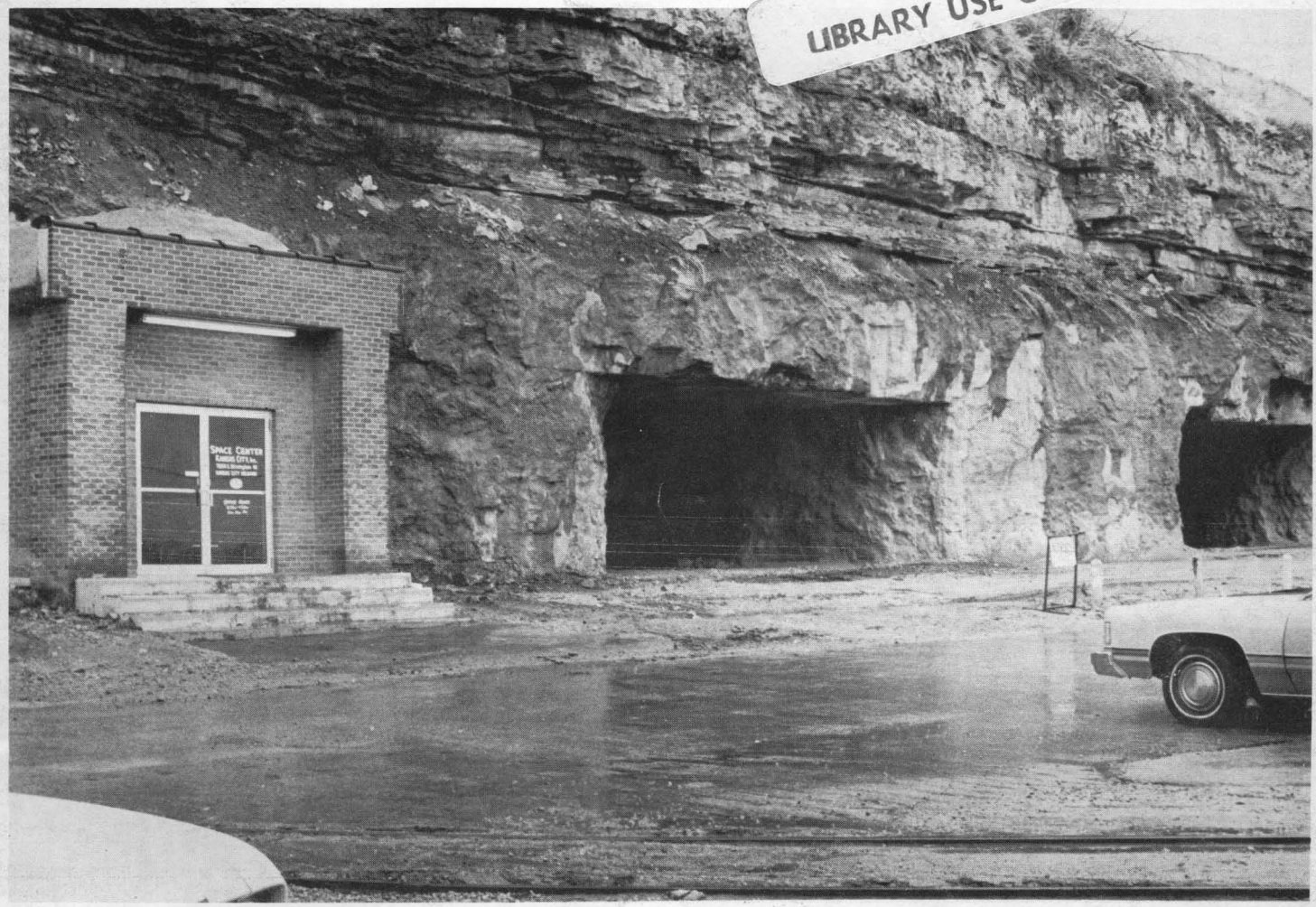
September, 1975

Vol. 24, No. 9

computers and people

formerly *Computers and Automation*



CAVERN BECOMES COMPUTERIZED WAREHOUSE

The Notebook on
COMMON SENSE, ELEMENTARY AND ADVANCED

is devoted to development, exposition, and illustration of what may be the most important of all fields of knowledge:

WHAT IS GENERALLY TRUE AND IMPORTANT =

COMMON SENSE + WISDOM + JUDGEMENT AND MATURITY + SCIENCE IN GENERAL + TECHNIQUES FOR SOLVING PROBLEMS +

TECHNIQUES FOR AVOIDING MISTAKES + SOME PARTS OF OPERATIONS RESEARCH + SOME PARTS OF SYSTEMS ANALYSIS + AVOIDANCE OF LOGICAL FALLACIES + ...

PURPOSES:

to help you avoid pitfalls
to prevent mistakes before they happen
to display new paths around old obstacles
to point out new solutions to old problems
to stimulate your resourcefulness
to increase your accomplishments
to improve your capacities
to help you solve problems
to give you more tools to think with
.....

Topic:
THE SYSTEMATIC PREVENTION OF MISTAKES

Already Published

Preventing Mistakes from:
- Failure to Understand
- Forgetting
- Unforeseen Hazards
- Placidity
- Camouflage

To Come

Preventing Mistakes from:
- Bias
- Interpretation
- Distraction
- Gullibility
- Failure to Observe
- Failure to Inspect
- Prejudice

....

Topic:
SYSTEMATIC EXAMINATION OF GENERAL CONCEPTS

Already Published

The Concept of:
- Expert
- Rationalizing
- Feedback
- Model
- Black Box
- Evolution
- Niche
- Understanding

To Come

- Strategy
- Teachable Moment
- Indeterminacy
- System
- Operational Definition

....

8 REASONS TO BE INTERESTED IN THE FIELD OF COMMON SENSE, WISDOM, AND GENERAL SCIENCE

COMPUTERS are important —
But the computer field is over 25 years old. Here is a new field where you can get in on the ground floor to make your mark.

MATHEMATICS is important —
But this field is more important than mathematics, because common sense, wisdom, and general science have more applications.

LOGIC is important —
But this field is more important than logic, because common sense plus wisdom plus science in general is much broader than logic.

WISDOM is important —
This field can be reasonably called "the engineering of wisdom".

COMMON SENSE is important —
This field includes the systematic study and development of common sense.

SCIENCE is important —
This field includes what is common to all the sciences, what is generally true and important in the sciences.

MISTAKES are costly and to be AVOIDED —
This field includes the systematic study of the prevention of mistakes.

MONEY is important —
The systematic prevention of mistakes in your organization might save 10 to 20% of its expenses per year.

"RIDE THE EAST WIND: Parables of Yesterday and Today"

by Edmund C. Berkeley, Author and Anthologist

Published by Quadrangle/The New York Times Book Co., 1974, 224 pp, $6.95

The Fly, the Spider, and the Hornet

Once a Fly, a Spider, and a Hornet were trapped inside a window screen in an attic. For several hours they walked up and down, left and right, here and there, all over the screen. They could look through the screen at the summer woods, feel the summer breezes, and smell the summer smells; but they could not find any hole to pass through the screen to the woods and fields so tantalizingly close, yet so far away.

Finally they decided to hold a conference on the problem of getting through the screen. The Fly spoke first, and said, "My Colleagues, ...

The Fox of Mt. Etna and the Grapes

Once there was a Fox who lived on the lower slopes of Mt. Etna, the great volcano in Sicily. These slopes are extremely fertile; the grapes that grow there may well be the most delicious in the world; and of all the farmers there, Farmer Mario was probably the best. And this Fox longed and longed for some of Farmer Mario's grapes. But they grew very high on arbors, and all the arbors were inside a vineyard with high walls, and the Fox had a problem. Of course, the Fox of Mt. Etna had utterly no use for his famous ancestor, who leaping for grapes that he could not reach, called them sour, and went away.

The Fox decided that what he needed was Engineering Technology. So he went to a retired Engineer who lived on the slopes of Mt. Etna, because he liked the balmy climate and the view of the Mediterranean Sea and the excitement of watching his instruments that measured the degree of sleeping or waking of Mt. Etna. The Fox put his problem before the Engineer . . . .

The Fire Squirrels

Scene: Two squirrels, a young one named Quo, and an older one named Cra-Cra, are sitting by a small campfire in a field at the edge of a wood. Behind them hung on a low branch of a tree are two squirrel-size hammocks. Over each of the hammocks is a small canopy that can be lowered to keep out biting insects. It is a pleasant summer evening; the sun has just recently set, and the stars are coming out: ——

Quo: Cra-Cra, you know I don't believe the old myths any more. Tell me again how it really happened.

Cra-Cra: Just this: we received our chance because they dropped theirs. It is as simple as that.

Quo: In other words, they were the first animals to use tools, and we are the second?

Cra-Cra: Yes. There is a mode of surviving in the world . . . .

Missile Alarm from Grunelandt

Once upon a time there were two very large and strong countries called Bazunia and Vossnia. There were many great, important, and powerful leaders of Bazunia who carefully cultivated an enormous fear of Vossnia. Over and over again these important and powerful leaders of Bazunia would say to their fellow countrymen, "You can't trust the Vossnians." And in Vossnia there was a group of great, important, and powerful leaders who pointed out what dangerous military activities the Bazunians were carrying on, and how Vossnia had to be militarily strong to counteract them. The Bazunian leaders persuaded their countrymen to vote to give them enormous sums of money to construct something called the Ballistic Missile Early Warning System, and one of its stations was installed in a land called Grunelandt far to the north of Bazunia.

Now of course ballistic missiles with nuclear explosives can fly any kind of a path all around a spherical world, and they do not have to fly over northern regions. But this kind of reasoning had no influence on the leaders of Bazunia who wanted the money for building BMEWS. Nor did it have influence on their countrymen, who were always busy, trying to make money — in fact often too busy to think clearly . . . .

---

52 parables (including fables, anecdotes, allegories)
23 never published before
27 authors
18 full-page illustrations
330 quotations and maxims

7 Parts: The Condition of Man / On Flattery and Persuasion / On Perseverance and Resourcefulness / Behavior — Moral and Otherwise / The Problem of Truth / On Common Sense / Problem Solving

---

THE VALUE OF THIS BOOK TO YOU CAN BE VERY GREAT

JUDGE FOR YOURSELF AT NO COST

RETURNABLE IN 10 DAYS FOR FULL REFUND IF NOT SATISFACTORY
You can read it all in 10 days — and keep it only if you think it is worth keeping.

HOW CAN YOU LOSE?

