use of the plotter for sketching geo-statistical parameters and isolines; and (3) the combination of both results on one map by graphical methods of transfer from one scale to another.

One more possibility exists – using a cathode ray tube (CRT) for the preparation of urban maps. This was examined by the Research Institute of the Illinois Institute of Technology,[12] and was found feasible. Experiments at this and other institutes showed that the price of preparing a map in this fashion is relatively very cheap, in comparison with other methods, but that the investment in equipment is very high.[13] Despite the advantages, this system has not been tried at the Hebrew University, since it does not possess CRT equipment.

Plans for Development

After the completion of the urban atlas, a series of programs are being prepared which will enable use of CG systems in simulation models. These are designed to test development patterns of built-up urban areas under various hypotheses of the growth of the population and various planning alternatives. The goal is to get the results of the simulation in the shape of a map printed by the computer. This will appreciably increase the efficiency of the evaluation of various planning alternatives, and enable quick examination of the simulation model's sensitivity to different hypotheses about the various factors in urban growth. The final stage of the development plan is the use of a light-pen for transferring the input to the computer, and the saving in the use of the digitizer for the translation of the original graphic data.

Jerusalem's urban atlas is now in the final stages of preparation. It will, in fact, be the second edition, even though the first edition has never seen the light of day. The first edition was at the printers on the eve of the Six-Day War in June 1967. The first edition of the atlas was prepared for Western Jerusalem alone and all the processing was done by hand, with dozens of investigators going over hundreds of detailed block maps of 1:1250 scale and summarizing the information for maps of the atlas on a small scale of 1:15,000. The unification of Jerusalem in the wake of the Six-Day War enabled completion of the Data Bank framework and detailed field surveys for East Jerusalem as well. It was, therefore, decided to prepare the atlas again, for the whole of Jerusalem. However, in order to prepare the atlas quickly in its new edition, all the mapping work was implemented by the computer. A calculation of the average time for preparing an atlas map by hand and by the computer shows a saving in time of 1 to 20. Similarly, the quality of the material from the point of view of precision is incomparably higher with the computer.

The success of the system of processing and mapping urban data with the computer's help, as exemplified in the Jerusalem atlas, opens new horizons to the researcher and urban planner. Undoubtedly, urban research in the coming years will employ the systems of CG on the widest scale. □

References

1. Siders, R. A.: Computer Graphics. American Management Association, New York, 1966.
2. Urban Renewal Service: Using Computer Graphics in Community Renewal. University of Washington, Seattle, 1963.
3. Threshold of Planning Information Systems. American Society of Planning Officials, Chicago, 1967.
4. U. S. Bureau of the Census: Conference on Small Area Statistics. G.E. 40, No. 5. U.S. Government Printing Office, Washington, D.C.
5. Hemmence, C. George: Planning Agency Experience with Urban Development Models and Data Processing. Journal of the American Institute of Planners, Sept. 1968, pp. 323-327.
6. Passouneau, J. R., and R. S. Wurman: Urban Atlas: 20 American Cities. M.I.T. Press, Cambridge, Mass., 1966.
7. Leyland, P. George: Implication of the New Haven Census Use Test for Transportation and Land Use Planning. Highway Research Record, No. 229, 1968, pp. 77-98.
8. Laboratory for Computer Graphics and Spatial Analysis: Symap V Operator's Manual. Harvard University, 1968.
9. Programs for computer mapping purposes were prepared by M. Stier, Geography Department, Hebrew University.
10. Bacchi, R.: Graphical Rational Patterns. Israel Universities Press, Jerusalem, 1966.
11. Bacchi, R.: Standard Distance Measures and Related Measures for Spatial Analysis. Regional Science Association: Papers, Vol. 10, 1962, pp. 83-132; and Shahar, A.: Some Applications of Geo-Statistical Methods in Urban Research. Regional Science Association: Papers, Vol. 18, 1966.
12. Horberg, A.: Computer Aided Mapping of Census Factors Distributed in Geographical Tracts and Districts. IIT Research Institute, Chicago, 1966.
13. Nussbaum, E.: Automatic Plotting. General Electric Information Service Department, Washington, 1967.

INTEGRATED DATA BASE IS KEY TO PRODUCTION CONTROL SYSTEM

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"Our goal was to create and maintain a complete production routing for every manufactured and assembled part, and to be able to capture a complete history of shipment information in order to make an analysis of parts shipped and to whom they were shipped."

An electronic data base integrating files on materials, parts, products, customers and sales is the foundation for a comprehensive production control system at the Troy, Ohio, plant of B. F. Goodrich Aerospace and Defense Products, a division of the B. F. Goodrich Company.

The plant's terminal-oriented computer system, called TROPICS (Troy Production Information and Control System), is designed to provide operational, engineering, purchasing and sales personnel with a common "on-line" source of up-to-the-minute product data. Its broad goal is to keep manufacturing operations as closely attuned to market demands as possible and to help plan for the future in a time of rapid expansion.

Though still under development, the system is built around an IBM System/360 Model 30 with associated disk files. The system already permits direct inquiry and retrieval over visual display terminals on the status of parts, products, orders, and other related matters. In the near future, TROPICS will be expanded to include such functions as inventory control, requirements planning and sales forecasting.

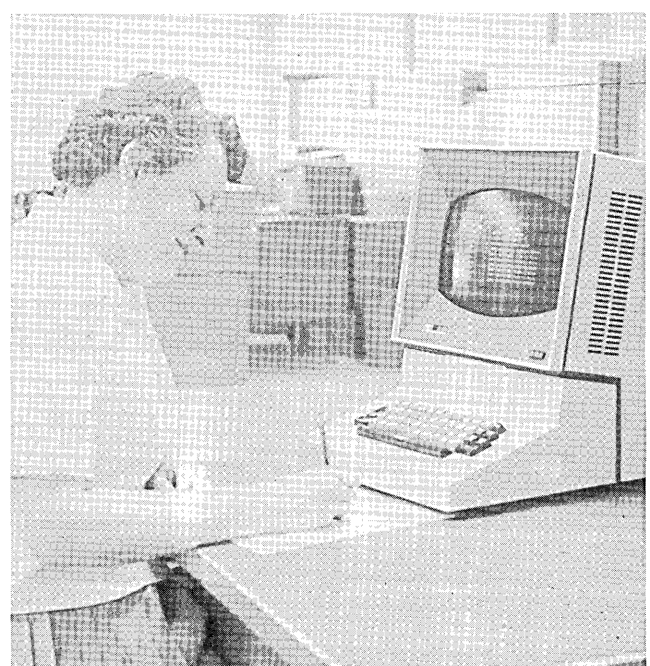
Need for System Foreseen

It became clear to the B. F. Goodrich aerospace division several years ago that the growth and increasing complexity of operations at the Troy plant demanded the application of an advanced data processing system to maintain adequate control.

The Troy plant manufactures a great variety of wheels, brakes and spare parts for aircraft, ground and water vehicles, and industrial applications. Employees in the plant work directly or indirectly on about 10,000 different production items. Since 1964, the manufacturing area has quadrupled in size and contains 420 pieces of production equipment.

In 1966, just after a large expansion and prior to a second, members of the aerospace division became extremely concerned about their ability to cope with the tremendous growth that was taking place in the production, marketing, and selling of their products. The plant's methods of operation and number of people, it appeared, would soon be outstripped by expansion requirements.

Their solution to the problem was to begin study and implementation of a computer-based system that would



In the Troy plant's material planning area, an inquiry is made via a display terminal by an order handler, Similar visual display terminals, all linked to a common product data base, are located in the plant's engineering and sales areas.

cope not only with current expansion but also future expansion. In November and December of 1966, a systems study of the Troy plant was conducted by the Information Systems Development Department of B. F. Goodrich, headquartered in Akron. The data and information gathered during this study led to the birth of TROPICS.

Objectives

The major objectives of the systems development were:

1. Establish data files that would completely describe the parts produced at Troy.
2. Be able to perform a gross explosion for all requirements by time period.
3. Develop an inventory reporting and control system, using input terminals at points of receipt, inspection and production.
4. Develop a requirements planning system that would determine the type and quantity of raw materials, component parts and sub-assemblies needed to meet production requirements in future time periods.
5. Develop a shop reporting and dispatching system.
6. Develop a sales forecasting system that takes into consideration that a number of items are produced at Troy based upon an anticipated demand.
7. Develop an operation planning system to perform the job of capacity planning. Based upon requirement planning files and schedule tables, this system would take into consideration available men and machines and develop starting dates in order to level out the loading pattern.
8. Develop an operation scheduling system by utilizing the best known techniques including simulation and linear programming.

Parts List Computerized

Although much attention was paid to the urgency of implementing a shop reporting system at Troy, the first phase of development placed emphasis on product information. We realized that if we had data pertaining to product parts, we could better determine how to control the problems associated with the manufacturing and assembly of these items. The starting point proved to be the Engineering Department, for here was where all new products first received specific documentation.

Furthermore, the parts list is a document used by practically every function at the Troy plant. Starting with the parts list, we could give service to a large number of people and at the same time give them familiarity with computer capabilities. This first phase of TROPICS would provide immediate relief to the time-consuming jobs of maintaining and searching files for higher assembly uses of component parts and of calculating gross material requirements for various products.

Though we quickly determined the benefits of such a system, even more quickly we realized the complexities of designing and programming it with a limited work force. We became aware of an available program called the Bill of Material Processor, which would help us create and maintain four disk files which were necessary for the system.

We used the program to eliminate some programming problems, but it was necessary to iron out differences in program languages and operating systems between the Troy project and local Akron computer operations, and modify the software to meet our own requirements.

Gathering the data for the files became a tremendous exercise in patience, communication, and perseverance. Without the help and involvement of aerospace personnel in designing the systems, gathering the data, and participating wherever needed, there would have been no system.

Item and Product Structure Files

Towards the end of 1967, we began creation and maintenance of an item master file and a product structure file. The item master might be compared to the inventory file of some of the other divisional systems. The structure file is a file that depicts the makeup of an assembly. Internal to the computer, these structure strings are represented as records and are commonly called "chains."

By March of 1968, these files were well established and we were producing output from the files. We had successfully replaced the old manually typed parts lists at Troy with computer produced lists. Now, when a draftsman makes a change to an assembly structure, he need not worry whether the same structure is changed on other retrieved parts lists. There is only one structure for an assembly in the file regardless of how many times it is used on different top assemblies.

Also, using the where-used retrieval capability of the system, any individual can easily determine on what brakes or wheels that component part or assembly is used. After the change is made, a request can be passed to the computer to produce parts lists for all top level wheels and brakes. The summarized requirement function of the Material Planning and Control Group, which took days for several people to prepare, is now prepared in about two hours by the computer.

Interrelated Data Base

In April, 1968, we began detailed plans for the implementation of Phase II of TROPICS, the creation of a series of sub-systems, each with associated data files that would relate to each other. The ability to inquire directly into these files via visual display terminals was also planned. By establishing one common data base we would eliminate the need for repetitious data and data records between departments. Our goal was to create and maintain a complete production routing for every manufactured and assembled part, and a description of the operations performed upon these parts, and to be able to capture complete shipment history information in order to make an analysis of parts shipped and to whom they were shipped.

At about the same time that Phase II was being planned, we learned of a data base system called MARS (Manufacturing Record System). The approach seemed intriguing and challenging. We decided to pursue it as our means of establishing a data base.

The MARS concept involved establishment of a data base consisting of three basic master files, a parts master file, a people and places master file, and an order master file. It also provided for a linkage file that ties together master files. This linking, of course, is not a physical linking, but rather an addressing scheme whereby records are linked together through programs that call upon the addresses of the records contained in the various files.

After a great deal of in-house programming, we established, in addition to the item master file and product structure file, a customer master file, a work center master file, and a sales order master file. We also created several linkage files which, in addition to connecting master files together, contain pertinent user data. These linkage files include a shop routing file, a customer shipping history file and a sales order detail file.

For about a year, the system was developed and tested using our Akron computer operations. In June, 1969, a computer was installed at Troy in a newly-constructed facility for data processing equipment and personnel.

How the System Works

The Troy plant's Product Information System currently has four major sub-systems in full operation: item and parts information; order information, customer information, and shop routing information.

Items and Parts: A visual display terminal is located in the Engineering Department, permitting engineers and draftsmen to inquire into the item master file to determine specifics about a part, such as the latest engineering order number, current change letter or drawing size. After interrogating the file the engineer may want to add to or change the status of a particular part. He then submits an engineering change to the drafting supervisor, who assigns the job to a draftsman.

The draftsman uses the parts list and blueprint to make the necessary additions or revisions to the part or assembly in question. Any changes to the parts list are sent to Data Control to be coded and submitted to the computer for file updating. A new or revised parts list is produced and sent to the Engineering Blueprint Department for duplicating and filing. This sub-system has resulted in great savings in time, increased flexibility and fewer errors for drafting and engineering personnel.

Order Information: Three forms, the sales order, change notice and order shipping copy, enter the Troy plant by phone or mail and are forwarded to the Material Planning and Control Department. The information from these forms is then coded and sent to computer operations for updating of the order master and order detail files. Daily audit and control reports are produced and forwarded to Material Planning and Control for analysis. Included is a daily shipped dollars by category report, with a breakdown by type of customer and item type.

Several inquiries via data terminals are used by Material Planning and Control personnel. A sales order can be retrieved by number and its status examined regarding parts ordered, scheduled date, ordered quantity, shipped quantity, etc. A second inquiry retrieves all in-house orders for a particular part number, showing such information as customer name, ordered quantity and shipped quantity.

Each week the entire order file is examined for items that have been added or changed. These items are then "exploded" in order to determine new requirements not only for customer ordered parts, but also for sub-assemblies and components necessary to produce these parts. Likewise, all shipments for the week are "exploded" to retrieve on-hand inventory amounts.