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

To: Berkeley Enterprises, Inc.
815 Washington St., S9, Newtonville, MA 02160

( ) Please send me _____ copy(ies) of *Ride the East Wind:*
I enclose $7.00 per copy (includes handling).

Total enclosed _____ (Prepayment is necessary)

My name and address are attached.

Vol. 24, No. 9
September, 1975

computers and people formerly *Computers and Automation*

Editorial Offices
Berkeley Enterprises, Inc.
815 Washington St.
Newtonville, MA 02160
617-332-5453

"Computers and People," formerly "Computers and Automation," is published monthly, 12 issues per year, at 815 Washington St., Newtonville, MA 02160, by Berkeley Enterprises, Inc. Printed in U.S.A. Second Class Postage paid at Boston, MA, and additional mailing points.

Subscription rates: United States, $11.50 for one year, $22.00 for two years. Canada: add $1 a year; elsewhere, add $6 a year.

NOTE: The above rates do not include our publication "The Computer Directory and Buyers' Guide". If you elect to receive "The Computer Directory and Buyers' Guide," please add $12.00 per year to your subscription rate in U.S. and Canada, and $15.00 elsewhere.

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

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

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

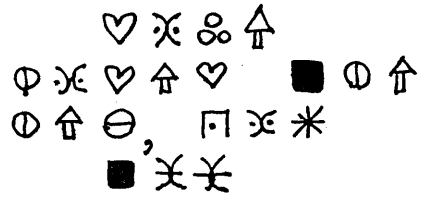
The magazine of the design, applications, and implications of information processing systems — and the pursuit of truth in input, output, and processing, for the benefit of people.

Correction: At the end of the second (right hand) column on page 23 of the June 1975 issue, please delete the "square box" and please include: *"(please turn to page 29)".*

Front Cover Picture

The front cover shows the entrance to limestone caverns which have been converted into a huge warehouse space of 1.2 million square feet, and are being enlarged every year as more limestone is mined. The warehouse contains large supplies of foods, which are received, inventoried, and dispatched by computer. For more information, see the story on page 32.

Notices and Announcements



Key

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

NOTICE

*D ON YOUR ADDRESS IMPRINT MEANS THAT YOUR SUBSCRIPTION INCLUDES THE COMPUTER DIRECTORY. *N MEANS THAT YOUR PRESENT SUBSCRIPTION DOES NOT INCLUDE THE COMPUTER DIRECTORY.

EDITORIAL

Wondering, Computing, and Going in New Directions

A curious mind is always wondering and often investigating.

Almost all human beings are born with a great deal of curiosity. But many of them have their curiosity trained out of them, as tired parents and tired teachers say to them, "Never mind why — just do it, there's a good boy (or good girl)." A portion of human beings, however, escape and when adult still have large stores of curiosity.

— Why should we have to buy oil? Why isn't the sun a much better source of energy?

An ad by ITT in the "Wall Street Journal", of August 9, 1974, said that one of their new mills would convert wood waste into useful energy, recapturing the sun's heat and light, and would save fully 90 percent of the oil that the mill would burn in a year — 56 million gallons.

— In these days of fashionable recycling of waste, why should we waste urine and feces and much water washing them down the drains?

An interesting article "Growing Fish in Sewage" by Reg Noble in "The New Scientist" for July 31, 1975, mentions that "Each of us produces about 0.5 tons of urine and feces per year, and another 50 tons of water is used to wash this down the sewers." Isn't this practice a short-sighted and stupid waste of useful chemicals?

— Why can't a computer discover new and interesting mathematical ideas?

An article in the August issue of "Computers and People" reported on a nontrivial statement in mathematics, which is true for the first 2500 consecutive cases, with exactly one exception at case 618. This article was "An Almost-True Theorem Involving Tetrahedral Numbers" by Herbert E. Salzer and Jeffrey Mogul. Wouldn't it be worthwhile to explore systematically the borderline territory in mathematics between true statements and almost true statements?

— Why not investigate again, efficient computer-assisted ways for translating from one natural language like Russian into another natural language like English?

In 1966 a committee of the National Academy of Sciences produced a report "Language and Machines: Computers in Translation and Linguistics" published by the Academy in Washington, D.C. The committee was the Automatic Language Processing Advisory Committee; the chairman was Dr. John R. Pierce, then of Bell Telephone Laboratories, now retired. They pronounced a verdict on translation by computer from one natural language to another: the report pointed out that a great deal of money had been spent, no great accomplishments had been produced in the sense of computer-produced translation that could be relied on as telling the actual meaning of what was being said in the foreign language, and that the supply of human translators had always been adequate. And so the project of language translation by computer has fallen into disrepute.

But is this verdict still to be relied on in 1975? A gain by a factor of 10 in the efficiency of automatic computer hardware and software should have happened as a result of 9 more years of research and development. Such a change might make this verdict one more statement disproved by the advance of technology.

— Why can't we make most if not all the language of thought calculable like mathematics?

See in the August issue of "Computers and People" the article by Lawrence M. Clark, "'All the Language of Thought Calculable Like Mathematics'". A computer of course would be necessary to carry this out.

Think what such a computer program if it existed might imply. For example, suppose you are having an argument with Joe Doakes. The computer program would tell each of you the precise meaning of what each of you was asserting. Or you might command such a computer program: "Translate this newspaper report of a speech out of its gobbledy-gook and express it in plain English." The computer program might respond "What is being asserted is .... and the reasons for the assertions being made, and the reasons against, are these ....".

The resourcefulness and imagination with which we in the computer field have gone in new directions using the powers of present-day computers, has on the whole been rather narrow, it seems to me. In a few directions, we have traveled with eagerness and hospitality; in most directions, we have not.

In the computer field, we need many more resourceful and imaginative approaches to new ideas.

Edmund C. Berkeley

Edmund C. Berkeley
Editor

MULTI-ACCESS FORUM

ON MAXIMDIJES

1. From: William Ray Jines
Mobil Research and Development Corp.
Field Research Laboratory
P.O. Box 900
Dallas, Texas 75221

I enclose a list of ten Maximdij problems and also a list of their solutions. These have been tried and solved by some of my fellow scientists at this lab. I have marked the ones (4, 6, and 7) which I have previously sent you. Problem 2 proved to be extremely difficult. Problem 9 is rather unusual in that two four-lettered words appear in sequence and each is the reverse image of the other. Problem 10 does have an incorrect alternate solution.

This little game has caught on here. We've all enjoyed it, and find ourselves counting letters in any expression or maxim we think of.

Thank you very much for your previous letter.

(1) 1234 56 71484 914 14089 56.

(2) 123415 62637 6895 68537 85 62043.

(3) 1233244566 76 428 62 123324 74 354 96 78 76 74 02354.

(4) 12343 543 6578 1344940 51 035.

(5) 123456 47 428 39660.

(6) 12 3456 7584 65989 458 189 3456 27508.

(7) 1234 56 7 65118 9704 08 1234.

(8) 1234 5678 784 5639.

(9) 123 3456 6543 78 123 9770.

(10) 123 4153 615 783 5190.

2. From the Editor:

I am glad that the Maximdijes we have published have provided enjoyment for you all.

Thank you for your puzzles and the solutions. (The solutions will be published in the next issue of "Computers and People".)

Having cheated and looked at your solutions, I would like to comment that a good Maximdij has a good maxim, one that is reasonably true and one that is worth remembering, so that the solver gets some value out of his work. Your No. 2 is a slogan. No. 3 is not clear to me. No. 10 though said often is I think dangerous and untrue. The remaining seven are I think all good maxims.

In the case of the Maximdijes that we publish, we try to select those that are quick and easy to guess. There is more fun I believe in this kind. It is very easy to construct difficult ones.

ON NUMBLES

1. From: Harry E. Easton
P.O. Box 12163
Richmond, Va. 23241

I just gave your July Numble (number 757) to my HP-65. It was an interesting experience. I used the brute force approach, all work and no intelligence. It took the poor thing 24 hours to arrive at the answer. Roughly the program was assume WISDOM to be 123456. Dissect the number and store the digits equivalent for W,S,D, and M. Multiply WISDOM by S. Dissect the answer and store W',S',D',D", and M'. Compare with letters from the multiplicand. If not equal, increment WISDOM 1 unit and repeat.

While it was running I worked out a faster solution. Maybe I can describe it. I had a hard time making the HP-65 understand.

1. Assume A is 9 and M is 1. The units digit of A times M is M. When equal, go to the second equation. If not equal, decrease A 1 unit and store. Repeat until A is 1; increase M 1 unit, store, and make A 9; repeat until match is reached.

2. Assume I is 9. .....

3. The units digit of I times M is S. .....

This gave me M,A,I,L, and S. About 2 and 1/2 minutes. Assuming W is 1 and substituting for the other letters, I went back to the brute force formula and incremented by 10 units. 5 more minutes.

And this gave me

WISDOM SAILS WITHOUT WIND AND TIDE

Thanks for an interesting problem.

Now if I can only make the HP-65 do a Maximdij!

2. From the Editor:

Your report from the front line trenches of making a hostile computer solve a Numble is fascinating. — Anybody else with a report?

□

Computer Technology and Surveillance

Paul Armer
Center for Advanced Study in the Behavioral Sciences
Stanford, Calif.

"Suppose you were an advisor to the head of the KGB, the Soviet Secret Police. Suppose you are given the assignment of designing a system for the surveillance of all citizens and visitors within the boundaries of the USSR. The system is not to be too obtrusive or obvious. What would be your decision?"

The state-of-the-art of computer technology — or, putting it somewhat more broadly, about information processing technology — is, I think, a most important sub-set of surveillance technology. I do not pretend to know very much about the technology of bugging and wiretapping; so I will not discuss it explicitly. However, I will be talking about the technology of microelectronics — bugging and wiretapping depend on that same technology.

Measuring Rapid Change

People concerned with rapid change often find it useful to have a yardstick for measuring the amount of change. The concept of "an order of magnitude" is just such a yardstick. As you know, an order of magnitude is a "factor of ten". We can travel by foot at about 5 miles per hour, by automobile at something like 50 miles per hour, and by jet aircraft at about 500 miles per hour. Here we have 5, 50, and 500; each of these modes of transportation differs in speed from the previous one by a "factor of ten" or an "order of magnitude". /1/ Thus, the last century has seen a change of two orders of magnitude in transportation speed. The capability of getting around at 50 miles per hour has profoundly affected our way of life. For example, it made the flight to the suburbs possible, and even influenced our culture. As we hear so often, jet travel has shrunk our world tremendously. With the context of two orders of magnitude change in a century before us, let's look at what has been happening with the electronic computer.

The Electronic Part of Computers: Speed, Size, Cost

The speed of the electronic portion of computers has been increasing by an order of magnitude about every four or five years. During the last decade, the size of the electronics has decreased even faster than that — computers are becoming incredibly small. Most importantly, the cost of raw computer power has declined by an order of magnitude every five to six years, and this trend looks like it will continue for at least another decade.

Computers are now being manufactured such that the entire processor fits on a single chip about an eighth of an inch on a side. To make the processor more useful you have to add another chip or two, or three, for memory and for communicating with the outside world. Systems of this kind can be purchased today for less than $100.

In my classes I often hold up such a device and point out to the students that 25 years ago that amount of computing power would have cost more than $1 million and would have occupied several large rooms.

Pyramid Technology and Some Other Analogies

Permit me to make another analogy to emphasize this point. It is estimated that the pyramid of Khufu at Giza in Egypt, built in 3000 B.C., required the labor of 100,000 men for 20 years. If the technology of pyramid building had experienced the same increases in speed and decreases in cost as microelectronics technology has over the last 25 years, a similar monument could be built by 20 men in a single year at a cost insignificant enough to make it reasonable as an outlet for many egos. One needs little imagination to picture how Washington, D.C. would look if this were indeed the case. /2/

We have all seen the impact on our society of an increase in the cost of energy by a factor of two or three. What kind of an impact could you expect from an increase, or reduction, of two or three orders of magnitude — that is, a factor of 100, or 1000? I point out that our society runs on information as well as on energy.

Suppose I were able to predict that the cost of an automobile, or of housing, would decrease by a factor of 100 over the next decade? It is quite reasonable to predict that the cost of raw computer power will indeed decrease by a factor of 100 or more in that period of time.

There will be several microprocessors in every car; trucks will probably have one at each end of every axle; there will be one in most appliances, and there will be one pasted on the back of every typewriter. I am sure there are countless uses that we don't even dream of today.

Based on testimony given June 23, 1975, at hearings held jointly by the Subcommittee on Constitutional Rights of the U.S. Senate Judiciary Committee and the Subcommittee on Science and Technology of the Senate Committee on Commerce.

"First, I would like to say a bit about myself so that you can put my comments into context. I think of myself as a 'computer-nik'. I have been in the computer field since 1947, which was about the time that we began to realize the enormous potentialities of computers for processing information. From 1947 until 1968 I worked at the Rand Corporation, spending ten of those years as head of their computer science department. I am currently a Fellow at the Center for Advanced Study in the Behavioral Sciences, where I coordinate a Program on Science, Technology and Society sponsored by the National Science Foundation.

"In 1962 I began to devote time to studying the social implications of information processing technology, and since 1971 that has been my major area of concern. Consequently, I am pleased to be here because the impact of information processing technology on privacy and on freedom has been a concern of mine for more than a decade. I feel that the possible uses of computers for surveillance may not yet be fully recognized."

Other Computer Costs

Lest I leave you with the impression that information processing is about to become a free good, I must emphasize that I am talking only about the electronic portions of computers — there are many other activities associated with making use of a computer. There are mechanical devices for getting information into and out of computers; there are sensors which measure information such as a person's blood pressure or the acceleration of a truck and then feed the information into the computer. Another significant cost is the cost of programming the computer.

Now, the costs of all these other factors are not changing very rapidly, so the total systems' cost is not going to zero; but the cost of the electronics, for all practical purposes, is going to zero.

Information Processing and Surveillance

Now, what does information processing technology have to do with surveillance? A great deal. However, to my knowledge very little information processing technology has been researched and developed as surveillance technology per se; rather, it has been developed with other motives in mind, like improving business data processing or guiding missiles or getting men to the moon. But surveillance is an information processing task just as much as a payroll application is. If you improve the efficiency of information processing technology for payrolls, you improve it for surveillance. Often systems that are put up for other reasons (as we shall see shortly) can also serve surveillance.

Networks

Before going to that, I want to talk about several areas of information processing technology which are of particular importance to surveillance. We have heard quite a bit about networks from Mr. Cooke this morning, due to the publicity given to them of late as though they represented a great new technological breakthrough.

The first networks consisted of many terminals connected to a single computer. Though there may have been earlier examples, I believe that American Airlines' first seat reservation system went into operation about 1952. It soon became clear that one could just as easily communicate from one computer to another as from a terminal to a computer.

Interface Message Processors

Now, the most sophisticated computer network that I am aware of is the ARPANET, which was described this morning. It was put up by ARPA — beginning in 1968. The ideas behind the network had been known for at least five years — ARPA put them together in a system for the first time. As Mr. Cooke told you, the network consists of a number of computers (called "hosts"), communication lines, terminals, and devices called IMPs (for Interface Message Processor). Since there are a number of dissimilar host computers in the network and an even greater variety of terminals, the IMPs must be capable of handling dissimilar host computers and terminals.

It has been said during the last month that "setting up a computer network involving virtually any computer, government or private, is almost as easy as making a telephone call". /3/ This statement is dead wrong. First of all, to get into a computer from a network, either the computer must be physically connected to the network, or the network must be able to establish a dial-up connection with the computer.

Connections of Computers to Communications

Most of the computers in operation today are not connected to any communication system. Of the few that are, most are connected to intra-company networks, using lines leased from a common carrier; and/or they may have telephone numbers which can be dialed by a terminal or by another computer. Even if two computers are connected to the same network, unless host-to-host protocols have been agreed to (and adhered to), no IMP will be able to transfer information from one computer to another.

Now, this is not to say that five government agencies couldn't agree on such protocols, and agree to interconnect their computers, and then pass information back and forth. Mr. Cooke described just such a system when he described the COINS network earlier. But the notion that one computer could surrepetitiously go around stealing information from any unsuspecting computer, government or private, is hogwash.

Penetration of Computer Systems

Five or ten years from now most computers will probably be attached to a network, or be reachable via a telephone number. And most will probably adhere to a standard protocol. But by then we should have been wise enough to develop safeguards that will make unwanted penetration from the outside difficult and expensive. Note that I didn't say "impossible".

Even if two computers are connected to the same network and adhere to a common protocol for exchanging messages, the problem of, say, collating together two files on individuals can still be quite difficult. Is Bill Jones the same as William E. Jones? If both records have the same address, it's probably a safe assumption, but if the addresses are different, you don't really know, for the two records may have been obtained at quite different times.

The Universal Identifier

For this reason those who face the task of putting such files together would like to have a universal identifier; they usually suggest that we use the Social Security number for this universal identifier.

Those who fear the results of the collation of several files into complete dossiers naturally oppose the use of any form of universal identifier. I mention this because I believe it is important that we understand the implications for privacy and surveillance before adopting a universal identifier or permitting the Social Security number to become a universal identifier.

I don't mean to imply that computers today are not penetrated by individuals with malevolent intent. One of the more publicized instances of computer crime involved penetration of a telephone company computer used for supplying equipment and spare parts needed by company employees. The penetrator would dial in, order large amounts of equipment, and have it delivered to a location from which he could subsequently remove it. Over time, he obtained equipment worth several hundred thousands of dollars.

A Favorite Pastime of Bright Students

On university campuses a favorite pastime of bright students is to attempt to penetrate the computer. And they succeed all the time.

For the above reasons I believe that those in charge of military security still (with only a few exceptions) will not permit the storage of classified material in a computer which can be accessed from the outside. Thus, if one has personal data files with sensitive information therein, they should be treated like classified material.

Let me say a bit more about security in computer systems. Security was recognized as a problem only recently. As a result there are practically no computers in use today that were designed and built with the security problem in mind. Security precautions that have been incorporated into computer systems are invariably only in the software, or in control of physical access to the computer and terminals. Software is indeed soft. Good security requires that both the hardware and the software be designed with security in mind.

It is interesting that the sole exception to the above, that I am aware of, other than cryptographic devices, resulted from ARPA-supported research in the MULTICS project at MIT. ARPA has been a major source of support for research on computer security.

As you will soon see, I am greatly concerned with the application of information processing technology to surveillance. That being so, why have I defended networks? The answer is simple — I think they have been getting a bad reputation.

Interconnection of Government Computers

I understand there is some sentiment for legislation forbidding the inter-connection of any government computers. I personally think that's throwing the baby out with the bathwater. If there is concern about the FBI computer being programmed to penetrate the Social Security computers, and the Census Bureau computers, then treat the files of Social Security and the Census like classified information. That is, don't let them be accessible from the outside until the technology exists to satisfy those concerns necessary to safeguarding classified information. But don't generalize to all government computers.

Note that the FBI computer is already on a network. While I suspect that as much security was built into that system as could be reasonably purchased at the time, the chief source of leaks from those files is that tens of thousands of law enforcement personnel have a legitimate reason for access to the files. While the wholesale transfer of information may be difficult, individual files can be copied rather easily.

Recognition of Spoken Words

Let me briefly mention another area of research in information processing which, though being carried out for quite other reasons, is also related to surveillance. I refer to speech understanding, sometimes referred to as voice recognition. By this I don't mean the identification of the speaker as in voice prints, but rather the recognition by a computer of what words have been spoken, so they can be entered and stored in the computer just as though the words had been typed on a terminal connected to the computer.

One reason for wanting this capability is so that we can input information into a computer orally. The goals of research in this area today are not terribly ambitious, yet even so, they are elusive. The hope is to get the computer to be able to understand a few dozen words, spoken by a small number of cooperative people whose voice characteristics the computer knows in advance.

Listening to Tapes Resulting from Surveillance

This technology is related to surveillance because a bug, or a tap, results in miles of tape recordings, most of which is of no interest to the goals of the surveillance. Transcribing all that tape is expensive — just listening to it is expensive.

I do not mean by the above to suggest I believe that research in speech understanding should be stopped because it might be used in surveillance, though I am aware of computer scientists who have refused to work on such projects for exactly that reason. But, as speech understanding capability increases, we must recognize that surveillance capability does, too.

Before leaving this topic I should also observe that the surveillance situation is usually more difficult than recognizing a few words for computer input, because here the speakers are not trying to cooperate and their voice characteristics may not be known in advance.