A purchased part explosion is used to calculate requirements for the Purchasing Department, and a fabricated part explosion is used by the schedulers in Material Planning and Control to assist in machine loading. At month end the order file is purged of all items that have been completed over 30 days. Coupled with the purging at month end is the preparation of several reports: "Total Open Orders by Market Group," "Monthly New Business by Market Group," "Monthly Net Changes by Market Group," "Current Month Shipments by Market Group," and "Open Order Dollars by Time Period." These reports are distributed to Troy and Akron Aerospace and Defense Products personnel.

Customer Information: The Sales Department maintains a customer master file on every customer served by the Troy plant. When the need arises for either a change or addition to the customer file, the Sales Department phones Data Control, which then codes and submits proper revisions to computer operations for file updating.

The customer information system also receives shipment data from the order information system for maintenance in the customer shipment history file. This enables the Sales Department to make visual display inquiries on the current month and year-to-date shipped dollars for a given part number and for a particular customer. At month end several reports are prepared for the Sales Department, including an analysis of 13 months of shipment history by part number and by customer.

Shop Routing: New products and changed products require discussion between the routing and tool design areas. After new or revised tool designs are initiated, routing personnel study the blueprints to determine the path that material must follow in order for the shop floor to produce the desired product. This specified routing sequence is transcribed onto computer update sheets.

Prior to submission of routing data the data terminal is used to verify that the Routing and Engineering Departments are in accord. This is determined specifically by the latest engineering order number. After all routing data has been obtained, the routing input document is forwarded to the Time Study Department for application of time standards.

This information is then sent to computer operations for a computer-produced shop routing. The routing accounts for movement of material from work center to work center, and describes the actions to be performed by the machine operator at that work station. When a part can be produced by an alternate method, the system has the ability to retrieve and describe the alternate path on the shop floor. This system also allows for the establishment and maintenance of a work center, usually a grouping of similar types of equipment or an area under one supervisor.

Further Development

Our currently installed systems, especially the shop routing system, lead readily into our next phase of development, shop reporting and dispatching. In this system we will establish a shop order master file containing data on items to be manufactured or assembled in the shop. The shop order will also be compared against the shop routing file so that material movements and shop floor operator actions can be extracted from the shop routing file.

A Shop packet will be prepared and will accompany the job on the floor. At various points in the plant will be located data collection devices. As a job arrives at and departs from a work center, information will be inserted into the data collection terminal, sent to a control center, then forwarded to computer operations for processing.

Various outputs pertaining to job, man and machine status will be prepared. The status of a job will be determined by making a visual display inquiry. Emphasis in design will be upon man and machine communication so as to improve output of the shop floor.

To sum up the accomplishments and benefits of the Troy Production Information and Control System to date;

1. Each operating department that has become involved with TROPICS has realized its own particular benefits.
2. There is one master file or data base for the entire plant.
3. By auditing all input data, the computer requires all users to standardize to the item master file which is controlled by engineering releases. This standardization tends to minimize communication errors.
4. The Troy plant management has been provided with the most accurate and timely data ever experienced. ☐

Looming Battle for the Eastern European Computer Market

When Soviet Prime Minister Sergei Kosygin came to Britain four years ago, the only manufacturing plant he visited was the computer systems, radar and advanced electronics centre of Elliott-Automation at Boreham Wood, thirteen miles from Charing Cross.

Whether this was by accident or design never became clear, but one thing was quite plain despite the almost continuous flashes from hundreds of cameras and the jostling of tightly packed pressmen – Kosygin was intensely interested in the control of industrial processes by the automation techniques of which Elliott at that time was Britain's main protagonist. Kosygin is an engineer by training.

ICL Exports

Since then there has been an upsurge in computer business between Britain and the countries of Eastern Europe. But not more than a month ago, the managing director of the only British-owned and controlled business computer company, International Computer Ltd. (ICL), made a strong plea to be allowed to export freely to the area, and particularly to the Soviet Union which he described as a vast potential market.

Arthur Humphreys, in the seat of power at ICL for three years, told a meeting of a Parliamentary Committee that outlets towards the eastern bloc countries were worth cultivating; and, that if Britain did not get into those markets quickly with the equipment the countries of the Socialist bloc require to modernise their economies, the Americans would be there in force, despite strategic embargoes.

This is a theme that Humphreys has pursued on a number of occasions before. At first sight he would seem to be overplaying the act, since in the second half of the 1960's British computer manufacturers have probably taken around £20 million worth of orders for business machines, and ICL itself has an order from Russia for £5 million in the pipeline.

Britain has been by far the most important supplier to Eastern Europe, way ahead of all the American giants. What then, has the ICL executive to fear?, one could ask. After all, several of the giants have been testing the market behind the Iron Curtain with relatively little success.

But what he foresees is that once some kind of settlement is reached in Vietnam, the COCOM controls, designed to prevent "strategic goods" from reaching the Socialist countries, will crumble overnight. Then, the floodgates of United States salesmanship will open, and it is anyone's guess how much of the market – particularly the Soviet market – would be left for ICL, or for any other European company.

Britain, though not involved in the Vietnam adventure, nevertheless has adhered scrupulously to these COCOM procedures. They apply through the Board of Trade which knows just how much latitude the British Government can take to pass certain contracts. Where there is doubt, the case has to be put up through the permanent British delegate to COCOM in Paris – there are also French and Japanese representatives as well as members from the NATO and other non-Communist countries.

What happens thereafter is not clear. Delegates refer problem cases back to their governments and, Arthur Humphreys says, this is where the trouble begins. There is no direct refusal – only endless delays as exasperating to the would-be buyer as to the manufacturer. Alternatives acceptable to the main anti-Communist power – America – can be suggested but they invariably are such that when computers are involved, the performance of the acceptable alternative is nothing like the original proposal.

The Computer Population

Russians take a rather detached view of the whole rather clumsy procedure, according to the British salesmen who discuss embargo matters with them, tending to shrug and say "why throw good business away?" That there is good business is beyond doubt; Professor Stanley Gill of Imperial College of Science and Technology, University of London, who is one of Britain's best-known computer scientists, estimated after his 1969 visit to the Soviet Union that the total non-military computer population there was around 1,200. If the other countries of Eastern Europe have the same number again – which probably is over-generous – this would give a total business computer installation of 2,400 machines for a population of 300 million inhabitants. Britain with 50 million people has more than 4,000 computers above the £30,000 (72,000 dollars) mark and more than 7,000 machines in all. America's computer population is near the 55,000 level.

Vast as the discrepancy is now, it could worsen rapidly as the computer markets outside America expand. Total value of the world's computer equipment is around 30,000 million dollars of which 9,000 million dollars is outside America. By 1975 the world figure may be as much as 75,000 million dollars, shared almost equally between the United States and the other economically advanced countries of the world.

Multi-National Plan

To meet the challenge of such fast growth rates, Eastern Europe does not need advanced computer technology so much as advanced manufacturing technology, and it is towards this that scarce hard currencies have been channelled. There is the multi-national plan for a whole range of Rjad computers for which the focal centre will be Minsk.

But because it is a multi-national and multi-lingual plan – Russia designing the main computer, Czechoslovakia contributing the peripherals, Poland the electronic memories, Rumania and Bulgaria components, and Hungary software – it inevitably will be cumbersome and slow.

Based on a report in **Le Figaro**

This means a growing market for companies in the West who are prepared to sell the latest equipment available and not the second generation computers, which America has been trying to interest East European countries in for the past three years. The proviso is a better appreciation in Europe of the economics of eastern trade — an understanding that many would-be exporters in Britain claim the Board of Trade is lacking. There is complete agreement that once the specification is met, the purchasing organisations in the East pay on the nail.

That is the picture so far as business computing is concerned. Perhaps expansion in this area has suffered because the Socialist nations have been striving hard to build up production of manufactured goods to levels comparable with those of the industrialised countries of Europe by supplying the latest computer-control techniques in their industry.

GEC Elliott Automation

It is no surprise that Czechoslovakia bought a steel plant control system from Britain before it was quite fully implemented in a British steel mill, or that many controllers have been or are being installed by Elliott-Automation throughout the area, notably at the vast Schwedt petrochemical and refining complex in East Germany. Elliott-Automation is now part of the GEC group by its inclusion in the £100 million (240 million dollars) a year GEC-Elliott Automation company. This company's East European business trebled in 1969 and it took orders worth near to £8 million (19.2 million dollars) for equipment directly connected with plant automation.

Ferranti

Meanwhile, the other major automation company in Britain, after an unsuccessful flirtation with Russia, has created an intriguing capitalistic situation in Czechoslovakia by appointing the latter's Inorga group to promote the Ferranti Argus series computers in that country and other neighbouring areas.

The Argus is as advanced a computer as any in the West. Inorga has a respectable number of large industrial control projects to its credit. Ferranti has applied its machines to the control of steel mill operations, message switching in the world-wide seat reservation network of the British Overseas Airways Corporation, and is the major supplier of Imperial Chemical Industries for its chemical plant operations. The marriage of the two should be extremely fruitful and the situation is one which largely absolves Ferranti from having to maintain big support teams outside Britain.

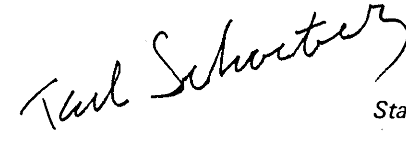
COCOM Relaxation

Between them, GEC and Ferranti are likely to take the lion's share of the external contracts for process and manufacturing control in the next several years, despite COCOM — which to be accurate has relaxed its stringency somewhat in the last 12 months.

Just how much it has relaxed will be demonstrated without any further doubt by what happens to the latest contract placed by the Soviet Union with ICL — the £5 million (12 million dollars) deal mentioned earlier. This is for two of the largest machines made in Britain which are each to have a precursor of the same family, but much smaller, to prepare the basic routines.

But they are intended for Serpukhov, to work with the huge 70 GeV accelerator there. Now since this machine, on which the Russians must have spent £100 million (240 million dollars), is twice as large as anything operating in America, there is a built-in mental block to be overcome by the United States delegates to COCOM. Secondly, it is a nuclear research centre — and no one is likely to make a clear distinction between fundamental high energy physics research and bomb work, except of course the British.

But to argue the point needs advanced knowledge the British representatives are unlikely to possess. Moreover they have often been accused of over-scrupulous observation of COCOM rules so whether or not Serpukhov gets big British computers will be an interesting matter to observe.



Ted Schoeters
Stanmore, Middlesex
England

c.a NUMBLES

NUMBER PUZZLES FOR NIMBLE MINDS —AND COMPUTERS

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 705

```
   M A Y A L L              W E L
 + P E O P L E S          x C O M E
 = C S S O H R O      = B L Y M O E L

         BCT = WMP = YCT

   749018     073462     3180736
```

Correction of Numble 704

Unfortunately there was an error in Numble 704 in the April issue; a "Q" was printed in place of an "O". Please replace line QUUNRGN with OUUNRGN. Because of this error, we will publish the solution to Numble 704 in the June issue rather than this issue.

Our thanks to the following individuals for submitting their solutions to **Numble 703:** G. P. Petersen, St. Petersburg, Fla.; Brad Webb, Austin, Tex.; and Robert Weden, Edina, Minn. **Numble 702:** Bernard Kreul, Cypress, Calif.; and G. P. Petersen, St. Petersburg, Fla.

c.a PROBLEM CORNER

Walter Penney, CDP
Problem Editor
Computers and Automation

PROBLEM 705: AL'S 3-RING PROBLEM

"Oh, woe is me!" exclaimed Al rummaging through the waste basket. "I must have thrown away the printout of that Magic Ballantine program."

"Magic Ballantine? What's that?" Bob asked.

"It was really a three-circle Venn diagram that Dr. Lawthorne wanted to use in his Logic class. The numbers 1 to 7 were to be put in the seven areas so that the four numbers making up each circle had the same sum."

"I don't see what connection that would have with a Venn diagram."

"He may have wanted to show that each of the three circles had the same area. But I didn't question why, I just did it."

"How did you go about it?"

"Brute force. I just took all 5040 ways of putting the numbers in the various areas and checked whether the sums were the same."

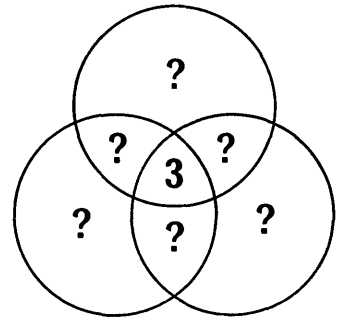
"There must have been quite a few that worked," Bob mused.

"Well, not so many, but too many to do by hand. I don't want to write the program over again and run it just to get the one Dr. Lawthorne decided to use."

"He wants to use only one?"

"Yes, he picked one out. All I remember is that it had 3 in the center." Al continued his rummaging.

What figures did Al put in the various parts of the diagram so that the four numbers making up each circle had the same sum?

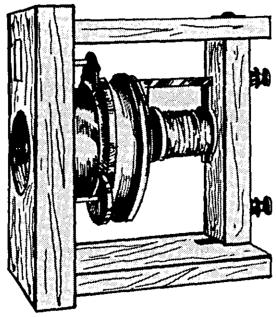


Solution to Problem 704: Buttons and Bulbs

If there is any bias in favor of right, a subject should press right all the time. With 75% right and 25% left, his score will be 75%. If he tries to match the bias in the lights, pressing right (randomly) three times as often as left, his score will be only 62.5%.

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.

Where were you when the



telephone rang?

Chances are you weren't anywhere—yet. For it was March 10, 1876 when Alexander Graham Bell made that first historic telephone call to Mr. Watson...and another significant milestone in man's attempt to better himself and his environment had been passed.

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David Dickie ends the murderous range wars with common-sense compromise that put cattle and sheep on the same grazing ground and brought peace to the West.