Electronic Funds Transfer Systems

Let me now turn to a new topic. Several times I have referred to situations where the technology under discussion was developed for reasons other than surveillance, but it happens that it is useful for surveillance purposes. As a prime example of this I want to talk about electronic funds transfer systems. I can't give you a detailed definition of an electronic funds transfer system (usually referred to as EFTS) because the system hasn't been built. Its final form will be an outcome of intensive competition, and also of government regulation. But the general form is reasonably clear. Terminals will exist in stores, hotels, restaurants, etc. (where they are referred to as point-of-sale terminals), and in financial institutions, including unattended terminals miles from the nearest office of the institution. In short, terminals will be at any location apt to have a large number of non-trivial financial transactions.

Let's look at one way it might work. Say you are about to buy a book. You present your card (some-

times called a "debit card", although National Bank-Americard calls theirs an "asset card") to a clerk who puts it into a terminal which reads it and then calls up your bank. If you have enough money in your account, or if your bank is willing to grant you that much credit, the transaction is okayed; your account is debited; and a credit is dispatched from your bank to the book store's bank account.

Three Factors that Yield Surveillance Gold

The dimensions of the final form of EFTS which are of importance to its potential surveillance capability are such things as the percentage of the transactions recorded; the degree of centralization of the data; and the speed of information flow in the system.

Suppose for a minute all transactions over $10 must go through the system and that they are immediately debited to your account in your bank's computer. Thus the system not only collects and files a great deal of data about your financial transactions — and that means a great deal of data about your life — but the system knows where you are every time you make such a transaction.

Suppose that the rule for all transactions over $10 is not compulsory, but voluntary. And further suppose that you have gotten into the habit of using the system because: one, it is convenient; and two, it may be cheaper than other payment mechanisms. Now comes an instance in which you want privacy and decide to use cash. If you have to obtain the cash from the EFT system, that cash transaction will stand out like a sore thumb. The point here is that it's not enough just to have the option of using cash, the cash option must be used frequently or it becomes useless as a means for privacy.

To give you an idea of how powerful a surveillance system an EFTS would be, consider the following. In 1971 a group of experts in computers, communication, and surveillance was assembled and given the following task: Suppose you are advisors to the head of the KGB, the Soviet Secret Police. Further, suppose that you are given the assignment of designing a system for the surveillance of all citizens and visitors within the boundaries of the USSR. Further, the system is not to be too obtrusive or obvious. Not only would it handle all the financial accounting and provide the statistics crucial to a centrally planned economy; it was the best surveillance system we could imagine within the constraint that it not be obtrusive.

That exercise was almost four years ago, and it was only a two-day effort. I am sure we could add some bells and whistles to increase its effectiveness somewhat. But the fact remains that this group decided that if you wanted to build an unobtrusive system for surveillance, you couldn't do much better than an EFTS. /4/

Prevention of Abuse of EFTS

Naturally, the EFTS proponents believe that laws could be written to prevent abuse of the system. I am less sanguine. I'm not concerned about the bankers invading my privacy or using the system for surveillance purposes; but I am afraid that EFTS system operators may be unable to resist pressures from government to let the EFTS be used for surveillance.

There are in existence today computer systems which could be used in exactly this way, although the number of financial transactions involved is comparatively small. What I have in mind here are the credit authorization systems of National Bank-Americard, Master Charge, American Express, and various check authorization systems. All can have individual accounts flagged. If an individual tries to make a purchase, or tries to cash a check, the system is interrogated. If the account has a special flag the police (or whoever) can be notified where that individual is at that very instant. Check authorization systems are especially subject to such abuse because they depend on the police for information about bad check passers and for information on forgers for their computer data bases. I have no doubt that such systems have already been so abused.

Why Be Concerned?

Why should we be so concerned about surveillance? I don't think I can put it any better than Henry Goldberg did in a recent speech:

> ... 1984 is really a state of mind. If you are always tied to the consequences of your past activity, you will probably adopt a 'don't stick your neck out' attitude. This would create a pressure towards conformity, which would, in turn, lead to a society in which creativity would be an early victim and the democratic ideal of a citizenry with control over its own destiny would not flourish for long. /5/

In a recent speech Professor Philip B. Kurland pointed out that we will not celebrate the 200th anniversary of the U.S. Constitution until 1987, and that before we can do so, we must successfully get past 1984. He further said that if he were in charge of some Bicentennial celebration, he would require all participants to read Orwell's "1984" to show what the new nation was created to avoid. /6/ I would extend the advice to those concerned about electronic funds transfer systems. And to "1984" I would add the recently published "The War Against the Jews — 1933 to 1945" /7/, and Tom Houston's memo on domestic intelligence, which was issued to all American intelligence agencies in President Nixon's name on July 23, 1970. The book "1984" shows what might happen; the latter two documents detail actual events.

References

1. Adapted from R. W. Hamming, "Intellectual Implications of the Computer Revolution", Amer. Math Monthly, Vol. 70, No. 1, Jan. 1963.
2. Adapted from W. H. Davidow, unpublished paper presented at a conference of the Computer Society of the Institute of Electrical and Electronics Engineers, Inc., Washington, D.C., Sept. 10, 1974.
3. W. Raspberry, Washington Post, June 18, 1975, quoting Ford Rowan of NBC News.
4. The Center for Strategic and International Studies, Georgetown University, Oct. 29-31, 1971.
5. H. Goldberg, "Impact of the Less Cash, Less Check Society", presented at a meeting of the Computer and Business Equipment Manufacturers Association, May 28, 1975.
6. P. H. Kurland, "The Unlearned Lesson of Watergate", Wall St. Journal, 6/17/75.
7. L. S. Dawidowicz, The War Against the Jews — 1933-1945, Holt, Rinehart, and Winston, New York, 1975.

□

Anti-Monopoly and Pro-Competition: The Antitrust Enforcement Act of 1975

A. G. W. Biddle, President
Computer Industry Association
1911 No. Fort Meyer Dr., Suite 801
Rosslyn, Va. 22209

"The forces within our society are pulling it apart — each striving to get more than the next. Isn't it time to adopt meaningful ways to get our economy and our system back on the right track?"

The Computer Industry Association appreciates this opportunity to endorse S-1136, The Antitrust Enforcement Authorization Act of 1975. In doing so, we are but one of a growing list of business organizations that are coming to realize the importance of adequate enforcement of our antitrust laws.

Nature of the Computer Industry Association

The Computer Industry Association represents some 35 member companies with combined revenues in excess of $1.5 billion dollars annually. Member firms employ more than 40,000 persons in facilities throughout the United States. They range in size from under a million dollars in annual revenues to something in excess of $300 million. Their products cover the full spectrum of goods and services associates with computers and data processing — mainframes, memories, tape drives, disc drives, printers, data entry devices, terminals, software, and services such as leasing, systems consulting and service bureau operations.

The Association was formed three years ago this month. Its objective then and now is to endeavor to bring about free and open competition within the computer and data processing industries — industries that have, since their inception, been dominated and controlled by a single company.

Effect of Dominant Monopoly

The Chief Executives and employees of our member firms know what it is like to be subjected to the unilateral use of market power by a dominant monopoly firm. The economists speak of the anticompetitive effects of tying practices, cross subsidization, exclusionary tactics, and other restraints of trade . . . . our members know about them first hand. They have been required to adapt to a market environment that is ever changing. In part the changes stem from the fast paced technology that is so much a part of our industry; but of far greater importance, the environment is changed and modified by the dominant company in our industry whenever it sees its position threatened.

Observers of Antitrust Enforcement

We have, of necessity, become close observers of the antitrust enforcement process in America. In 1956, the U.S. Government entered into a Consent Decree with IBM after the filing of an antitrust complaint in 1952. The injunctive relief that the Government obtained failed to reach the true kernel of monopoly power. Thirteen years later, the Antitrust Division again brought suit. This time the relief sought is structural in nature. Unfortunately it will be at least four more years before we will know whether the courts can effectively reach a judgement that effectively deals with a structural monopoly problem of this complexity and magnitude under current procedures and laws.

As our members see it, the free market system in America today is not working as effectively as it should. They view the Antitrust Enforcement Act of 1975 (S-1136) and the Antitrust Improvements Act of 1975 (S-1284) as but two of a number of constructive steps that are needed in our nation's efforts to promote competition and to return to a balanced economic structure where industry can provide the consumer with goods and services at the lowest prices with a fair and equitable return to management, labor and capital. We believe that American industry is cppable of providing a continuing stream of new products, goods, and services, through innovation and the exploitation of American technological skill.

Growing Number of Giant Institutions

As citizens, we are alarmed to see the growing number of giant institutions — manufacturing concerns, labor unions, financial institutions, as well as state and federal bureaucracies — that have become unresponsive to public needs. Rather than being the servants of the people, the concentration of economic, market, and political power has allowed many of these entities to become selfserving and autocratic.

This article is based on a statement by the Computer Industry Association before the Committee on Antitrust and Monopoly of the Committee on the Judiciary of the United States Senate and the Subcommittee for Consumers of the Senate Commerce Committee; in regard to S-1136 (The Antitrust Enforcement Act of 1975); presented by A.G.W. Biddle, June 10, 1975.

Dealing with Monopoly Power

Until just recently, the antitrust enforcement process failed to deal with the most serious problem that our antitrust laws were designed to prevent — monopoly power. It would appear that Federal law enforcement has been picking away at the indicia of monopoly power, while leaving the power itself intact. Since monopoly power — shared or otherwise — is the basic concern of the Sherman Act, it should be the primary objective of the bulk of our antitrust enforcement efforts.

"Baneful Effects"

Chief Justice White, in the 1911 Standard Oil decision stated that the Sherman Act was designed to protect the public from single company monopolies, and from acts and structures which "although they did not consitute a monopoly were thought to produce some of its baneful effects". Those "baneful" effects — high prices, poor quality of goods and services, retarded innovation, insurmountable barriers to entry, lack of responsiveness to consumer needs, excessive corporate political power, etc., are all well known to this sub-committee.

The emphasis on punishing anti-competitive corporate conduct, rather than remedying monopolistic structure and its performance, appears to be deep seated in the institutions which enforce our antitrust laws. This may be due, in part, to historical accident because both Sections 1 and 2 of the Sherman Act are criminal statutes. Thus, the law can be seen as punishing not only predatory conduct like price fixing and market allocations but the structurally oriented offense of monopolization as well.

Is Domination by a Single Company "Good"?

IBM, in its public relations and defense strategies, harps on the theme that they "are being punished for being good", thus diverting attention from the more basic and fundamental question — is it in our national interest to have an industry as vital as this one totally dominated by a single company?