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CALENDAR OF COMING EVENTS

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

May 7-8, 1970: Seventh Annual National Information Retrieval Colloquium, Sheraton Hotel, Philadelphia, Pa. / contact: Philip Bagley, Information Engineering, 3401 Market St., Philadelphia, Pa. 19104

May 10-13, 1970: 1970 ASTD (American Society for Training and Development) Training Equipment and Services Exposition, Anaheim Convention Center, Anaheim, Calif. / contact: ASTD, P.O. Box 5307, Madison, Wis. 53705

May 11-13, 1970: 24th Annual Technical Conference and Exhibit of the American Society for Quality Control (ASQC), Pittsburgh Hilton Hotel, Pittsburgh, Pa. / contact: Robert W. Shearman, Admn. Secy., American Society for Quality Control, 161 West Wisconsin Ave., Milwaukee, Wis. 53203

May 13-15, 1970: 8th Annual Convention of the Association for Educational Data Systems, Deauville Hotel, Miami Beach, Fla. / contact: Dr. Henry C. Fox, c/o SIRS Project, 3525 N.W. 79th St., Miami, Fla. 33147

May 17-20, 1970: 23rd International Systems Meeting, Las Vegas Convention Center, Las Vegas, Nev. / contact: Richard B. McCaffrey, Assoc. for Systems Management, 24587 Bagley Rd., Cleveland, Ohio 44138

May 18-20, 1970: Sixth Annual Data Processing and Automation Conference, National Rural Electric Cooperative Association, Cosmopolitan Hotel, Denver, Colo. / contact: C. E. Aultz, NRECA, 2000 Florida Avenue, N.W., Washington, D.C. 20009

May 18-22, 1970: "Image 70," 23rd Annual Photographic Science and Engineering Conference, New York, N.Y. / contact: Society of Photographic Scientists and Engineers, 1330 Massachusetts Ave., N.W., Washington, D.C. 20005

May 19-21, 1970: G.E. 400 Computer Users Association Annual Conference, Towne House, Phoenix, Ariz. / contact: Bruce H. Reinhold, Pittsburgh National Bank, 10th St. and Fort Duquesne Blvd., Pittsburgh, Pa. 15222

May 20-25, 1970: Nippon Office Management Association (NOMA) 40th Business Show, Tokyo International Trade Center, Tokyo, Japan / contact: Masaharu Takeuchi, Executive Director, NOMA, Shuyodan Bldg., 25-2, 4-chome, Sendagaya, Shibuya-ku, Tokyo, Japan

May 21-22, 1970: International Computing Symposium 1970 (Joint meeting of all European ACM chapters), Bonn, Germany / contact: Chmn. of the German Chapter of the ACM, 7032 Sindelfingen, Iseler Str. 1, Germany

May 24-25, 1970: Southern N.E. Telephone Co. SET-GUIDE Group Meeting, Selection, Evaluation, and Training of EDP Personnel, Minneapolis, Minn. / contact: Mr. Joseph Andreana, Southern N.E. Telephone Co., 300 George St., New Haven, Conn. 06506

May 24-28 1970: 29th General Meeting of GUIDE, Leamington Hotel, Minneapolis, Minn. / contact: Allan J. Burris, Northern Trust Co., 50 So. LaSalle St., Chicago, Ill. 60690

May 25-27, 1970: Forum of Control Data Users (FOCUS) Annual Conference, St. Paul Hilton, St. Paul, Minn. / contact: William I. Rabkin, FOCUS Exec. Sec., c/o Itek Corp., 10 Maguire Rd., Lexington, Mass. 02173

May 26-28, 1970: IDEA, 11th Annual Symposium & Exhibit of the Society for Information Display (SID), Statler Hilton Hotel, New York, N.Y. / contact: William M. Hornish, Western Union, 82 McKee Drive, Mahwah, N.J. 07430

May 27-29, 1970: Eighth Annual Workshop Conference of the Interagency Data Exchange Program (IDEP), Cosmopolitan Hotel, Denver, Colo. / contact: James D. Mason, TRW, 1 Space Pk., Redondo Beach, Calif. 90278

June 1-3, 1970: "Session 70", the Inaugural Joint National Conference of the Information Processing Society of Canada (formerly the Computer Society) and the Canadian Operations Research Society, Vancouver, British Columbia / contact: W. J. Sheriff, Suite 1404, 1177 W. Hastings St., Vancouver 1, B.C.

June 8-10, 1970: International Conference on Communications (IEEE), San Francisco Hilton Hotel, San Francisco, Calif. / contact: A. M. Peterson, Stanford Research Institute, Menlo Park, Calif. 94025

June 9-10, 1970: Grenoble Workshop on Microprogramming, Mathematiques Appliquees, CEDEX 53, 38 — Grenoble-Gare, France / contact: Guy G. Boulaye and Jean P. Mermet, Mathematiques Appliquees, CEDEX 53, 38 — Grenoble-Gare, France

June 15-16, 1970: Conference on Solid State in Industry, (IEEE), Statler-Hilton Hotel, Cleveland, Ohio / contact: A. J. Humphrey, Technical Program Chairman, The Reliance Electric & Engrg. Co., 24701 Euclid Ave., Cleveland, Ohio 44117

June 16-18, 1970: Computer Group Conference and Exposition (IEEE), Washington Hilton Hotel, Washington, D.C. / contact: Bob O. Evans or Donald E. Doll, IBM Federal Systems Div., 18100 Frederick Pike, Gaithersburg, Md. 20760

June 16-18, 1970: Conference on Computers in the Undergraduate Curricula, The Univ. of Iowa, Iowa City, Iowa / contact: Brooks Booker, Center for Conferences and Institutes, The Univ. of Iowa, Iowa City, Iowa 52240

June 18, 1970: Ninth Annual Technical Symposium, Washington, D.C. Chapter ACM, National Bureau of Standards, Gaithersburg, Md. / contact: General Chairman, 1970 Symposium Committee, Washington, D.C. Chapter ACM, P.O. Box 6228, Washington, D.C. 20015

June 18-19, 1970: 29th Management Conference of ADAPSO, Washington Hilton Hotel, Washington, D.C. / contact: ADAPSO, 551 Fifth Ave., New York, N.Y. 10017

June 22-23, 1970: Eighth Annual Conference, ACM Special Interest Group for Computer Personnel Research, Center for Continuing Education, Univ. of Maryland, College Park, Md. / contact: Robert A. Dickmann, The Johns Hopkins Univ., Applied Physics Lab., 8621 Georgia Ave., Silver Spring, Md. 20910

June 22-24, 1970: Data Processing Supplies Association, Spring General Meeting, The Olympic Hotel, Seattle, Wash. / contact: Data Processing Supplies Association, 1116 Summer St., P.O. Box 1333, Stamford, Conn. 06904

June 24-26, 1970: 11th Joint Automatic Control Conference (JACC), Georgia Institute of Technology, Atlanta, Ga. / contact: Prof. Eugene Harrison, Dept. of Mechanical Engineering, Clemson University, Clemson, S.C. 29631

June 29-30, 1970: Conference on Optimisation Techniques in Circuit and Control Applications, Institution of Electrical Engineers, Savoy Place, London, WC2, England / contact: Manager, Conference Department, IEE, Savoy Place, London, WC2, England

June 29-July 1, 1970: SIAM 1970 National Meeting, Univ. of Denver, Denver, Colo. / contact: Society for Industrial and Applied Mathematics, 33 South 17th St., Philadelphia, Pa. 19103

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

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. 14-24, 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 □

ACROSS THE EDITOR'S DESK

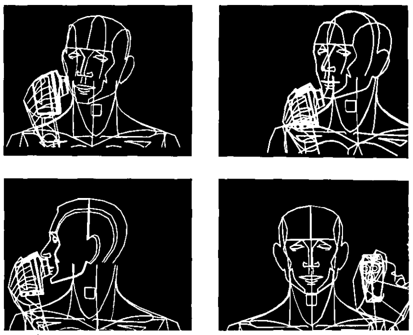
Computing and Data Processing Newsletter

Table of Contents

APPLICATIONS

3-D 'COMPUTER MAN' SELLS NORFLCO SHAVERS

Did you see CBS Friday Night Movie on April 17th? This was the date scheduled for the first showing of a 3-dimensional commercial completely programmed by a computer.



The 30-second commercial shows a 3-dimensional man using and explaining the features of the new Norelco cordless shaver. With this computer programmed figure, the computer draws the figure and animates all its movements in a fraction of the time it would take the many artists necessary when working in the traditional process of animation.

The TV use of a "computer man" spokesman was conceived by LaRoche, McCaffrey & McCall Inc., agency for Norelco shavers and personal care products. William Fetter of Newport Beach, Calif., used the animated figure data he created through arrangements with Computer Graphics Inc. Designed for use in man-machine interaction studies, the measurements of the man represent the mean measurement of 50% of Air Force pilots, based on anthropometric data.

COMPUTER CONTROL SYSTEM READS WATER METERS AUTOMATICALLY

In 17 homes served by Monmouth Consolidated Water Co. (N.J.) the water meters are being read automatically by a computer control system located in South Milwaukee, Wis., nearly 1,000 miles away. Badger Meter Mfg. Co., the meter supplier, reports that the computer is obtaining daily readings from Holmdel, N.J., by means of tone signals transmitted over long-distance lines of the Bell Telephone System. When the signals are received in South Milwaukee, they are decoded by the master control and data station, and a printout of water consumption is prepared.

The long-distance meter reading is part of a New Jersey field test in which American Telephone & Telegraph Company and affiliates are evaluating automatic systems for reading water, gas and electric meters. Several utilities in the Holmdel area, and a number of meter manufacturers, have announced they will participate.

The telephone transmissions between Holmdel and South Milwaukee mark the first time during the AT&T tests that a computer has "interrogated" and printed readings from water meters under actual operating conditions.

At a prearranged time each day, the computer automatically dials a long-distance number to gain access to a switch train (provided by the Bell Telephone System). Then, the computer dials in sequence the phone numbers of each utility customer in order to obtain meter readings. A dc signal activates the transponder on the meter, but does not cause the telephone to ring. If the phone is being used, the computer moves on to another customer until the line is free.

The encoder-transponder feeds back tone signals which correspond to the meter reading. In 2 seconds, these signals are transmitted over the long-distance lines and back to the master control and data station. There, they are converted to binary coded decimal readings for the computer printout.

Computerized reading of the water meters in Holmdel is the result of a cooperative effort by two utilities and two manufacturing firms. They are: Power Systems Division, McGraw-Edison Co., South Milwaukee; Badger Meter Mfg. Co., Milwaukee; Monmouth Consolidated Water Co., Long Branch, N.J.; and The Bell Telephone System.

ACCIDENT-PRONE DRIVERS IN MASSACHUSETTS ARE PINPOINTED BY COMPUTERS

At the Registry of Motor Vehicles, Commonwealth of Massachusetts, computers have exploded over 7000 names of drivers who have been involved in three or more car mishaps in the period 1967-69, inclusive. Operators with 5 to 10 accidents against their records are commonplace in the two huge volumes labeled "Accident Repeater Listing". At present, a Boston driver is the "record holder" with 15 auto accidents in the last three years; 13 of his 15 accidents accounted for personal injury insurance claims. Also, 13 of the accidents occurred in Boston where insurance rates are among the highest in the state and nation. Another Bay State driver ran up a string of 5 accidents in 1969 — all within a five-month period — and all resulting in personal injury claims. Before computerization, motorists employed various tactics to escape detection, such as transposing first and last name in an accident report — which often escaped notice.

Registrar Richard E. McLaughlin explained how his agency — with the computer's help — is driving these careless operators off the road. The Accident Repeater Listing is constantly examined. An operator's license number tells the story and the computer plays no favorites. Involvement in three or more auto mishaps in an 18-month period will win automatic review of your driving record by the Registry. You will be given a hearing — and unless you can convince the Registry you are an innocent victim of someone else's negligence, your license to operate will be suspended indefinitely. Regaining this permit to operate requires the successful completion of a special driver-improvement course given by the Registry; passing a competency test; or passing a physical examination to determine whether you have the capacity to operate a vehicle safely.

The Accident Repeater Listing also points up the fact that some people appear to be making a living out of accident insurance claims. The Registry automatically notifies the Fraudulent Claims Bureau (created last year in the state department of Insurance) of multiple-accident involvements. This Bureau also forwards to the Registry its computer tape to check against the Registry's tape to determine the identity of individuals who may not have reported accident involvement. This cooperation between these two agencies allows no errant motorist to evade detection.

PSYCHOLOGISTS USE SMALL COMPUTER IN STUDIES OF HUMAN MEMORY

Why do we remember some things and not others? Drs. Bennet Murdock and Endel Tulving, psychologists at the University of Toronto, hope to find the answer to this and to other questions about the human memory. The key piece of equipment in their planned research projects is a small general purpose PDP-12 computer (manufactured by Digital Equipment Corp., Maynard, Mass.). Dr. Murdock will study the short-term ability and Dr. Tulving will be interested in the human memory's ability to retrieve stored information.

Dr. Murdock, using the PDP-12's built-in display device, will show a group of words (perhaps 20) to a subject for a few seconds. Then the subject will be asked to use the computer keyboard to tell the computer what words were displayed on the screen. After the subject has responded, the computer will present a new display dependent upon his first answers — a re-arrangement of the words to see if the subject remembers the same cluster or clusters of words, or a whole new set of words to determine if there is a relationship between words remembered in the first set and the second. Dr. Murdock, while testing some current theories and developing some new ones, may also be able to suggest ways to present material to people for easy or difficult recall.

Dr. Tulving, interested in information retrieval, believes so-called memory loss is, in reality, a problem in retrieval of information. "For instance, if you were asked to name the books you read in the last year, you might well have difficulty remembering the titles. On the other hand, if you were asked to pick from a list presented to you, the books you had read during the past year, you would probably have little difficulty. This suggests to me that the information was available in your memory but not readily accessible." He indicated that many problems or experiments can be handled without a computer. "But, for problems requiring decisions as to what step to take next based upon the information being gathered, while the experiment is in progress, the computer is a necessity."