I sincerely hope that our courts and our antitrust laws can effectively deal with this extremely important question. How it is decided will largely determine the kind of country this will be in the years ahead, for US v. IBM represents a fork in the road. If IBM's unilateral power over the computer and data processing industry remains unchecked the barriers to new entry will be impossible to overcome. Many of the companies that exist today will wither and die for lack of capital. To protect the public interest, those that remain will probably be placed under some form of federal regulation — and our nation moves one step further away from our underlying beliefs in pluralism and free enterprise.

Money for Defense by One Company Exceeds the U.S. Budget for Antitrust Activity

We need — we must have — more effective enforcement of our antitrust laws. But how can we expect to attain this goal if a single corporate defendant can spend more in its defense than is available to the entire Antitrust Division of the Department of Justice? Are our priorities as a nation so out of balance that we can only afford a per capita expenditure of six cents per year to keep alive the free enterprise system that built America to industrial greatness? I sincerely hope that the answer is no.

This legislation calls for a modest increase in the appropriations authorized the Antitrust Division and the Bureau of Competition of the Federal Trade Commission. Over a three year period their respective budgets would increase from a current level of $17 million and $12.5 million to $45 million each. In total, this represents an expenditure of forty cents for every man, woman and child in America. Last week, the Senate authorized $138 dollars per person to protect our citizens from foreign aggressors. Is forty cents too much to spend to protect these same citizens from those who would destroy our freedom of choice rather than face the rigors of free and equal competition? Again, I hope that the answer is no.

Threat by Regulatory Abuse and Monopoly Power

For the first time in many years, the Congress and the Administration are in accord that our free enterprise system is threatened by regulatory abuse and unrestrained monopoly power in the private sector. With this in mind, we would urge that immediate steps be taken to provide for the actual appropriation of the proposed funds, rather than merely to authorize them subject to later cuts.

Secondly, we would suggest that some consideration should be given to extending the life of this authorization. This might be done by providing that, absent further action by the Congress, authorizations for antitrust enforcement beyond FY 1978 would be automatically adjusted upward or downward in direct proportion to changes in the Gross National Product in constant dollars. This would insure continuity of the enforcement program over time and reduce the likelihood that it would be subject to political pressure.

There are some who question whether the amounts suggested by the sponsors of this bill are excessive — whether the divisions can spend this much effectively. From our point of view, we believe that they can. However, we do not wish to see a mere escalation of the battle between the Antitrust Division and the Defendant's massed legal power. Rather, we would like to see a substantive improvement in the quality of cases brought and a realistic reappraisal of the total antitrust enforcement process. In this regard, we believe that the Congress should put the burden of proof on the Antitrust Division and the Bureau of Competition. If the monies appropriated are not used, or are carried forward, the Congress should know why.

Industry Experts

1. Consideration should be given to establishing a new section within the Antitrust Division that would consist of "industry experts" drawn from the private sector. Today, the main thrust of the Division's enforcement effort draws upon the talents of its attorneys and its economists. In the IBM case it has become all too apparent that the Division lacks expertise about the specific industry, the technology, and the impact of various practices upon it. In order to bring a successful suit, and perhaps of even greater importance, to implement a successful relief program, this kind of knowledge is essential. This need is not unique to the IBM case. Similar capabilities will be needed for the AT&T case and other cases that the division may bring with respect to technology based companies.

We would think that this section would include personnel drawn from marketing and sales, engineering, manufacturing, product planning and accounting. Their participation would provide

additional perspective to the Antitrust Division in its efforts to identify and properly deal with both monopoly and oligopoly situations in our economy.

As a starting point, we would think that this section whould have expertise in the seven industries cited in the Industrial Organization Act.

2. We believe that there would be merit in establishing a similar unit within the Bureau of Competition. However, we would envision that the FTC's section would, in addition, also have personnel drawn from the financial community. Its function would be to assist in the Bureau of Competition's enforcement efforts and be available on call to assist Federal District Court Judges during the relief phase of private Sherman-Clayton actions. Judge Neville, as well as other jurists, has told this Committee of the difficulty that the courts have in coming to grips with the relief question. Similarly, we have observed a growing concern that the relief granted in private antitrust actions is, in some cases, counter to the total public interest.

The assignment of qualified technical and economic experts to the Court would provide the assistance that they so sorely need, while also ensuring greater consistency between the relief granted in private cases and our overall national antitrust enforcement program.

Why Two Enforcement Bodies?

3. The lay observer finds it difficult to understand why we have two antitrust enforcement arms: the Antitrust Division of the Department of Justice, and the Bureau of Competition at the Federal Trade Commission. It is even more difficult to understand the rationale underlying why one case may be brought by the FTC while another, almost identical case, is brought by the Antitrust Division.

It seems to us that the Congress should examine this duplication of effort and either combine the two entities into one, or amend their respective charters so as to achieve a higher level of complementary effort. Perhaps the Antitrust Division should be charged with structural monopoly problems, and the FTC with conduct problems. Perhaps they should be merged into a new type of entity that is answerable solely to the Congress, and which is more effective than either today. We don't know. We do believe, however, that the problem should be examined — and soon.

Modernization

4. The resources of both the Antitrust Division and the Bureau of Competition must be expanded and modernized. The computer has become an essential tool in the preparation and conduct of cases by the private bar. Certainly those charged with enforcing the law need similar capabilities.

A Posture of Pro-Competition

5. It would also seem appropriate to earmark a portion of these new funds for a management audit of both entities. With all due respect to the members of the legal profession, both the Antitrust Division and the Bureau of Competition are in business — the business of reducing unjustified waste in our economy and stimulating the day-to-day operation of the free enterprise system. As such, they need clearly defined goals and objectives, well-conceived plans of action, and the controls required to assure maximum performance, just like any other business enterprise.

Wrong Motivation

6. Lastly, the Congress might take this opportunity to ask both the Antitrust Division and the Bureau of Competition to examine in depth how we might, over time, shift from an "anti-monopoly" posture to a "pro-competition" posture. A searching examination of our tax, labor and banking laws, regulatory policies and procedures, and numerous' other aspects of our overall economic system would undoubtedly show that we are motivating the business manager to do the very things that we then indict him for under our antitrust laws. Is it any wonder that the whole process has become an adversary one?

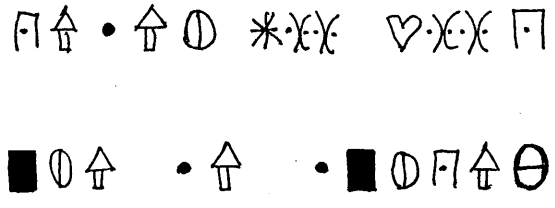
New Legislation Is Long Overdue

In conclusion, we sincerely hope that this joint sub-Committee will report out S-1136. This legislation is long overdue.

Similarly, we hope that the Congress will enact, and that the President will sign into law, S-1284, the Antitrust Improvements Act of 1975. Our basic antitrust laws have been on the books for more than 85 years — yet daily we see an increase in the concentration of economic, market and political power. One has but to review the record of the hearings on Industrial Concentration held before the Antitrust and Monopoly Sub-Committee of the Senate to realize that the problem is extremely serious. We are following too closely in the footsteps of England, not to see where we are headed.

The enormity of the problem is clear and the need for prompt and successful remedial action is clear. It is equally clear that Congress must act if there is to be any action at all. Steps must be taken to clarify and revise the laws and procedures that make our competitive free enterprise system function. We can no longer afford the luxury of changing Administration views or the narrow interpretation of the Sherman-Clayton Acts by our Courts if we are truly dedicated to competition within the private economic sector.

Our nation has not had a positive, clearly defined goal for a long time. The forces within our society are pulling it apart — each striving to get more than the next. Isn't it time to adopt meaningful ways to get our economy and our system back on the right track? Isn't it time that more businessmen came forward to suggest them, rather than opposing any who say that the time has come to re-examine the workings of the free enterprise, competitive, capitalist system in America? Is it not time that we had a new goal — a new vision? One where government, the private sector, and the people strive together to return to pluralism, fair dealing, honesty, and true competition on the merits. These are the ingredients that gave America greatness. □



Federal Government Data Processing: Considerations of Policy

Dr. George E. Mueller
Chairman and President
System Development Corp.
2500 Colorado Ave.
Santa Monica, Calif.

formerly
Associate Administrator for Manned Space Flight
National Aeronautics and Space Administration

"During the next ten years it is estimated that the Federal government will spend $25 billion on data processing."

During this conference, both the government's views as a major buyer and private industry's views as vendors will be discussed. My years at NASA as a buyer and more recently at SDC as a seller, have raised fundamental questions in my mind regarding our procurement system — and suggest some possible solutions. Let me first discuss several problems relating to the government/industry interface and then conclude with a suggestion for greater industry participation in the generation of the Federal Government's ADP-related policies and procedures.

Federal Support

During the past three decades, the Federal Government has been a primary support to development in the computer industry. Rapid technological improvements in hardware and software as well as increased industrial diversity and competition have resulted from the Federal role as major customer and funder of research. We all recall that within NASA, Houston contributed to the development of IBM's OS system, that Huntsville contributed to the EXEC 8, and that Kennedy helped develop the operating system for the GE 635 — now known as GCOS. The effect which the Federal Government will have on the computer industry over the next decade, and whether it can continue to have a major positive influence on industrial growth are two of the important questions to be explored at this conference.

Federal Influence

Federal influence — for good or bad — can result from its status as a key customer, by legal constraints imposed on the industry or on users, and through the support for research and development that will generate marketable products.

Today, the Federal Government represents 12% of the U.S. ADP market. It is a very large but no longer critical customer in most segments of the computer industry. Also, since research and development under government contract is no longer the major source of funds in most areas of ADP technology, the Federal influence on basic ADP products and services is more likely to be shaped by legal constraints on users and suppliers than through positive contributions to progress. Recent privacy rules are an example of such an influence.

There are problem areas in procurement policy and procedures as well as aspects of the privacy area that require solutions. I suggest that one solution may lie in Data Processing professionals becoming more heavily involved in government policy development.

Federal Buying vs. Federal In-House Supplying

One problem area, Federal Government competition with the private sector, raises a very basic question: When should the government turn to industry to perform a job rather than performing it itself? OMB Circular A-76, which has been the policy guidance in this area, needs both further clarification and greater enforcement.

It states, "The guidelines in this circular are in furtherance of the Government's general policy of relying on the private enterprise system to supply its needs."

GSA's FMC-5 which establishes ADP procurement policies for equipment and services, states, "It is the general policy of government to rely on the private sector for its goods and services except when such action is not in the national interest."