COMPUTER ANALYSIS OF AIR POLLUTION IN CONNECTICUT

A mathematical "model" stored in a computer enables scientists at Travelers Research Corp. (Hartford) to simulate atmospheric conditions anywhere in Connecticut, and to study various methods of reducing air pollution. A research team headed by Arthur W. Bostick developed the pollution model over a two-year period. The research is aimed at producing specific recommendations for improving Connecticut's air quality.

To formulate the complex mathematical equations that make up the model, exhaustive data on pollution caused by motor vehicles, power plants, factories, home heating units and other sources was fed into an IBM System/360 Model 40. The data was gathered from 25 strategically located measuring stations and from specially equipped mobile (trucks and aircraft) stations that made it possible to measure pollution from sources outside the state. For each station, it was determined how often and under what conditions air quality failed to meet standards set by the Connecticut Clean Air Commission. By reducing this mass of data to meaningful form, the computer makes it possible to test many alternative methods of improving air quality. Even future technological advances (such as the widespread use of battery powered vehicles and nuclear power generation) can be evaluated. Computer models should help to answer many questions about air pollution.

Bostick's group is applying the computer model to air pollution control for metropolitan Toronto. As the model can be adapted to simulate any set of atmospheric conditions, he foresees the possibility of its use in many other urban areas.

EDUCATION NEWS

PROFESSIONAL TRAINING AND DEVELOPMENT PROGRAM (PTD)

The Middle Atlantic Educational and Research Center (MERC), located on the campus of Franklin and Marshall College in Lancaster, Pa., has set up a new program aimed at helping college graduates (especially those from small colleges) understand what computers can and cannot do. The ultimate objective of the new MERC program is to involve as many students — future professional and business people — as possible in the conceptual and technical use of computers. According to MERC officials, PTD will have a multiplying effect, ultimately extending to colleges across the country.

The first part of the program is designed to acquaint college professors and high school teachers with modern-day computer facilities, and the part computers play in practically every phase of modern life and, in particular, their specific disciplines. Part two provides "on the job" experience in computer operations and programming, and includes visits to MERC facilities and selected computer installations where computers are playing an innovative role in community, school, or industry.

PTD was launched last February with the training of Mrs. June Herr of Lebanon Valley College, and Thomas Woodrow of Juniata College, under industrial grants from AMP, Inc. of Harrisburg and the Howmet Corporation of Lancaster. Other participants will be enrolled in the MERC Program as funding becomes available.
(For more information, circle #41 on the Reader Service Card)

VOLUNTARY COMPUTER COURSE, A JOINT UNDERTAKING

Computer time and computer language instruction was made available to a few high school students in a voluntary computer course, jointly devised by La Jolla (Calif.) high school teachers, University of California, San Diego faculty, and Systems, Science and Software (S^3) scientists. The four-week course consisted of 12, two-hour classes, and was devoted to basics and programming.

— High school students under direction of Drs. Wersan and Alexander, running actual programs through S^3's UNIVAC 1108

The high school students developed programs that included linear equations, computer sorting, mortgage interest, and orbital calculations. After the first week, students used FORTRAN to program S^3's multi-million dollar 1108 UNIVAC computer. It is likely that the S^3 computer and software development firm will repeat some variation of the course in the near future. It also hopes that the idea will spread.

THREE NEW YORK ORGANIZATIONS COMBINE TO TRAIN THE DISADVANTAGED

Three New York organizations, Programming Sciences Corporation, Marketing Survey & Research Corporation and Social Research Corporation, have formally agreed to implement a program which will move the disadvantaged from the unemployment rolls to the computer room. The program is designed to provide new skills and career opportunities, and to improve the quality of life of the unemployed and under-employed. It is also expected to fulfill some of the existing and future manpower requirements of Metropolitan New York users.

Social Research Corporation will administer the project. Training will be accomplished at their New York facility using Programming Sciences' EDUPUTER® (see Computers and Automation, January 1970, page 62). Programming Sciences Corporation will be responsible for tailoring the course curriculum, materials and training to the levels of comprehension of the trainees. Marketing Survey & Research Corporation will administer testing, screening, counseling, job placement and follow-up.

The agreement calls for concentration on the training of computer console operators, keypunch operators and I/O quality control clerks and placing them in jobs with users of data processing equipment.

NEW COMPUTER EDUCATIONAL SERVICES OFFERED BY CTC COMPUTER CORP.

A new educational service in the data processing field has been designed for both commercial computer users and non-users. CTC Computer Corporation in California is offering courses to companies and organizations for the benefit of their employees. Courses can be taught on the customer's premises or at CTC's facilities in Palo Alto. Course schedules are flexible to conform to customers' requirements.

The curriculum includes courses to assist the commercial computer user in furthering and upgrading his skills as well as courses to broaden a non-user's understanding of computing. Among the specific courses offered are: ADP Orientation, Introduction to Systems Analysis, UNIVAC 1108 EXEC 8, and IBM 360 OS courses for operators, programmers and managers.
(For more information, circle #42 on the Reader Service Card)

NEW PRODUCTS

Digital

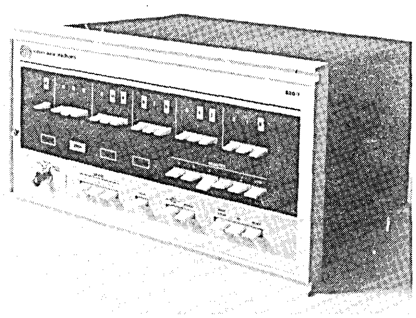
P1075 COMPUTER SYSTEM / Philips Data Systems

The P1075, a new addition to Philips Data Systems P1000 computer systems, is available with store capacities of 16K, 32K and 48K octads. New dual-drive random-access disc units can boost these capacities with up to an additional 480,000,000 octads. The computer system has been designed specifically for business applications where large storage capacities are necessary — such as in warehousing and stock control, banking, ticket reservation and information retrieval; in fact any work that can be programmed in Autocode, COBOL, or RUG. Programs written for the P1075 can be run without change on any P1000 system.

Some of the main characteristics of the system: core stores are word organized with a word length of 32 bits; internal data interface is one octad; and cycle time is less than one microsecond per octad. The processing unit contains a set of 125 instructions including edit, COBOL move, multiply/divide, point location, etc. All software is fully developed.
(For more information, circle #43 on the Reader Service Card)

VARIAN 620/f MINICOMPUTER / Varian Data Machines

The latest addition to Varian's 620 computer line, the 620/f, also



is the fastest by a factor of over two. Cycle time is only 750 nanoseconds. The new computer includes such features as 100% upward compatibility with the 620/i, new low cost line of peripherals, expanded instruction set, and an optional 300-nanosecond read-only memory.
— SJCC Booths 3004-3007
(For more information, circle #44 on the Reader Service Card)

SYSTEM TEN / Friden Division, The Singer Company

System Ten, a low-price computer system, offers a choice between on-line, real time processing and batch processing by card, disc, or tape. Announced as a "people-oriented concept in electronic data processing", the user oriented workstations go almost anywhere a job requires. System Ten's processor with its peripherals can be placed in any office environment without use of bulky cables or false floors.

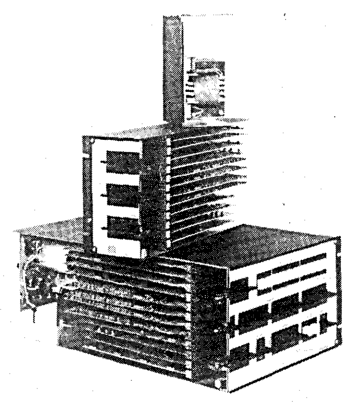
The Model 70 workstations are simplified terminals that may be used as typewriters when not communicating with the processor. Designed for operator convenience, the terminals include a work surface area, forms storage and operator personal storage area.

Core memory storage is available in 10,000 character modules from 10,000 to 110,000 characters of storage. Memory speed is 3.3 microseconds. Use of standard 80-column punched cards, magnetic tape, or paper tape, provides compatability with other data processing systems.

A complete software and support program including education, service and field systems engineering will be available with the first deliveries of System Ten in September of this year.
(For more information, circle #45 on the Reader Service Card)

MICRO 812 DATA COMMUNICATIONS PROCESSOR / Micro Systems Inc.

The Micro 812 is the third of a series of microprogrammed, low cost digital computers developed by Micro Systems Inc. The Micro 812 is being used as a data concentrator, as a pre-processor for time sharing and information systems networks, and as a stand-alone, interactive processing system. Core memory cycle time is 1.1 microseconds; the core memory is expandable to 32,768 bytes. Variable word lengths are available for 8, 16, 24, or 32 bit arithmetic load and store instructions.



— To demonstrate functional design and modularity, Micro Systems literally cut a Micro 800 physically in half on a band saw

The basic 812 configuration includes a microprogrammed processor, power supply, 4096 x 8-bit core

memory, power-fail interrupt, automatic restart, and real time clock. A variety of communications and peripheral controller interface options are available.
— SJCC Booth 24001
(For more information, circle #46 on the Reader Service Card)

B4500 SERIES / Burroughs Corp.

The first model of the new B4500 Series of data processing systems — the B4504 — is oriented principally to general business and industrial data processing and will use COBOL as its primary business language capability. The B4504 system is the next step for users of the B3500 who later will require faster and greater processing power. It is completely compatible with the B3500.

The B4504's main memories (twice as fast as the B3500) operate at 500 nanoseconds per cycle, with a memory word of two 8-bit bytes or four 4-bit digits accessed in one memory cycle. Main memory is addressable to the 4-bit digit level. Address memory operates at 50 nanoseconds (also twice as fast as the B3500). The main memory, with a minimum of 100,000 bytes, can be expanded in increments of 50,000 bytes per module, up to a maximum of 500,000 bytes. B4504 memory can be extended through the use of Burroughs disk file subsystems, which can store up to 18 billion bytes of information.
(For more information, circle #47 on the Reader Service Card)

DC 6024/3 COMPUTER / Datacraft Corp.

The DC 6024/3 is the second high speed computer to be introduced by Datacraft in its 2½ year existence. The new computer has a full cycle time of 1.0 microseconds and a fixed word length of 24 bits. Designed for use in applications requiring real-time control and complex calculations, the first system was delivered in early February.

The DC 6024/3 basic system includes five 24-bit general-purpose registers (three of which may be used for indexing), an 8192 word memory (with parity) expandable to 65,536 words in increments of 8192 words, hardware multiply/divide/square root, four levels of priority interrupt and a standard software package. A console ASR-33 typewriter can be used as the basic input/output device.
— SJCC Booth 24007
(For more information, circle #48 on the Reader Service Card)

ARGUS 600 COMPUTER / Ferranti Ltd.

Ferranti's Automation Systems Division has introduced the ARGUS 600, a versatile digital computer aimed at the large low-cost computer and control system markets for which existing, more powerful digital computers are not economically feasible.

The ARGUS 600 has an 8-bit word length, a basic core store of 1024 words (expandable in blocks of 1024 words up to a maximum of 8192 words) and operates on a single-address order code of 17 instructions. It is programmed in ASSIST, the mnemonic language written specifically for the new equipment. The standard interface of the ARGUS 600 hardware permits modules from the standard Ferranti ARGUS range of peripheral and plant connection equipment to be added as required. Standard software supplied with the computer includes a basic loader, mnemonic assembler, a diagnostic package, double-length arithmetic and character handling routines.

The ARGUS 600 is completely compatible with large digital computers. It can be linked directly or over telephone lines and will use the same program and data input media.
(For more information, circle #49 on the Reader Service Card)

CSP-30 COMPUTER / Computer Signal Processors, Inc.

The 16-bit, general purpose digital computer, CSP-30, has a basic cycle time of 100 nanoseconds which results in a capability of performing over 3 million instructions per second. An integrated circuit (IC) memory and a core memory are combined to optimize the balance between speed and economy. Either memory can hold instructions and data.

The complete CSP-30 system consists of a: central processor, magnetic tape program entry device, control panel, power supply, and KSR 35 Teletypewriter (free-standing). An optional console version has a desk-mounted control panel. All versions include complete software.
— SJCC Booths 201-202
(For more information, circle #50 on the Reader Service Card)

Special Purpose Systems

THE DEVONSHIRE / Devonshire Computer Corp.

The new computer, called the Devonshire, has been developed exclusively for a wide range of communications uses. The machine is made up of a communications processor and a programmable input-output controller. The programmable data communication processor is designed in modules, permitting "custom" systems to be developed from standard elements.

The Devonshire is specifically organized to accept and deliver data to and from as many as 253 various types of communications devices simultaneously. Virtually any type of remote terminal — displays, keyboards, printers, plotters, other computers, etc. — may be used with the new computer, allowing users to choose their terminals on the basis of price and performance rather than compatibility with the central processor.

Software for the Devonshire includes a basic assembler, program update, basic monitor, diagnostic routines, and debugging routines. Applications packages include terminal device I/O routines, communication logical routines, a real-time relocating loader/monitor and secondary storage physical and logical I/O programs.
(For more information, circle #51 on the Reader Service Card)

QANTEL V, A BUSINESS COMPUTER SYSTEM / Qantel Corp.

The QANTEL V System operates as a small business accounting center having, as an option, total communications capabilities. The system provides low-cost automation for payroll accounting and check-writing, data concentration/transmission, accounts payable, accounts receivable, letter writing, and various other business operations. QANTEL V can be operated by secretarial help with less than one day's training on the machine.

The basic system includes a 4K processor (capable of interfacing with up to eight I/O devices), an I/O typewriter, and a paper tape reader/punch. The system requires no air conditioning and may be operated in any business environment. A standard secretarial desk is sufficient to house the entire system. Current optional devices include a communications controller and magnetic tape transport.
(For more information, circle #52 on the Reader Service Card)

L4000 ACCOUNTING COMPUTER / Burroughs Corp.

The L4000, newest member of Burrough's family of compact computers, is the first in the 'L' series designed specifically for accounting applications; it also can operate as a billing computer or as a terminal computer. The L4000 has a forms handler that accommodates a variety of documents such as front-fed cut forms, ledgers and unit set forms, as well as continuous forms and journals. The 26-inch forms carriage has a 225-position print line.

The computer has integrated circuitry, disk memory, advanced logic and "firmware" (strings of micro-instructions stored in the computer's disk memory). L4000 firmware provides complete internal control of computation, print formatting, printer positioning, forms movement, and console and peripheral data input and output. Every application program automatically resets these controls for the operator. Application programming is priced separately from the computer hardware and basic firmware. The computer is modular and can be expanded as the customer's requirements change.
(For more information, circle #53 on the Reader Service Card)

DATANET-500 DATA COMMUNICATIONS PROCESSING SYSTEM / General Electric

The new DATANET®-500 data communications processing system can serve up to 250 communications lines at the same time and can accommodate 500 to 1,500 users. The system is capable of executing 200,000 instructions per second while transferring 1.2-million characters per second of peripheral input-output and controlling 100 full-duplex low-speed channels.

Designed from the ground up as a communications processing system, the building-block design permits expandability from small-scale aplications to large network control systems. The building blocks consist of four basic subsystems: the processor, memory, communications and input-output subsystem. Memory modules are available in 8K, 16K, 32K or 64K sizes. The DATANET-500 can be teamed with most computers and terminal devices on the market. A basic system is housed in a free-standing cabinet occupying the floor space of an office desk.
(For more information, circle #54 on the Reader Service Card.)

Memories

LARGE-SCALE MEMORY SYSTEMS / Standard Computer Corp.

Standard Computer's entry into the large-scale memory systems business has been announced with the development of its first memory product. The system is a low cost, massive (up to 16 million bytes of information), fast response (700 nanoseconds), on-line core memory. The product will not only be used in advanced versions of the IC-7000 time sharing computers but will be offered to users of other systems desiring major upgrading of their capabilities.

The self-contained memory system packages up to one million bytes of storage in a single cabinet (72 x 38 x 78 inches), and up to 16 such cabinets can be connected to form an integrated memory system of the desired capacity. The memory system can be connected to as many as four computer systems at the same time.
(For more information, circle #55 on the Reader Service Card)

MOSTAK II MEMORY SYSTEM / Electronic Arrays, Inc.

MOSTAK II memory is a 1024 word, 8 bit per word memory with a full cycle time of 1 microsecond. The MOSTAK II, like the MOSTAK I, employs monolithic MOS random access memory devices. The system is a two board arrangement with one board containing all the clocking and timing system while the second board contains the Memory Array. MOSTAK II can be used as a direct replacement for core memory of comparable size.
— SJCC Booths 3008-3009
(For more information, circle #56 on the Reader Service Card)

DISK PACK SYSTEM FOR PDP-8 AND PDP-12 COMPUTERS / Digital Equipment Corp.

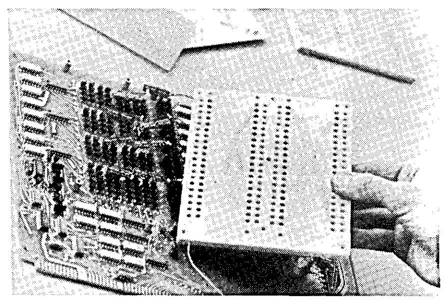
A low-cost, random access disk pack system with software monitor has been developed for Digital's PDP-8 and PDP-12 lines of small computers. The new system, called RK08, can provide PDP-8 or PDP-12 users with up to 3,325,952 words of storage, each 12 bits in length. Each removable file provides 831,488 words of storage. Up to four can be handled by the system controller.

The software monitor requires 8,192 words of computer core memory and either a high-speed paper tape reader or magnetic tape storage for building the system and loading programs. It also can be used with other mass storage devices, such as the company's fixed head disk and magnetic tape units.

Average access time to locate data in the system is 154 milliseconds. In an additional 80 milliseconds, 4096 words of core memory can be transferred to or from the disk.
(For more information, circle #86 on the Reader Service Card.)

MSBS READ-ONLY MEMORY / Memory Technology, Inc.

A new addition to Memory Technology's MSBS READ-Only memory line has up to 393,000 bits of storage accessible in 200 nanoseconds. The new systems pack up to 49,152 bits



on a single 12.9" x 10.4" printed circuit board — double the capacity of former systems, while retaining the high speed, low power and multiple system expansion capabilities.
— SJCC Booths 2113-2114
(For more information, circle #57 on the Reader Service Card)

FASTRACK MODEL 8100 DISC MEMORY SYSTEM / Computer Peripherals Corp.

The Fastrack® Model 8100 has standard 24 million and 48 million bit head-per-track Disc Storage Modules, which can be combined to provide memories from 24 million to 96 million bit capacities. The Model 8100 is compact, with a 40-inch high chassis, slide-mounted to fit a standard 19-inch rack. Data transfer rates are either 3 MHz or 6 MHz. Optional features allow for write lockout protection as well as multi-controller access.
— SJCC Booths 4611-4612
(For more information, circle #58 on the Reader Service Card)

816/716 DISC STORAGE SYSTEM / Peripherals General, Inc.

The 816/716 Disc Storage System, is designed to provide a low cost storage facility which can interface directly with the central processor of small to medium computers. It also is intended for use in special storage systems. Removable disc packs are used as the storage medium. The 816/716 System has a maximum capacity of 116 million bits.

The new system consists of a controller (Model 816) and one or two disc drives (Models 716) which interface with the controller. The Model 816 is a 16 bit unit capable of handling up to two disc drives; the Model 716 Disc Drive uses the 1316 disc pack, and is plug-for-plug compatible with the IBM 2311.
— SJCC Booths 10012-10013
(For more information, circle #59 on the Reader Service Card)

PDP-10 COMPATIBLE DRUM SYSTEM / Bryant Computer Products

Designed specifically for the PDP-10 computer, the basic PDP-10 Drum System consists of an interfacing controller and a 9 million character drum memory. Average access speed is 17 milliseconds. The interfacing controller can handle from one to eight Bryant nine million character drums, providing PDP-10 users with expansion capabilities for a mass storage media of up to 72 million characters.
— SJCC Booth 500
(For more information, circle #60 on the Reader Service Card)

Software

BANK SERVICES PACKAGE / Delta Data Systems, Inc., College Park, Md. / An automated accounting system specifically developed for use by banks involved in customer services; may be purchased as a complete integrated system, as individual modules, or as part of a Facility Management Service. The system, written in COBOL, is available for IBM, Honeywell, Burroughs and NCR equipment. It can operate within 32K of core. The system is marketed under a perpetual licensing agreement for $32,000, which includes source decks, and user and operator documentation.
(For more information, circle #61 on the Reader Service Card)

CONSTRUCTION ESTIMATING PROGRAM / IBM Corporation, White Plains, N.Y. / Allows the IBM 1130 computing system to produce a summary of cost estimates for an entire building project as well as any of hundreds of separate cost factors involving labor, materiel and equipment. The program uses information from the Associated General Contractor Manual's Standard Divisional Coding System. The program is scheduled to be available in June at a monthly charge of $50, under a license agreement.
(For more information, circle #62 on the Reader Service Card)

DIBOL (Digital Equipment Business-Oriented Language) / Digital Equipment Corp., Maynard, Mass. / A COBOL-like language made up of three distinct components: (1) a language processor that enables a user to state the problem in a simple manner; (2) a data management system that operates on files without additional programming; and a monitor system that ties the components together and enables the user to operate the system easily. DIBOL systems can be based either on DEC's PDP-8I or PDP-8/L computers.
(For more information, circle #63 on the Reader Service Card)

EMPHASIS (Evaluation Management using Past History Analysis for Scientific Inventory Simulation) / National Cash Register Co., Dayton, Ohio / A management information system for NCR Century Series computers. The system is designed in two phases: Phase 1 includes everything except automatic stock replenishment; Phase 2 (to be released later) will include the automatic preparation of purchase orders. This total inventory management system is addressed specifically to the manufacturing, food, and hard goods distribution fields.
(For more information, circle #64 on the Reader Service Card)

PRO/TEST (PROfitable approach to TESTing) / Synergetics Corp., Burlington, Mass. / Capabilities of this proprietary test data generator are expanded to include conditional field generation, allowing the non-programmer to rapidly generate data for program and system testing. User receives the PRO/TEST processor, a 150 page user manual, the PRO/TEST forms, and a summary guide. Available for both IBM System/360 (OS and DOS) and Honeywell Series 200 computers.
(For more information, circle #65 on the Reader Service Card)

SALES-CALL / System Implementation Corp., New York, N.Y. / A computer application software package which gives marketing management the ability to monitor and help schedule the activities of their sales force. Operates on any IBM/360 model 30 or larger computer. The software package is for sale with complete documen-

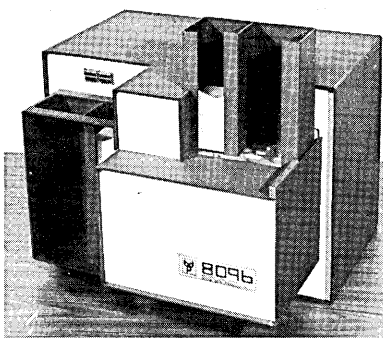
tation regarding its operation, use, and self-customizing features.
(For more information, circle #66 on the Reader Service Card)

YARDSTICK / Hub S. Ratliff, Houston, Texas / Simulates and projects the income, expense and economics of a time-shared computer system. YARDSTICK is a measure of profitability and success (designed for investors, potential investors and time-shared computer center managers) not an engineering design model. The program is written in BASIC (there is a version in FORTRAN IV) for Digital's PDP-10 computer. It sells for $25,000 and includes source program listings, complete documentation and the tailoring of the system to the individual customer. YARDSTICK occupies about 6K words of computer core.
(For more information, circle #67 on the Reader Service Card)

Peripheral Equipment

80/96 CARD READER / Bridge Data Products, Inc.

The new Model 80/96 Mutliple-Card Card Reader feeds, reads, and stacks the new 96-column System/3 card as well as the standard 80-column card and its stub varieties. Made as a plug-in, add-on package, the 80/96 comes complete with electronics and enclosures.



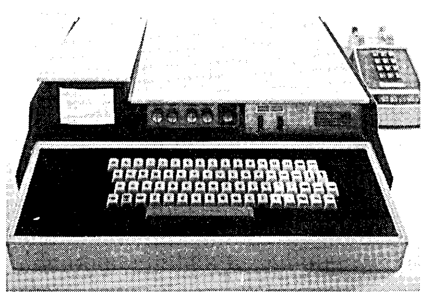
Cards are magazine fed, and the read station adjusts automatically to the card type inserted. It reads 500, 96-column cards per minute, or 300, 80-column cards per minute.
— SJCC Booth 50011
(For more information, circle #68 on the Reader Service Card)

HIGH-SPEED PRINTER / Path Computer Equipment, Inc.

The non-impact communications printer, known as Model 1200, prints all standard US ASCII characters at a rate of 96,000 characters per minute in the 80-character-per-line format — or at 158,400 per minute in a 132-character version. The Model 1200 uses ordinary uncoated bond paper, resulting in substantial savings to users. Standard units are fed from paper rolls in lengths to 2,000 feet with automatic cutting into 11-inch lengths or with take-up rolls. Paper width is 8½ inches for the 80-character format and 14-7/8 inches for the 132-character line.
(For more information, circle #69 on the Reader Service Card)

ENVOY, A PORTABLE CRT TERMINAL / Applied Digital Data Systems, Inc.

The full scale, portable, CRT terminal, called ENVOY, has high display capacity, and complete editing and formatting capabilities. Weighing only 30 lbs. and packaged in a rugged carrying case, the ENVOY displays up to 1024 alphanumeric characters on a 5" diagonal CRT. The terminal, compatible with teletype data communication systems, transmits and receives data over ordinary telephone lines at a rate of either 10 or 30 characters per second (switch selectable).



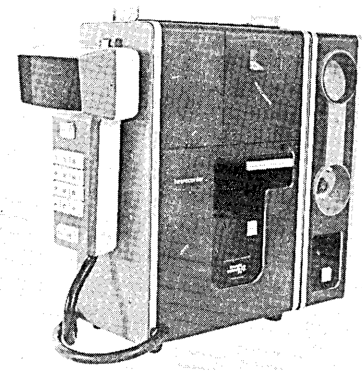
To operate the terminal, the user simply plugs it into an ordinary outlet, folds out the keyboard, pops up the screen, inserts an ordinary telephone into the built-in acoustic coupler and dials his computing center or service bureau.
(For more information, circle #70 on the Reader Service Card)

DIGITAL CASSETTE TAPE DRIVE / Ampex Corp.

The new serial-by-bit two track cassette tape drive, Model TMC, is designed to provide users with a precision on-line data storage device when incorporated into such systems and subsystems as data terminals, minicomputers, data acquisition systems and keyboard data-entry equipment. The TMC accepts Ampex PC-800, or Phillips-type, cassettes. Standard recording speed is 12 ips at 800 bits per inch. It offers a data rate of 9,600 bits per second, thus packing up to 350,000 characters on a single cassette.
— SJCC
(For more information, circle #71 on the Reader Service Card)

KEY-TO-TAPE DATA RECORDER WITH DISPLAY AND COMMUNICATIONS CAPABILITY / Heuristic Concepts Inc.

The new data collection device, called Heurecorder M600, is a portable key-to-tape recorder combining magnetic tape cartridge storage with display and communications capability. Data is entered through a hand-held keyboard that contains a Nixie tube display for verification of correct entry. After visual verification, the data is transferred from the recorder's buffer memory onto an IBM MT/ST magnetic tape. The lightweight (12 pounds)



battery powered recorder makes it possible to collect, verify and record data at any remote location, and using any accessible telephone, to transmit this data to a central computer site or a teletype terminal.
(For more information, circle #72 on the Reader Service Card)

VARIABLE WIDTH LINE PRINTER / Data Printer Corp.