OMB statistics show that only 17% of Federal ADP costs are for outside services and 31% for supplies and equipment, leaving 52% for in-house activities.

Capabilities of the Computer Industry

Circumstances have changed significantly during the last decade as the data processing industry's resources have expanded. Whole new service areas have grown in capabilities and size. Many of the regulations, laws and policies governing Federal ADP procurement were written many years ago in a period when this very volatile and expanding industry comprised a totally different mix of products and services. Today, a vast array of services outside of hardware are available within the commercial marketplace. I believe that both Federal and state governments should look at ways to use these capabilities to their fullest to improve government services.

For example, different Federal agencies with similar requirements and capabilities vary widely

---

Based on an address at the conference "Federal Government Data Systems, 1975-1985" sponsored by the American Institute of Industrial Engineers, in Washington, D.C., June 25, 1975.

in their use of both facility managers for their computing centers, or software services contractors for their major development projects. In addition, the National Council of Technical Services Industries 1974 report on "Reliance on the Private Sector by the Federal Government for Data Processing Services", discussed instances where a governmental agency in direct competition with the private sector, acquired additional capacity in order to serve non-mission requirements for other agencies.

Procurement of Turn-Key Systems

To increase usage of outside services I believe most procurements should be changed from component purchases to turn-key systems procurements based on requirements specifications. This is already a common practice in NASA.

We should set a reasonable and attainable goal of having 40% of governmental data processing activities performed by the private sector by 1980, through outside services.

Privacy Requirements

Privacy requirements represent another difficult problem area. My own philosophy is somewhat different from that generally proclaimed by critics of data processing who emphasize the potential negative impact of computer-based systems on privacy. I maintain, that properly managed and designed, a large integrated computer-based data system approach, when compared with past manual systems, can and will protect the privacy of the individual while improving system efficiency. My optimism regarding the privacy aspects of large integrated systems is based on the simple fact that current decentralized, manual systems have not met privacy requirements. The costs of providing adequate safeguards for manual systems and monitoring their continuous application is too high to be practical.

Large, centralized, automated systems, in addition, provide benefits in the form of cost reductions and security levels that can be varied to meet user needs.

In a centralized, automated system environment it is relatively easy and practical to have separate privacy organizations to set security guidelines, provide required procedures and continuously monitor large installations. The requirements for notice, accuracy, relevance, access and purpose limitation can all be better controlled and screened in a properly designed large facility, with full-time security, privacy and audit staffs, than in small installations of manual or computer-based systems. Meeting these requirements on a routine level requires only an expansion of currently available data management and control systems using available software technology.

Security Requirements

In the security area there are admittedly major unresolved technological problems. The prevention of accidental or intentional unauthorized disclosure, modification, or destruction of data requires very different procedures to protect systems from penetration by the sophisticated outsider than from the dishonest insider.

SDC's past work in security for the defense community, has always assumed that we were protecting against a skilled, technologically sophisticated penetrator with access to his own carbon copy of the system in question. Emphasis was placed on operating system controls, certifiably secure systems, and the like. In these areas we are still several years from satisfactory solutions. Protection against the sophisticated outsider for multi-access, communications-oriented computing is still a problem.

Security Against the Dishonest but Authorized User

In the private and civil government sectors where the privacy regulations apply, a different set of assumptions is required. Experience has shown that in these areas the greatest threat is the dishonest, but authorized, user of the system. Today, the security levels possible through the use of newer data management systems and high quality password management are equal to those attainable in only a few of the highest quality manual systems.

This does not mean that skilled penetrators are not a threat. Rather, it means that skilled penetrators are not a highly probable threat. Justice Department statistics indicate that there were approximately 340 data processing related security violations in 1974 in the private sector. Of these, only two were committed by programmers, both of whom were authorized to use the system. All of the violators misused that to which they were already authorized.

Incidentally, the average economic impact of each violation was over a half million dollars. More importantly, there was no reported major economic or operational impact in 1974 in the private sector resulting from a technically sophisticated attack on a computer system.

Social Costs of Disclosure

Certainly, there is a difference between the computer security problems of the private sector — in which impact is measured in dollars and those of the non-defense related government sector where the costs of disclosure are more often social. The solutions to both of these classes of problems are similar, however, in that both are targeted at the same class of penetrator — the insider. Against such insiders, current disclosure accounting and journalization methods can satisfy the requirements of the privacy legislation, as well as provide a level of security adequate for most civilian agencies.

Finally, there is the issue of Federal Government procurement procedures and their impact on both the buying agency and the selling company. Three levels of data processing product or service procurements can be recognized: the standard item procurement; the custom item procurement; and the turn-key procurement. There are several key evolving problem areas.

Making Improved Items Quickly Available

GSA's present practice is to enter standard items into the GSA schedules and to utilize non-schedule GSA ADP procurement procedures for custom and turn-key items. Because of the effort and time required to utilize the general procurement procedures, GSA, user agencies and vendors have been expanding the products and services having GSA schedules and generating a rapidly increasing list of mandatory procurement contracts. For many established and standardized products, GSA schedules and mandatory contracts are clearly justified; what

needs to be implemented is a mechanism for truly competitive periodic reevaluations so that improved items are quickly available to the user.

"Tailorable" Items

In the area of custom item procurement many of the proposed mandatory procurement contracts are for equipment and services having discrete and unique capabilities. Aside from shortening the procurement process and improving standardization there are few apparent benefits from mandatory contracts for these types of items. And there is a possible negative impact when agencies over-purchase technical capabilities or do not get the technical capabilities they need.

With the advent in the marketplace of microprogrammable processors and flexible storage devices there is no reason that systems designed for the user's real needs should not be procured. Perhaps GSA should institute a schedule for "tailorable" systems where the basic components can be purchased from a schedule and the customizing can be supplied from a T&M fixed price schedule.

Turn-Key Items

Use of the GSA non-schedule ADP procurement procedures for cuxtom or turn-key items requires a great deal of effort on the government side for preparation of specifications, procurement, evaluator and selection, On industry's side, a great deal of effort is wasted in proposal writing and second guessing source selection boards. Additionally, turn-key procurements, which are becoming increasingly prevalent, are multi-technology and multi-function in nature. The complicated and lengthy procurement process for these complex systems separates the decision-making from the pool of technicians who could actually determine if the best-and-final configuration and services package will really produce an acceptable working system for the government.

As time passes, fewer and fewer companies will be able to afford these expensive proposal efforts, which only serve to raise the ultimate cost of their systems to the government. They will increasingly bypass government business, and competition will be reduced. Of particular concern is the requirement for "best and final" offers. In practice this results in an auction where the most knowledgeable contractor "wins" to the ultimate sorrow of both parties.

Policy Level Post for Data Processing

In conclusion, I would propose that the Executive branch establish a policy level post for data processing equivalent to the existing telecommunications policy post. This would help assure maximum effectiveness for the contributions made to our society and Federal Government operations from data processing.

The impact of recent Federal Government policies on data processing has not been fully realized. For example, last month's policy statement on Criminal Justice Information Systems' privacy and security by the Department of Justice requires dedicated equipment usage by the late 1970s. This is just about the time when secure new data processing equipment, software and procedures that will not require expensive dedicated equipment should be available. As a data processing executive, I look forward to the large State CJIS systems that will probably be created to meet this policy and the significant business it will create for the industry. But as a taxpayer, perhaps the money could be better spent.

My plea is, therefore, use the data processing professionals available in both government and industry. Use them as staff, for testimony and to produce impact studies on such matters as the effect of privacy regulations on data processing users and vendors.

Federal Spending for Data Processing

As we look forward to the next ten years, during which it is estimated the Federal Government will spend $25 billion on data processing, we must work for a partnership in national service between the Federal Government and the extensive and growing resources of the computer industry — a partnership that will draw on the strengths of each. □

Hints for Solving Numbles — Part 1

Neil Macdonald
Assistant Editor

The relations of digits in multiplication give a good deal of information that is useful in solving Numbles.

For example, consider the multiplication:

```
          * * * * A
      x       * A *
      -------------
          * * * * *
        * * * * * x
      * * * * * *
    = -----------
      * * * * * * * *
```

The right hand digit of the product of A times A is the digit x. Now x may equal A, or x may not equal A, say B. One of these two cases is bound to happen. If we try each possible case, we have

Table 1: A times A ends in A: 0, 1, 5, 6

Table 2: A times A ends in B:

A:	2	3	4	7	8	9
B:	4	9	6	9	4	1

Similarly, the right hand digit of the product A times B may be A or B or C. The possible cases are summarized below:

Table 3
A times B ends in A

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

Table 4
A times B ends in B

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

Table 5
A times B ends in C

A	B	C
2	3	6
2	4	8
2	5	0
2	7	4
2	8	6
2	9	8
3	2	6
3	4	2
3	6	8
3	7	1
3	8	4
3	9	7
4	2	8
4	3	2
4	5	0
4	7	8
4	8	2
4	9	6
5	2	0
5	4	0
5	6	0
5	8	0
6	3	8
6	5	0
6	7	2
6	9	4
7	2	4
7	3	1
7	4	8
7	6	2
7	8	6
7	9	3
8	2	6
8	3	4
8	4	2
8	5	0
8	7	6
8	9	2
9	2	8
9	3	7
9	4	6
9	6	4
9	7	3
9	8	2

(please turn to page 30)

THE FIRST "NO SOFTWARE" COMPUTER: The ADAM® System of John Peers & Company, Inc.

John Peers, President, and
Gerard Horgan, Technical Director
John Peers & Company, Inc.
887-A Mitten Road
Burlingame, Calif. 94010; and
Edmund C. Berkeley,
Editor, "Computers and People"

"Perhaps, we ought to be examining the whole philosophy of a computer being applied to business. What we ought to be saying is, 'Maybe, we have taken a wrong turn'."

Part 1: INTRODUCTION

Edmund C. Berkeley
Editor, *Computers and People*

Up until May 1975 it seemed to me necessary and unavoidable that a computer have software (or computer programs) in order to solve problems and do useful work.

Then across my desk came some manufacturer's literature which contained the following interesting statements:

[Beginning of Quotations]

— No more software with ADAM® — the new low-cost computerized system which for the first time ever does not need a special computer language (like COBOL or BASIC or FORTRAN) and does not need prepared "software".

— ADAM works in English, using verbs and nouns. It cuts out the professional programmer middleman, and lets you tell the computer what you want it to do in your business.

— Professional programmers are not needed. Instead, ADAM learns directly from you, what you want it to do. ADAM learns your work using your terminology. As a result there are no professional programmers needed. And since there are no programmers, you do not produce "software".