Form widths varying from 3½ to a full 19½ inches are accommodated by the new V-132 line printer. The variable width machine has a 600 lpm printer mechanism, pedestal mounted electronics buffered with a single line memory, and an 8 channel vertical format unit. A sound deadening cabinet also is available.
(For more information, circle #73 on the Reader Service Card)

FRENCH, GERMAN, SPANISH AND SWEDISH KEYBOARDS FOR KEY-CASSETTE TERMINALS / Sycor, Inc.

SYCOR models 301 and 302 key-cassette video terminals soon will be available with French, German, Spanish, and Swedish keyboard configurations, in addition to English. The terminals, designed to be operated by clerical and other employees without special EDP training, utilize keyboards, similar to those of standard typewriters, for data entry to computers. The terminal provides a keyboard, magnetic tape cassette recording and a CRT display. It also contains a microprocessor for electronic editing and control of automatic verify, tape search, file update, and pooling function.
(For more information, circle #74 on the Reader Service Card.

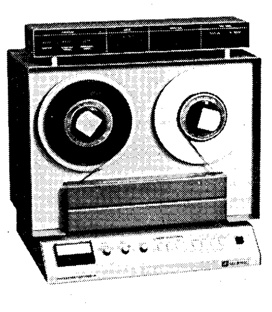
88 CHANNEL MULTIPLEXER / Rixon Electronics, Inc.

The new time division multiplexer, known as TDX-2, can multiplex up to 88 channels with one unit. Users can intermix up to four speeds — 300, 150, 134.49 and/or 110 bps. The Rixon TDX-2 is data transparent and will transmit all combinations of 7 and 8 bit data characters. The number of channels can be changed easily by adding or removing channel cards. The TDX-2 is available with or without integral high speed modems to suit customers' individual requirements.
— SJCC Booths 2103-2104
(For more information, circle #75 on the Reader Service Card.)

Data Processing Accessories

TAPE-CLEANER CERTIFIER / Data Devices Inc.

The Model 7900 Cleaner/Certifier has dual error counters: a permanent error counter (factory preset)



and a marginal error level (operator selected). Standard densities include 800 or 1600 BPI and are operator selectable. A write inhibit feature protects data tapes when the 7900 is in the cleaning mode. The new device uses a self-sharpening, rotating cylindrical blade for tape cleaning and is able to determine whether a reel of tape is computer acceptable, marginal or unacceptable. Options selectable by the operator include: clean only, test only, and combination clean/test.
— SJCC Booth 1000
(For more information, circle #76 on the Reader Service Card.)

DISC DRIVE EXERCISER / Peripherals General, Inc.

The Model 700 disc drive exerciser is intended for use with the IBM 2311, the PGI 711 and compatible disc storage drives, as well as for certain other disc drives which use the 2316 type disc pack. The new disc driver exerciser permits the user to localize disc storage drive malfunctions without suspending data processing. The device allows a complete logic and control check of a disc storage drive off-line. It also may be used on-line to monitor a unit performing under normal operating conditions.
— SJCC Booths 10012-10013
(For more information, circle #77 on the Reader Service Card.)

AUDEV 6400 COMPUTER TAPE / Audio Devices, Inc.

The new AUDEV 6400 computer tape is compatible with current systems and is capable of recording at densities up to 6400 FCI. The use of a new coating forumulation increases wear resistance. As newer, more sophisticated computer systems are developed, AUDEV 6400, will provide a 100% increase in storage cpacity over currently used 3200 FCI tapes.
(For more information, circle #78 on the Reader Service Card.)

HAND ENCODER FOR PERF. TAPE, CARDS / Robins Industries Corp.

A new, simplified hand encoder, Model DCN-64 "Commander," can be programmed with up to 64 individual codes in eight channels, plus feed holes, providing capability for virtually any hole-punch system. There are special versions for mylar tape and edge-punch cards. The compact, desk-top unit, measuring only 7-5/8" x 3" x 6" high, is operated by selecting the desired code on a dial, and pressing a lever. The tape or card automatically advances as each code or space is punched.
(For more information, circle #79 on the Reader Service Card.)

"SWINGER" DISK PACK STORAGE / Engineered Data Products, Inc.

The lightweight, space-saving storage rack "Swinger" provides maximum density of storage for disk packs. Specifically designed for disk packs, plastic-coated baskets "swing out" fully for easy convenient storage and retrieval of packs. The "Swinger" holds 16 to 22 industry compatible 4", 6", and NCR packs on a 62" high frame. A special suspension system insures stability by allowing only one disk to be swung out at a time. The new storage rack also allows for complete field adjustability for various size disk packs.
(For more information, circle #80 on the Reader Service Card.)

COMPUTING/TIME-SHARING CENTERS

TYPEWRITER TERMINAL BECOMES BUSINESSMAN'S PLOTTER WITH NEW SERVICE BUREAU PROGRAM

The Service Bureau Corporation (New York) recently announced a new computer time sharing program that turns a typewriter terminal into a precise plotting device that can translate files of business information into graphic displays. The new program MINI-MIS PLOT, is part of a family of programs designed to make the time-sharing computer more useful to a businessman. The package is part of the nationwide CALL/360 time sharing service supplied by The Service Bureau Corporation.
(For more information, circle #81 on the Reader Service Card.)

COMPUTER-RELATED SERVICES

MSI GRAPHICS OFFERS NATION-WIDE DIGITIZING DRAFTING SYSTEM (D/DS) SERVICE

A Digitizing Drafting System (D/DS) now is available to all firms, large or small, which have Numerically Controlled equipment. MSI places boths its personnel and equipment at the disposal of the manufacturer. The customer needs only to provide: suitable engineering documentation (drawings or specifications); type of machine tool; type of N/C controller; and any special instructions or auxiliary functions required. D/DS Service converts the drawing or blueprint into a proven, verified N/C Control Tape, ready to drive the customer's machine tool.
(For more information, circle #82 on the Reader Service Card.)

NEW "BASIC-TO-FORTRAN" TRANSLATION SERVICE

International Conversion Systems of New York City and Computer Software Systems of Stamford, Conn., are combining their resources to provide a new BASIC to FORTRAN Translation Service. The new service enables development and debugging of BASIC programs in a real time environment followed by on-line translation to FORTRAN for batch processing. Translation can be from any BASIC to any FORTRAN. Effectiveness is 100% on the more commonly used BASICS and where editing is required, the normal CSS time sharing edit procedures are used on-line.
(For more information, circle #83 on the Reader Service Card.)

NEW SERVICE FROM TELEFLORA WORLDWIDE TRANSMITS FLOWERS BY COMPUTER

Teleflora Worldwide, El Segundo, Calif., has a computerized communications and sales service system (provided by International Reservations Corp.) which permits Teleflora's subscribing florists to transmit orders to other Teleflora affiliates anywhere in the United States. Subscribers can call a single, toll-free number and place an unlimited number of outgoing orders for delivery anywhere in the United States. Calling individual Teleflorists with orders now is eliminated. Additionally, time zone changes no longer will create a problem. A 16-hour service will be available seven days a week from 7 a.m. to 11 p.m.
(For more information, circle #84 on the Reader Service Card.)

McDONNELL AUTOMATION CO. TO EXPAND HOSPITAL COMPUTER SERVICE NATIONWIDE

A hospital data processing system, developed over the past ten years by the Sisters of the Third Order of St. Francis, Peoria, Ill., has been acquired by McDonnell Automation Co., St. Louis, Mo. A joint announcement stated that McDonnell Automation Co. has assumed the operation and marketing of the services, along with its associated facilities and personnel in Peoria. McDonnell plans to expand the operation into a nationwide service, and to further accelerate the development of new applications for the present system.

The hospital data processing services consist of two related systems: an accounting system performs a wide variety of administrative functions; and the patient care information system, which connects terminals throughout the hospital to the central computer and selected other terminals.
(For more information, circle #85 on the Reader Service Card.)

RESEARCH FRONTIER

DEAF CHILDREN MAY BE HELPED BY COMPUTER-BASED PROCEDURE BEING STUDIED AT THE ROYAL VICTORIA HOSPITAL

Standard procedures now in use to test hearing capabilities of the newborn are open to question. Infants are often simply subjected to sharp sounds — such as hand clapping or noisemakers — to see if they react by sudden movements. However, these movements can be a result of other causes and a hearing loss can go undiscovered. At the Royal Victoria Hospital (Montreal, Quebec), a team headed by Dr. R. P. Gannon of McGill University's ear, nose and throat institute, has worked out an experimental computer-based procedure to help physicians measure the hearing capacity of newborns. Dr. Charles Laszlo, biomedical engineer on the team, designed the system around a computer, and electrocardiograph equipment to record heart beats.

With the computer-based system, nurses in the infant nursery at the hospital attach the electrodes of the machine to an infant within a week of birth. The machine is connected by a phone line to the computer in a remote location. During an initial period of three minutes, the baby's heart rate is charted when no sounds are being presented. Then the baby is subjected to sound generated at random intervals for three minutes. The two three-minute cycles are repeated once more. All the informaion is recorded on magnetic tape by the computer for later analysis.

Heart rate fluctuations are statistically compared. The data from the no-sound period is displayed on a screen with the data from the sound period. If there is a statistically significant difference in the heart rate swings during the no-sound and sound periods, it is considered an indication that the baby was reacting to the sound.

"It is a known medical fact," Dr. Gannon says, "that when a baby cannot hear normally at birth, and this is not discovered until he reaches the age of three or four, that part of the brain associated with hearing does not develop properly. This can be a handicap in teaching such a child to speak. But if we determine that there is a hearing deficiency, we can present the child with the correct auditory stimuli and that part of his brain will develop properly. This procedure could become standard in hospitals in the future."

NEW LITERATURE

BIOMEDICAL ENGINEERING DEVELOPMENT AND PRODUCTION, a 65-page report, issued by the National Institute of General Medical Sciences (a component of the National Institutes of Health, Department of Health, Education, and Welfare) explores ways to effectively bring together, on a regional basis, the resources of government, universities, business and manufacturing interests for orderly approaches to research, development, production and the distribution of medical instruments, systems and devices. Single copies are available on request from the Information Office of the National Institute of General Medical Sciences, Bethesda, Md. 20014

BULLETIN OF THE SPECIAL INTEREST GROUP FOR URBAN SYSTEMS, PLANNING, ARCHITECTURE, AND CIVIL ENGINEERING (SIGSPAC) of the Assoc. for Computing Machinery now is available on a yearly basis to institutional subscribers for $18 per year; single copies at $3 each. For more information, contact: Assoc. for Computing Machinery, 1133 Avenue of the Americas, New York, N.Y. 10036

DIRECTORY OF COMPUTER FACILITIES IN TEXAS, Industrial Economics Research Div., Texas A&M Univ., College Station, Tex. / Directory will cover computer installations in Texas, including computer make and model, memory size, type and quantity of peripheral equipment, computer applications, and availability of programming assistance. Special emphasis will be on those installations with computer time available for rent. Copies may be reserved ($5.00) by writing to the Industrial Economics Research Div., Box 77 FE, College Station, Tex. 77843

JOURNAL OF THE AMERICAN SOCIETY FOR INFORMATION SCIENCE commenced publication as a bi-monthly with the Jan-Feb 1970 issue. The official journal for the American Society for Information Science, JASIS was previously entitled American Documentation and published quarterly. The subscription rate will remain at $27.50 a year domestic, and $28 foreign. For more information, contact: American Society for Information Science, 2011 Eye St., N.W., Washington, D.C. 2006

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Control Data Corp., Minneapolis, Minn.	Telex Corp., Tulsa, Okla.	High speed computer printers (over an extended period)	$25+ million
Honeywell EDP Div., Wellesley Hills, Mass.	Diners' Club, Inc., New York, N.Y.	A commercial audio-response computer system, DA_2SH (Diners' Club Authorization and Accounting system by Honeywell)	$6 million
Sperry Rand Corp., Univac Div., Philadelphia, Pa.	General Dynamics Corp., The Electric Boat Div., Groton, Conn.	Computer systems (UNIVAC 1106, 1108, a 9400 and a 9300). The multiple Univac systems will be used in computer-aided design, stress analysis, sound analysis, manufacturing and inventory control	$5.4 million (approximate)
Sperry Rand Finland Company's Univac Division	Bank of Finland, Helsinki, Finland	Two UNIVAC 1108 multiprocessor computer systems to provide computer services for all of the Finnish universities	$4.4 million
Sperry Rand Corp., Univac Federal Systems Div.	U.S. Department of Housing and Urban Development	A UNIVAC 1106 computer system	$3.3 million
International Computers Ltd., London, England	The Government of the United Arab Republic, Cairo, Egypt	A 1906A computer to be installed in the Central Agency for Statistics for use by the National Computing Centre (established within the CAS)	$3 million
	British Rail, England	Two 1904A computers for centres at Crewe and Peterborough; will be used initially for a centralized payroll system for 350,000 employees	$2.4 million
Environmental Services Operation of EG&G, Inc., Boulder, Colo.	Department of the Interior, Bureau of Reclamation, Denver, Colo.	A weather modification project aimed at augmenting existing water supplies; work includes weather and avalanche monitoring	$1.7 million
Sylvania Electric Products Inc., a GT&E subsidiary, Mountain View, Calif.	Naval Ships Systems Command, Washington, D.C.	Shipborne electronic countermeasures equipment for use in receiving and detection systems	$1.6 million
Univac Division of Sperry Rand Canada Ltd.	Canadian Overseas Telecommunication Corp. (COTC), Montreal	Two UNIVAC 418-III systems for telex switching for COTC's international services	$1.4 million (approximate)
Data Products Corp., Woodland Hills, Calif.	U.S. Naval Ship Systems Command, Washington, D.C.	High speed militarized line printers to be used in conjunction with military communications systems and operational control systems centers in shipboard and land-based installations	$1.3+ million
Data Recording Instrument Co. Ltd., Staines, England	Nixdorf Computer, Germany	Supply of Type SC. 1030 Magnetic Tape Handlers	$1.3+ million
Systems & Research (Nederland) N.V.	KLM, Royal Dutch Airlines	Designing of a computer reservation system for tour operators in Holland	$1.2+ million
Burroughs Corp., Detroit, Mich.	State of Florida, Dept. of Law Enforcement, Tallahassee	Burroughs B3500 computer system for use in accelerating the control of crime in the state	$1.2 million
Peripherals General, Inc., Cherry Hill, N.J.	Westinghouse Corporation/Hagan Systems Division	Removable disc storage drive systems for the PRODAC 2000 Computer	$500,000
Ampex Corp., Culver City, Calif.	Systems Engineering Laboratories, Fort Lauderdale, Fla.	Core memory stacks for use in Systems' 810A and 840 computer systems	$450,000+
Seaco Computer-Display Inc., Garland, Texas	Interface Sciences Corp., New York, N.Y.	Ten Model 401 microfilm recorder systems	$411,504
Hoffman Electronics Corp., El Monte, Calif.	Hawker-Siddeley Aviation, Kingston-upon-Thames, England	Microminiature TACAN (Tactical Air Navigation) Systems for use in the Harrier VSTOL aircraft	$300,000+
Ampex Corp., Culver City, Calif.	Varian Data Machines, Irvine, Calif.	High-speed core memory stacks to be used in the Varian 520/i computer	$250,000+
Computer Audit Corp., Silver Spring, Md.	Dominick & Dominick, Inc., New York, N.Y.	A software control program, a step in modernizing the brokerage firm's data processing system	$50,000
Honeywell Ltd., England	Redman Heenan Froude, Worcester, England	An H316 system for logging, analyzing and plotting up to 900 different readings for 2,500 individual tests applied to its engineering products	$43,000 (approximate)
IBM Corporation, White Plains, N.Y.	Lithonia Lighting, a division of National Service Industries, Conyers, Ga.	205 IBM 2721 portable audio terminals (see Computers and Automation, March 1970, p.52) to provide instant access to business information for personnel and field representatives	—
Aetna Life & Casualty, Hartford, Conn.	Social Security Administration	Design and development of an automated system for the Part A, or hospital insurance, portion of Medicare	—
Health Care Computer Systems, West Los Angeles, Calif.	Harris, Kerr, Chervenak & Company	Design of modular software packages for major data processing requirements of the health-care industry	—
Computer Image Corp., Denver, Colo.	Visual Learning Corp., Cambridge, Mass.	A series of films on basic economics to be used for introductory college courses; work will be done on Computer Image's Scanimate Computer	—
International Data Systems, Reno, Nev.	Xerox Corp., Business Products Div.	Development of a prototype of a data recorder operating on a new concept created by IDS	—
IBM Corporation, White Plains, N.Y.	American National Insurance Co., Galveston, Texas	Design and programming of a company-wide total information data processing system	—

NEW INSTALLATIONS

OF	AT	FOR
Burroughs B3500 system	Electronic Processors, Inc. (EPI) Birmingham, Ala.	Demand deposit accounts installment loans, accounts receivable, payroll, sales analysis, utility billing and credit union accounting (system valued at over $660,000)
Control Data 1700 system	Getty Oil Company, Delaware City, Del.	Scanning, logging, and alarming functions; also will control some operating points on each of three refining units
Control Data 3300 system	New York State Education Department, Albany, N.Y.	A variety of business and scientific applications; will also be utilized by the New York State Library and State Museum
Control Data 6400 system	University of Brussels, Brussels, Belgium	Processing administrative management information, providing computer training for students, and a wide range of scientific research
	Internationale Atomreaktorbau GmbH (INTERATOM), Bensberg, West Germany	Technical and scientific calculations supporting development of nuclear reactors for power generation; calculations in connection with design and manufacture of reactor components, for documentation, projects control, cost control
Control Data 6500 system	McDonnell Douglas Astronautics Co., Western Division, Huntington Beach, Calif.	Aerospace programs including Delta, Saturn, Safeguard-Spartan, the Saturn 5 orbiting workshop and space station study (system valued at $4.8 million)
Control Data 6600 system	Bologna University, Italy	Scientific problem solving programs for students, engineering and industrial research projects and industrial applications; through Control Data 200 User Terminals, the Italian universities, Florence, Venice and Padua, also will gain access to the computer (system valued at $3.4 million)
Digital Equipment PDP-10 system	National Neutron Cross Section Center, Upton, Long Island, N.Y.	Researchers and engineers studying nuclear energy and building reactors to have quicker analysis of their experimental data and quicker access to a massive data base
Honeywell Model 110 system	Columbia National Corp., Columbus, Ohio	Insurance functions such as premium billing, commissions, and financial reports
	Credit Bureau of Cincinnati, Cincinnati, Ohio	Retail credit reporting, collections and service bureau billing of small business for the Cincinnati bureau as well as subsidiaries
	Fairfax County National Bank, Seven Corners, Va.	Demand deposit accounting, MICR entry, savings, loan, and other banking applications
	Midwest Mutual Insurance Co., Des Moines, Iowa	Policy writing, agents' statements and statistical work
	Weissenburg United Savings Bank, West Germany	Accounting applications; the bank has 12 branches
Honeywell Model 120 system	National Mortgage Co., Memphis, Tenn.	Mortgage loan accounting, general ledger and payroll applications; insurance applications later
	Richmond Life Insurance Co., Richmond, Va.	General accounting, commissions, and reports
	Tracy-Collins Bank & Trust Co., Salt Lake City, Utah	Many banking applications including demand deposit accounting, mortgage loan, escrow and property management, and teller cash
Honeywell Model 125 system	Home Mutual Life Insurance Co., Baltimore, Md.	Industrial policy issue, agents' production and contest reporting and field accounting
Honeywell Model 1250 system	Aachen District Savings Bank, West Germany	Savings and loan accounting and central bookkeeping
IBM System/3	Consumer's Market, Inc., Springfield, Mo.	Central warehouse inventory monitoring, payroll, invoices for the chain of food stores
IBM System/360 Model 20	Shadyside Hospital, Pittsburgh, Pa.	Order, stock, track and anticipate usage of over 1000 drugs and intravenous solutions
ICL 1902A system	Royal Military College of Science, Shrivenham, England	A diverse program of scientific research and for student instruction in programming
NCR Century 100 system	Associated British Malsters Ltd., London, England	Raw material inventory and cost control, production scheduling and delivery allocation
	Medi-Centers of America, Inc., Memphis, Tenn. (3 systems)	Payroll, accounts payable and receivable, and general ledger for about 25 institutions
RCA Spectra 70/46 system	University of North Carolina, Chapel Hill, N.C.	Record keeping, payroll, library control and utilities billings functions
Univac 494 system	Kesko Oy, Helsinki, Finland	Inventory control, order processing, warehouse operation, purchasing, statistics and forecasting (system valued at $1.6 million)
Univac 9200 system	Rugby Sportswear Inc., Buffalo, N.Y.	Updating all office systems such as sales reports, accounts payable and receivable, payroll
	St. Louis Park Medical Center, Minneapolis, Minn.	Automating general account billing and processing of Medicare and other health insurance claims
	United States Castor Corp., Overland Park, Kan.	Inventory control, order writing, invoicing, general accounting and sales analysis
Univac 9400 system	Akers Motor Lines Inc., Gastonia, N.C.	Traffic and operations profitability analysis, general ledger, maintenance, routing, interline transfers, tax schedules, terminal communications

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 APRIL 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 I. United States Manufacturers							
Autonetics	RECOMP II	11/58	2.5	30	0	30	X
Anaheim, Calif. (R) (1/69)	RECOMP III	6/61	1.5	6	0	6	X
Bailey Meter Co.	Bailey 750	6/60	40-250 (S)	32	3	35	0
Wickliffe, Ohio (R) (4/70)	Bailey 756	2/65	60-400 (S)	13	5	18	1
	Bailey 855	4/68	100-1000(S)	5	0	5	20
Bunker-Ramo Corp.	BR-130	10/61	2.0	160	-	-	X
Canoga Park, Calif.	BR-133	5/64	2.4	79	-	-	X
(A)	BR-230	8/63	2.7	15	-	-	X
(10/69)	BR-300	3/59	3.0	18	-	-	X
	BR-330	12/60	4.0	19	-	-	X
	BR-340	12/63	7.0	19	-	-	X
Burroughs	205	1/54	4.6	25-38	2	27-40	X
Detroit, Mich.	220	10/58	14.0	28-31	2	30-33	X
(N)	B100	8/64	2.8	90	13	103	X
(1/69-5/69)	B200	11/61	5.4	370-800	70	440-870	31
	B300	7/65	9.0	180-370	40	220-410	150
	B500	10/68	3.8	0	0	0	70
	B2500	2/67	5.0	52-57	12	64-69	117
	B3500	5/67	14.0	44	18	62	190
	B5500	3/63	23.5	65-74	7	72-81	8
	B6500	2/68	33.0	4	0	4	60
	B7500	4/69	44.0	0	0	0	13
	B8500	8/67	200.0	1	0	1	5
Control Data Corp.	G15	7/55	1.6	-	-	295	X
Minneapolis, Minn.	G20	4/61	15.5	-	-	20	X
(N)	LGP-21	12/62	0.7	-	-	165	X
(2/69-4/69)	LGP-30	9/56	1.3	-	-	322	X
	RPC4000	1/61	1.9	-	-	75	X
	636/136/046 Series	-	-	-	-	29	-
	160/8090 Series	5/60	2.1-14.0	-	-	610	X
	924/924A	8/61	11.0	-	-	29	X
	1604/A/B	1/60	45.0	-	-	59	X
	1700	5/66	3.8	65-130	41-50	106-180	C
	3100/3150	5/64	10-16	68-90	15-20	83-110	C
	3200	5/64	13.0	40-45	15	55-60	C
	3300	9/65	20-28	38-100	17-25	55-125	C
	3400	11/64	18.0	12	4	16	C
	3500	8/68	25.0	1	0	1	C
	3600	6/23	52.0	30	9	39	C
	3800	2/66	53.0	18	2	20	C
	6400/6500	8/64	58.0	23-50	14-17	37-67	C
	6600	8/64	115.0	32-40	11	43-51	C
	6800	6/67	130.0	1	0	1	C
	7600	12/68	235.0	1	0	1	C
							Total: 160 E
Data General Corp.	NOVA	2/69	8.0 (S)	130	6	136	800
Southboro, Mass. (A) (4/70)	SUPERNOVA	4/70	11.7 (S)	0	0	0	0
Datacraft Corp.	DC6024	5/69	54-200 (S)	7	0	7	5
Ft. Lauderdale, Fla. (A) (2/70)	DC6024/3	2/70	33-200 (S)	3	0	3	64
Digiac Corp.	Digiac 3080	12/64	19.5 (S)	14	-	-	2
Plainview, N.Y. (A) (2/70)	Digiac 3080C	10/67	25.0 (S)	5	-	-	1
Digital Equipment Corp.	PDP-1	11/60	3.4	50	2	52	X
Maynard, Mass.	PDP-4	8/62	1.7	40	5	45	X
(A)	PDP-5	9/63	0.9	90	10	100	X
(4/70)	PDP-6	10/64	10.0	C	C	23	X
	PDP-7	11/64	1.3	C	C	160	X
	PDP-8	4/65	0.5	C	C	1450	C
	PDP-8/I	3/68	0.4	C	C	2157	C
	PDP-8/S	9/66	0.3	C	C	1020	C
	PDP-8/L	11/68	-	C	C	2350	C
	PDP-9	12/66	1.1	C	C	425	C
	PDP-9L	11/68	-	C	C	41	C
	PDP-10	12/67	8.0	C	C	144	C
	PDP-12	9/69	-	C	C	275	C
	PDP-15	2/16	17.0	6	C	15	C
	LINC-8	9/66	-	C	C	142	C
							Total: 1350E