— ADAM is an apt student of the English language. It is easy to instruct ADAM, and it takes only about two days. Thereafter, you will be able to teach ADAM any new job (like invoicing, accounting, or stock control, etc.) all in about eight hours — even less if it's a simple job. A reasonable change in a job takes about one hour. All this is done by you or your operator.

— For a manufacturing company, it will do payroll, purchase orders, stock control, costing, invoices, statements, cash flow, budgets, and so on. For professional organizations ADAM will do expenses, costing, billing, profit centers, overhead, accounting, payroll, etc. In other words whatever business you are in, ADAM will help you run your business, without your having to change the way you run things.

— ADAM is manufactured so that it learns the meaning of new words in terms of previously learned words. The words are taught to ADAM via a keyboard. ADAM is taught the difference between verbs and nouns as well as structure (similar to sentences). For example, it knows the meaning of words like multiply, file, if, difference, total. About fifty words in all. From then on every time you use a word ADAM has not seen before, it will ask you to teach it the meaning of that word until all words are inter-defined and thus have meaning to ADAM. It is just like a selective dictionary to someone who already understands English.

— It is not necessary to change your existing system. You teach ADAM to do what you do right now without changes. ADAM will do it quickly and without error. And keep on doing it day in and day out. Control of requirements is kept with you. But when you want to change the procedure, it is very easy. And always it is under your control.

— ADAM works in English words, through its keyboard. All of ADAM's replies are shown in English on its TV screen. There are no codes, no assemblies, no punched cards, no punched tape.

[End of Quotations]

At the beginning of June in Burlingame, Calif., I received a demonstration from Joe Mahoney, Vice President for Marketing, and Gerard Horgan, Technical Director, in charge of the design and development of the ADAM system. The demonstration convinced me that the ADAM system was an interesting and important stepping stone towards a "no software" computer, and that it was a development on the frontier of computer science worth careful reporting.

Whether or not ADAM is to be classified as a "no software" computer depends upon the meaning to be assigned to the word "software". For many computer scientists, any flexible sequence of instructions given to a computer and stored within it in an easily changeable and erasable form is software.

The ADAM system does require sequences of instructions stored within it and each sequence of instructions has to be correct. But the instructions can be produced by ordinary people not versed in a special programming language. The instructions can be expressed in a form of English. Professional programmers are not needed for the class of problems that a businessman himself thoroughly understands. And the control over the systems of instructions being used does remain with the business and not with trained or professional computer programmers. These changes make a profound practical difference. This is the sense in which ADAM is a "no software" computer.

The philosophy behind this development is expressed here in Part 2 by John Peers, and the bare bones of an actual example are shown here in Part 3 by Gerard Horgan. □

Part 2: THE TROUBLE WITH COMPUTERS .... IS PEOPLE

John Peers, President, John Peers & Company, Inc.
887-A Mitten Road, Burlingame, Calif. 94010

This is an odd way to start an article, but I happen to think it's true. Apart from the fairly rare times that the computer hardware actually malfunctions, the main trouble of getting a computer to function is people. That, of course, divides into several categories.

The Kinds of People Concerned

There are the people who decide what they think they want the computer to do. Then there are the people who actually make the computer work. Then, there are the people who are to use it. Of course, all these people can be either misguided or just unable to comprehend what was being done by the previous person. However, particularly, I want to talk about the classical problem, not of using a computer once it has been programmed, but of getting a computer programmed to do what it has to do, to prove itself to be a useful tool for the person buying it.

Defining What the Computer Is to Do

First of all, let's look at the problem of defining what it is you want the computer to do. For the sake of brevity, I will call this piece Systems Analysis. Now, before I go any further, I need to introduce a statement which I call, "The Peers Law". The Peers Law runs something like this: "The solution to a problem changes the nature of the problem." What I am referring to can be easily explained by some obvious examples.

The problems you have which cause you to buy a motor car, are not the problems you have after you've got one. The changes in problems that you have prior to getting married, to those you have after you get married, are I think fairly widespread. Equally, the problems that people have in a company before they own a computer, are not the same problems that they have after they get one. Now, here comes the core of the situation: It is precisely the problems which exist prior to the ownership of a computer, which are analyzed and programmed and put on the computer. I think you will agree, that, if it is true that the problems of a company change upon acquisition of the computer, it is, of necessity, a little less than foolishness, to go to the trouble of coding a completely integrated system (which was thought to be required and defined) prior to the acquisition of a computer on which it is to run.

Change in a Company after It Acquires a Computer

In fact, there is some evidence to show that the whole tone of a company changes after it has decided to acquire a computer. In other words, we really ought to examine whether or not it isn't just plain difficult to solve the current software problem. It might be by the very nature of the problem, totally insoluable. Let's look at the whole problem in a little more detail. Examine, first of all, the problems facing a company that is sophisticated and already owns its own conventional computer. What problems does it have? The first and classic problem is that the DP Staff (with the possible exception of the DP Manager) are usually far more interested in the computer they own than in what the computer is being asked to do. This is in terms of solving the company's problems. It is more fun to write real-time executives and compilers. It's really not quite so absorbing to make sure that figures reconcile and balance. It is very boring to have to go back and change a program just because someone in sales happens not to like it and will not use the accurate information coming out of their current computer program.

A Whole New Army of People

This in itself leads to a whole army of people being employed simply to come into a company, in order to be able to tell management "what it is" the computer department is doing.

As far as the company itself is concerned, obviously the computer is a high cost item. When it comes to changes, there never seems to be an easy way to get things done quickly. And one can never actually stimulate the people who are working in the computer department to realize the actual needs of the company as a trading entity. Which, of course, is the only reason the computer was purchased in the first place. In other words, in a conventional situation the problems would appear to be built by the very nature of the tool.

Change: Easily, Quickly, and Cheaply?

Let's look at the people who are thinking about getting a computer but haven't got one yet. Are they frightened of it? Of course they are. As far as they are concerned, the word computer has overtones of fright and horror, coupled with extraordinary high cost and usually crippling inflexibility once it has been told to do something.

In fact, for the smaller businesses, who typically do not have a computer today, one of their major worries is the inability of the computer to accept change easily and quickly and at low cost. But I'll come back to where I started, which is that it is not the computer which cannot accept change. It's the humans which have not yet apparently found a way of getting the change onto the machine quickly.

Analogy: Stage Coach to Railroad

If all of this has a grain of truth in it (and I believe it has), perhaps we had better not be looking for more and more real-time multi-screened display systems or into the ten-nanosecond processors. Or even looking into gigantic machines with everyone sharing common problems. Perhaps, we had ought to be examining the whole philosophy of a computer being applied to a business. What we ought to be saying is, maybe we've taken a wrong turn. Maybe, just maybe, we ought to go back and say: "Hold everything, let's look at it all again."

That's really what I am suggesting. I am obviously very biased because we think we've come up with one way of peeking through the curtain of difficulty that surrounds programming. But let's look at the general problem. In fact, at this point an analogy might just make a bit of sense.

In the days of the "stage coach" (which perhaps equates with the days of the manual accounting system), when someone came along and developed the concept of the railroad train it was a tremendous

improvement over the stage coach. Obviously, the train had no need for horses, feed, and other such things. But man being the animal he is, as soon as he gets a better tool, he accepts the better tool as normal. He regards his previous normal as inferior and therefore immediately starts looking for something better than the new 'normal'. The problem with trains was that before you could run them, you had to have railroad tracks, and before you could lay the tracks, you had to buy the land. Before you could buy the land, you had to go out and find out where the tracks had to go. The problem with that was you had to know where the major cities were going to be, before you laid the track. Obviously it was extremely costly, you couldn't rip it up and move it somewhere else once having put it down. And (rather like conventional computers) the problem was, having built in the network of stations, tracks, and schedules the resultant structure was so horrendously complicated that it wasn't easily changed to meet the needs of the people using it.

Analogy: Railroad to Motor Car

Now I suppose the railways wouldn't like my saying this, but the real reason, I think, that another method of transportation developed was this limitation of flexibility. You couldn't just go where you wanted to go, when you wanted to go, how you wanted to go. And so out of the problem of what was initially a superior solution, developed the motor car which overcame these limitations.

Now, the motor car is a device which is basically the same as a train. It has wheels, an engine, and you have to drive it. The difference is that it is rather a smaller device and it doesn't have to run on tracks. Now in the scheme of things considering the whole complex concept of transportation, that is a fairly trivial difference. But, the impact on people using motor cars compared to people using the train is enormous. I would therefore simply point out, as far as the difference between cars and trains are concerned, the difference though slight, resulted in sales differences of perhaps a million times more motor cars than trains. Mind you, from an ecological point of view perhaps I shouldn't be extolling the motor car too much, since, the motor car itself being created as a superior solution to the train, is now regarded as normal. Now everyone thinks of its drawbacks and everybody's looking for a superior solution. Ah well, that's the human experience.

Analogy: Computer to What?

Where does that get us to as far as computers are concerned? I think the computer, a superior tool, developed in its current form, must evolve into a more useful dynamic form. If we look back at the problems that the new device, whatever it has to be, must solve. It must be dynamic because it can't suffer the ignominity of being programmed prior to being sold. Because that with which it is programmed is probably not what you required, after the first two years of being installed anyway. It must be very easily changed since business is such an extremely dynamic thing. And it must be usable by anybody who's had a little bit of training (equivalent to the driver's training course).

Getting Rid Of or Transforming Programming

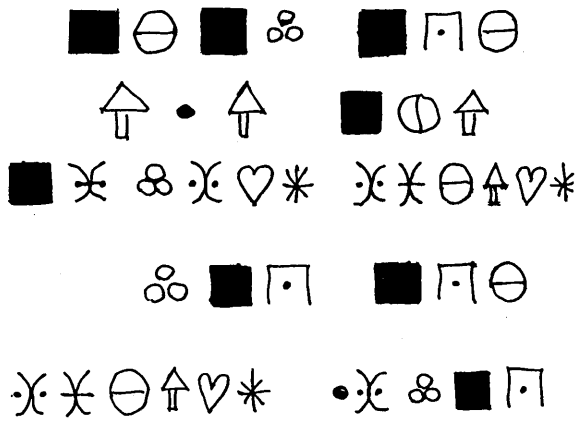
In other words, we have to get rid of programming. Yes, that's true, we have to get rid of programming. The concept of a language which is structured, the concept of compiling, editing, assembling and all the rest of the paraphernalia which goes with programming, is as limiting to the computer as a railway track is to a train. Of course, there will still be room for the large programming jobs in exactly the same way as the freight train is an essential part of our transportation system. But, neither can the needs of the smaller business or the small division of a larger business, or the private professional practice be constrained, by having to explain to a trained programmer what their problems are. It cannot be constrained by having solved the problem which unfortunately they have ill-defined. To be told it would take a year to change that which they've hung themselves by: not defining it properly. And equally, as the price of computer hardware comes down and the price of human labor goes up, you cannot be in the situation where the sale of inexpensive hardware is going to be limited by the application of expensive, unique, highly trained, highly specialised human beings (programmers).