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
Electronic Associates Inc.	640	4/67	1.2	75	30	105	15
Long Branch, N.J. (A) (2/70)	8400	7/65	12.0	19	6	25	2
EMR Computer	ADVANCE 6020	4/65	5.4	C	-	-	C
Minneapolis, Minn.	ADVANCE 6040	7/65	6.6	C	-	-	C
(N)	ADVANCE 6050	2/66	9.0	C	-	-	C
(4/70)	ADVANCE 6070	10/66	15.0	C	-	-	C
	EMR 6120	-	0.8	-	-	-	-
	EMR 6130	8/67	5.0	C	-	-	C
	EMR 6135	-	2.6	-	-	-	-
				Total: 90 E			Total: 30 E
General Electric	105A	6/69	1.3	-	-	-	-
Phoenix, Ariz.	105B	6/69	1.4	-	-	-	-
(N)	105RTS	7/69	1.2	-	-	-	-
(2/70)	115	4/66	2.2	200-400	420-680	620-1080	-
	120	3/69	2.9	-	-	-	-
	130	12/68	4.5	-	-	-	-
	205	6/64	2.9	11	0	11	-
	210	7/60	16.0	35	0	35	-
	215	9/63	6.0	15	1	16	-
	225	4/61	8.0	145	15	160	-
	235	4/64	12.0	60-100	17	77-117	-
	245	11/68	13.0	-	-	-	-
	255 T/S	10/67	17.0	-	-	-	-
	265 T/S	10/65	20.0	-	-	-	-
	275 T/S	11/68	23.0	-	-	-	-
	405	2/68	6.8	10-40	5	15-45	-
	410 T/S	11/69	11.0	-	-	-	-
	415	5/64	7.3	170-300	70-100	240-400	-
	420 T/S	6/67	23.0	-	-	-	-
	425	6/64	9.6	50-100	20-30	70-130	-
	430 T/S	6/69	17.0	-	-	-	-
	435	9/65	14.0	20	6	26	-
	440 T/S	7/69	25.0	-	-	-	-
	615	3/68	32.0	-	-	-	-
	625	4/65	43.0	23	3	26	-
	635	5/65	47.0	20-40	3	23-43	-
	655	-	80.0	-	-	-	-
Process Control Computers:	4020	2/67	5.0	142	43	185	70
(A)	4040	8/64	3.0	45	20	65	-
(4/70)	4050	12/66	7.0	22	1	23	1
	4060	6/65	8.5	18	2	20	-
Hewlett Packard	2114A	10/68	0.25	-	-	812	-
Cupertino, Calif.	2115A	11/67	0.41	-	-	661	-
(A)	2116A	11/66	0.6	-	-	367	-
(4/70)	2116B	9/68	0.65	-	-	1051	-
Honeywell	DDP-24	5/63	2.65	-	-	90	X
Computer Control Div.	DDP-116	4/65	0.9	-	-	250	-
Framingham, Mass.	DDP-124	3/66	2.2	-	-	110	-
(A)	DDP-224	3/65	3.5	-	-	60	-
(4/70)	DDP-316	6/69	0.6	-	-	150	-
	DDP-416	-	-	-	-	225	-
	DDP-516	9/66	1.2	-	-	550	-
	H632	12/68	3.2	-	-	10	-
	H1648	11/68	12.0	-	-	12	-
Honeywell	H-110	8/68	2.5	150	60	210	0
EDP Div.	H-120	1/66	4.2	800	150	900	-
Wellesley Hills, Mass.	H-125	12/67	6.0	75	175	230	-
(A)	H-200	3/64	9.2	800	275	1075	-
(4/70)	H-400	12/61	10.0	46	40	86	X
	H-800	12/60	30.0	58	10-12	70	X
	H-1200	2/66	11.6	230	90	315	-
	H-1250	7/68	12.0	130	40	170	-
	H-1400	1/64	14.0	4	6	10	X
	H-1800	1/64	50.0	15	3	18	X
	H-2200	1/66	16.0-26.0	125	55	180	-
	H-3200	2/70	24.0	0	0	0	-
	H-4200	8/68	32.5	15	2	17	-
	H-8200	12/68	50.0	8	3	11	-
IBM	System 3	1/70	1.1	0	0	-	-
White Plains, N.Y.	305	12/57	3.6	40	15	55	-
(N) (D)	650	10/67	4.8	50	18	68	-
(1/69-5/69)	1130	2/66	1.5	2580	1227	3807	-
	1401	9/60	5.4	2210	1836	4046	-
	1401-G	5/64	2.3	420	450	870	-
	1401-H	6/67	1.3	180	140	320	-
	1410	11/61	17.0	156	116	272	-
	1440	4/63	4.1	1690	1174	2864	-
	1460	10/63	10.0	194	63	257	-
	1620 I, II	9/60	4.1	285	186	471	-
	1800	1/66	5.1	415	148	563	-
	7010	10/63	26.0	67	14	81	-
	7030	5/61	160.0	4	1	5	-
	704	12/55	32.0	12	1	13	-
	7040	6/63	25.0	35	27	2	-
	7044	6/63	36.5	28	13	41	-
	705	11/55	38.0	18	3	21	-
	7070, 2	3/60	27.0	10	3	13	-
	7074	3/60	35.0	44	26	70	-
	7080	8/61	60.0	13	2	15	-
	7090	11/59	63.5	4	2	6	-
	7094-I	9/62	75.0	10	4	14	-
	7094-II	4/64	83.0	6	4	10	-
	360/20	12/65	2.7	4690	3276	7966	-
	360/25	1/68	5.1	0	4	4	-
	360/30	5/65	10.3	5075	3144	8219	-

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
IBM (Cont'd.)	360/40	4/65	19.3	1260	498	1758	-
	360/44	7/66	11.8	65	13	78	-
	360/50	8/65	29.1	480	109	589	-
	360/65	11/65	57.2	175	31	206	-
	360/67	10/66	133.8	9	4	13	-
	360/75	2/66	66.9	14	3	17	-
	360/85	-	150.3	0	0	0	-
	360/90	11/67	(S)	5	0	5	-
	360/195	-	232.0	-	-	-	-
Interdata	Model 2	7/68	0.25	-	-	18	0
Oceanport, N.J.	Model 3	3/67	0.4	-	-	213	74
(A) (4/70)	Model 4	8/68	0.6	-	-	147	87
NCR	304	1/60	14.0	15	2	17	X
Dayton, Ohio	310	5/61	2.5	8	0	8	X
(R)	315	5/62	8.7	460	400	860	-
(2/70)	315 RMC	9/65	12.0	125	45	170	-
	390	5/61	1.9	240	500	740	-
	500	10/65	1.5	1700	950	2650	-
	Century 100	9/68	2.7	550	150	700	-
	Century 200	6/69	7.5	100	50	150	-
Pacific Data Systems Inc. Santa Ana, Calif. (N) (1/69)	PDS 1020	Computer manufacturing operation terminated					
Philco	1000	6/63	7.0	16	-	-	X
Willow Grove, Pa.	2000-210, 211	10/58	40.0	16	-	-	X
(N) (1/69)	2000-212	1/63	52.0	12	-	-	X
Potter Instrument Co., Inc. Plainview, N.Y. (A) (10/69)	PC-9600	Product obsoleted					
RCA	301	2/61	7.0	140-290	100-130	240-420	-
Cherry Hill, N.J.	501	6/59	14.0-18.0	22-50	1	23-51	-
(N)	601	11/62	14.0-35.0	2	0	2	-
(5/69)	3301	7/64	17.0-35.0	24-60	1-5	25-65	-
	Spectra 70/15	9/65	4.3	90-110	35-60	125-170	-
	Spectra 70/25	9/65	6.6	68-70	18-25	86-95	-
	Spectra 70/35	1/67	9.2	65-100	20-50	85-150	-
	Spectra 70/45	11/65	22.5	84-180	21-55	105-235	-
	Spectra 70/46	-	33.5	1	0	1	-
	Spectra 70/55	11/66	34.0	11	1	12	-
Raytheon	250	12/60	1.2	155	20	175	X
Santa Ana, Calif.	440	3/64	3.6	20	-	20	X
(A)	520	10/65	3.2	26	1	27	X
(4/70)	703	10/67	(S)	145	20	175	8
	704	3/70	(S)	1	0	1	8
	706	5/69	(S)	27	3	30	13
Scientific Control Corp.	650	5/66	0.5	23	0	23	0
Dallas, Tex.	655	10/66	2.1	111	0	111	25
(A)	660	10/65	2.1	27	0	27	12
(10/69)	670	5/66	2.7	1	0	1	0
	4700	4/69	1.8	13	0	13	79
	6700	2/70	90.0	0	0	0	1
	DCT-132	5/69	0.7	23	0	23	509
	DCT-32	11/69	0.3	0	0	0	3
Standard Computer Corp.	IC 4000	12/68	9.0	6	0	6	8 E
Los Angeles, Calif.	IC 6000	5/67	16.0	9	0	9	-
(N) (8/69)	IC 7000	6/69	17.0	3	0	3	10 E
Systems Engineering Laboratories	810	9/65	1.1	24	0	24	X
Ft. Lauderdale, Fla.	810A	8/66	0.9	158	4	162	48
(A)	810B	9/68	1.2	58	1	59	17
(2/70)	840	11/65	1.5	3	0	3	X
	840A	8/66	1.5	36	2	38	X
	840MP	1/68	2.0	26	0	26	5
	Systems 86	-	10.0	0	0	0	2
UNIVAC (Div. of Sperry Rand)	I & II	3/51 & 11/57	25.0	23	-	-	X
New York, N.Y.	III	8/62	21.0	25	6	31	X
(R)	File Computers	8/56	15.0	13	-	-	X
(1/69-5/69)	Solid-State 80 I, II, 90,I,II, & Step	8/58	8.0	210	-	-	X
	418	6/63	11.0	76	36	112	20 E
	490 Series	12/61	30.0	75	11	86	35 E
	1004	2/63	1.9	1502	628	2130	20 E
	1005	4/66	2.4	637	299	936	90 E
	1050	9/63	8.5	138	62	200	10 E
	1100 Series (except 1107, 1108)	12/50	35.0	9	0	9	X
	1107	10/62	57.0	8	3	11	X
	1108	9/65	68.0	38	18	56	75 E
	9200	6/67	1.5	127	48	175	850 E
	9300	9/67	3.4	106	38	144	550 E
	9400	5/69	7.0	3	0	3	60 E
	LARC	5/60	135.0	2	0	2	-
Varian Data Machines	620	11/65	0.9	-	-	75	0
Newport Beach, Calif.	620i	6/67	0.5	-	-	1200	400
(A) (4/70)	R-620i	4/69	-	-	-	25	30
	520i	10/68	-	-	-	110	330
Xerox Data Systems	SDS-92	4/65	1.5	10-60	2	12-62	-
El Segundo, Calif.	SDS-910	8/62	2.0	150-170	7-10	157-180	-
(N)	SDS-920	9/62	2.9	93-120	5-12	98-132	-
(4/70)	SDS-925	12/64	3.0	20	1	21	-
	SDS-930	6/64	3.4	159	14	173	-
	SDS-940	4/66	14.0	28-35	0	28-35	-
	SDS-9300	11/64	8.5	21-25	1	22-26	-
	Sigma 2	12/66	1.8	60-110	10-15	70-125	-
	Sigma 3	12/69	2.0	10	0	10	-
	Sigma 5	8/67	6.0	15-40	6-18	21-58	-
	Sigma 7	12/66	12.0	24-35	5-9	29-44	-

THE
16th ANNUAL EDITION OF THE
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- A List of Over 1700 Applications of Electronic Computing and Data Processing Equipment
- A World Computer Census

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ADVERTISING INDEX

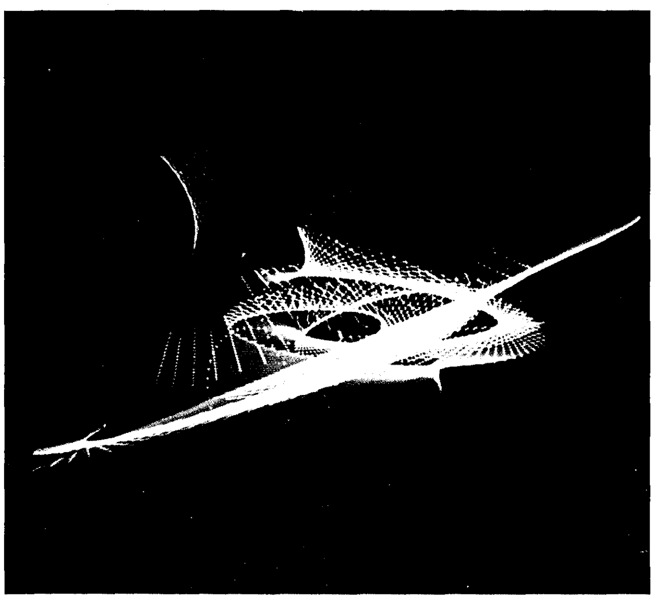
Following is the index of advertisements. Each item contains: Name and address of the advertiser / page number where the advertisement appears / name of agency, if any

YOU ARE INVITED TO ENTER OUR

Eighth Annual COMPUTER ART CONTEST

the special feature of the August, 1970 issue of

computers and automation



CIRCUS
— Tom Childs

The winning entry will appear on the cover of our August issue — more than 25 entries will be published inside. The 1969 first prize winner, "Circus", is shown here at the left.

GUIDELINES FOR ENTRY

1. Any interesting and artistic drawing, design or sketch made by a computer (analog or digital) may be entered.

2. Entries should be submitted on white paper in black ink for best reproduction. Color entries are acceptable, but they may be published in black and white.

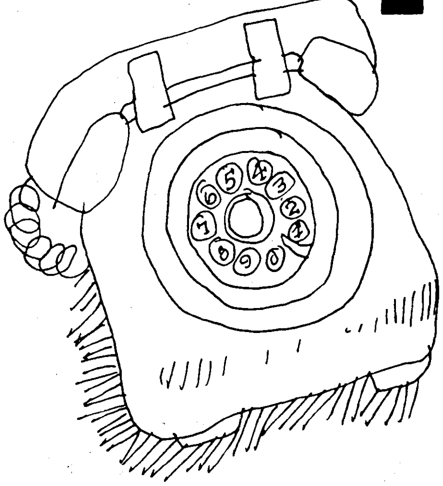
3. Entries should be limited in size to $12\frac{1}{2}$" by 17".

4. Each entry should be accompanied by an explanation in three or four sentences of how the drawing was programmed for a computer, the type of computer used, and how the art was produced by the computer.

There are no formal entry blanks; any letter submitting and describing the entry is acceptable. We cannot undertake to return artwork, and we ask that you not send originals.

Deadline for receipt of entries in our office is July 2, 1970.

Now your old phone can be your new computer.



Your fingers do the talking
You can actually time-share an IBM APL/360 Terminal System over the telephone. Just dial the system direct and type in on your own computer console. The computer will type out the correct response instantly.

Complete control is yours
The system allows continuous hands-on-time programming right at your desk. With simple on-line alteration of a program statement. And immediate on-line test of a program alteration.

A programming dream
It takes a programmer only one productive day to do in APL what it would take him three weeks to do in Fortran. And our optional instruction course can even teach APL to your secretary.

Use our systems library
You can use the real-time systems we have ready-made. Or tailor them as you like. We have numerous examples to serve as your guide.

"CRASHES" eliminated; down time eliminated
The design of APL *completely* protects the system from the software "crashes" that other systems suffer because of user-mistakes. We haven't had a software crash since inception on August 25, 1969.

Our time is your time
The system is operational 24 hours a day, 365 days a year, so you can use it anytime. And you pay only $12 per hour of use. It can handle seventy-five users simultaneously, so you virtually can have as many computers working for you as you have telephones and people to use them.

Call us for more information about the telephone as a substitute for the computer room.
The phone is waiting right there on your desk.
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