Computer to "Business Logical Machine"

So what's suggested, is really, the time has come to reexamine in basic concepts the role of this machine we currently call a computer. The word computer has too many hard overtones, mathematical overtones, high cost overtones. I have a feeling we need a word which derives from an alternative use, which is perhaps something to do with the concept of a Business Logical Machine (BLM). For the moment if I may, I will talk of the new generation of machines as BLM's. What the BLM's must be able to do is deal in the language of the person using it. That doesn't just mean that it has to work in English for English people, and Arabic for Arabs, or Spanish for the Latin American world (which it should do). What it means, is that the words which have a unique meaning to the people using the BLM's, must mean that precisely when they are using it, to the machine.

In other words, we have to somehow develop a machine where the choice of "what words mean" is as easily understood and as easy as picking a name from a dictionary.

Now again, I really am biased. Because that is the sort of thing that we've been doing in our company. We don't claim we have solved the whole problem. What we believe though, is that, the awareness that the problem exists and the first approach to solving it has been made by us. We'll have to wait for the future to see what happens. But one thing is for sure: The smile on the faces of the people who use our business logical machine is very nice to watch. □



Part 3: AN EXAMPLE OF ADAM® — A SIMPLE INVENTORY CONTROL SYSTEM

Gerard Horgan, Technical Director, John Peers & Company, Inc.
887-A Mitten Road, Burlingame, Calif. 94010

PARTS LIST

PART NO.	PART DESCRIPTION	UNIT PRICE	UNITS	ON HAND	MIN BAL	LEAD TIME	USAGE YTD	SUPPLIER
1,010	FRESH LAID EGGS	$0.650	10	55	10	15	178	CHICKEN
1,020	SIDE OF BACON	$50.000	2	25	15	30	60	PIG
1,030	VIT D HOMOGENIZED MILK	$0.150	1	100	40	5	750	COW
1,040	BARREL OF CHEDDAR CHEESE	$10.000	1	12	15	60	42	AVON FARMS
1,050	HOGSHEAD OF APPLE CIDER	$25.000	1	6	8	55	30	ORCHARD
1,060	4 X 4 OZ BUTTER PACKS	$1.100	1	35	20	10	78	DAIRY
1,070	WHOLE WHEAT LOAF	$0.580	1	33	15	3	90	BAKER
1,080	WHITE BRIDGE ROLLS	$1.500	13	40	20	3	25	BAKER
1,090	3 LB BAG CASTOR SUGAR	$1.800	1	20	25	15	45	REFINERY (SUGAR)
1,100	BOX OF CEREALS	$0.690	1	80	25	10	75	KELLOGS
1,110	BAG OF CORNFLOUR	$0.770	1	20	30	10	56	MILLER
2,000	2 LB BAG, KENYAN COFFEE	$3.500	1	9	10	44	25	GRINDER

Total inventory value $1,826.49

RECAP

```
CREATE PART RECORD  is a verb,
  1 Does  DLF
  2  and  DISPLAY    24    "PART NUMBER ?"
  3  and  INPUT    PART NO.
  4  and  DLF
  5  and  DISPLAY    24    "PART DESCRIPTION ?"
  6  and  INPUT    PART DESC
  7  and  DLF
  8  and  DISPLAY    24    "ABREVIATION ?"
  9  and  INPUT    PART ABRV
 10  and  DLF
 11  and  DISPLAY    24    "PRICE PER UNIT ?"
 12  and  $INPUT    UNIT PRICE
 13  and  DLF
 14  and  DISPLAY    24    "UNIT-EACH, DOZ, ETC ?"
 15  and  INPUT    UNIT
 16  and  DLF
 17  and  DISPLAY    24    "BALANCE ON HAND ?"
 18  and  INPUT    BAL ON HAND
 19  and  DLF
 20  and  DISPLAY    24    "MINIMUM QUANTITY ?"
 21  and  INPUT    MINIMUM
 22  and  DLF
 23  and  DISPLAY    24    "LEAD TIME IN DAYS ?"
 24  and  INPUT    LEAD TIME
 25  and  DLF
 26  and  DISPLAY    24    "USAGE THIS CAL YEAR ?"
 27  and  INPUT    USAGE TO DATE
 28  and  DLF
 29  and  DISPLAY    24    "SUPPLIER NAME ?"
 30  and  INPUT    SUPPLIER
```

```
31  and  DLF
32  and  DISPLAY     24     "INFO O.K.  Y OR N"
33  and  INPUT     ANSWER
34  and  IF     ANSWER     ^     "Y"
       do       REPEAT
35  and  SAVE     PART NO.     PART
36  and  SAVE     PART ABRV     PART NAME
37  and  DISPLAY     "  "
38  and  DISPLAY     24     "LAST RECORD ? Y OR N"
39  and  INPUT     ANSWER
40  and  IF     ANSWER     ^     "Y"
       do       REPEAT
41  and  CONTINUE
```

```
Trace        PART
 is a file,
     there are references to this word in :-
CREATE PART RECORD          LIST PARTS                  LIST PARTS BELOW MIN
PARTS LINE PRINT LOOP       PARTS REORDER PRINT LOOP    STOCK CHECK
```

```
                            All REFERENCES from FILE  PART
                            Total number of records in this file is  12
RECAP
PART    is  a  file,  REFERENCES
  1 Uses  PART NO.
  2  and  PART DESC
  3  and  PART ABRV          1     1,010
  4  and  PRICE              2     1,020
  5  and  UNIT PRICE         3     1,030
  6  and  UNIT               4     1,040
  7  and  BAL ON HAND        5     1,050
  8  and  MINIMUM            6     1,060
  9  and  LEAD TIME          7     1,070
 10  and  USAGE TO DATE      8     1,080
 11  and  SUPPLIER           9     1,090
                            10     1,100
                            11     1,110
                            12     2,000

RECAP                       All REFERENCES from FILE  PART NAME
PART  NAME    is            Total number of records in this file is  12
  1 Uses  PART ABRV
  2  and  PART NO.  a file,     REFERENCES
```

```
                             1     "BACON"
                             2     "BREAD"
                             3     "BUTTER"
                             4     "CHEDDAR"
                             5     "CIDER"
                             6     "COFFEE"
                             7     "CORNFLAKES"
                             8     "CORNFLOUR"
                             9     "EGGS"
                            10     "MILK"
                            11     "ROLLS"
                            12     "SUGAR"
```

```
RECAP
LIST PARTS is a verb,
  1 Does  MOVE     12     HDG
  2  and  MOVE     0     LCVR
  3  and  MOVE     0     INVENTORY VALUE
  4  and  PLF
  5  and  BEGIN     PART
  6  and  PARTS LINE PRINT LOOP
  7  and  PLF
  8  and  PLF
  9  and  PRINT     "Total inventory value    "
 10  and  PRINT     $22.2     INVENTORY VALUE
 11  and  PLF
 12  and  FORM
 13  and  CONTINUE

 RECAP
PARTS LINE PRINT LOOP   is a verb,
  1 Does  GET     NEXT     PART
  2  and  PRINT     8     PART NO.
  3  and  SPA
  4  and  PRINT     24     PART DESC
  5  and  SPA
  6  and  PRINT     $10.3     UNIT PRICE
  7  and  SPA
  8  and  PRINT     10     UNIT
  9  and  SPA
 10  and  PRINT     10     BAL ON HAND
 11  and  SPA
 12  and  PRINT     10     MINIMUM
 13  and  SPA
 14  and  PRINT     10     LEAD TIME
 15  and  SPA
 16  and  PRINT     10     USAGE TO DATE
 17  and  SPA
 18  and  PRINT     24     SUPPLIER
 19  and  PLF
 20  and  MULTIPLY     BAL ON HAND     UNIT PRICE
 21  and  ADD     PROD     INVENTORY VALUE
 22  and  MOVE     SUM     INVENTORY VALUE
 23  and  REPEAT

 RECAP
LIST PARTS BELOW MIN   is a verb,
  1 Does  MOVE     13     HDG
  2  and  MOVE     0     LCVR
  3  and  PLF
  4  and  BEGIN     PART
  5  and  PARTS REORDER PRINT LOOP
  6  and  CONTINUE

 RECAP
PARTS REORDER PRINT LOOP   is a verb,
  1 Does  GET     NEXT     PART
  2  and  SUBTRACT     MINIMUM     BAL ON HAND
  3  and  IF     DIF     <     0
       do       PARTS REORDER PRINT LINE
  4  and  REPEAT
```

```
RECAP
PARTS REORDER PRINT LINE   is a verb.
  1 Does  PRINT     8     PART NO.
  2  and  SPA
  3  and  PRINT     24     PART DESC
  4  and  SPA
  5  and  PRINT     $10.3     UNIT PRICE
  6  and  SPA
  7  and  PRINT     10     UNIT
  8  and  SPA
  9  and  PRINT     10     BAL ON HAND
 10  and  SPA
 11  and  PRINT     10     MINIMUM
 12  and  SPA
 13  and  PRINT     10     LEAD TIME
 14  and  SPA
 15  and  PRINT     10     USAGE TO DATE
 16  and  SPA
 17  and  PRINT     24     SUPPLIER
 18  and  PLF
 19  and  CONTINUE
RECAP
STOCK CHECK    is a verb.
  1 Does  MOVE     "NORMAL"     PITCH
  2  and  DLF
  3  and  DISPLAY.    24     "WHAT ?"
  4  and  INPUT     PART NO.
  5  and  IF     PART NO.      >     99,999,999,999
       do       GET     PART NO.      PART NAME
  6  and  GET     PART NO.      PART
  7  and  OLF
  8  and  OUTPUT     "no "
  9  and  OUTPUT     10     PART NO.
 10  and  OUTPUT     "  abr "
 11  and  OUTPUT     12     PART ABRV
 12  and  OUTPUT     "  desc "
 13  and  OUTPUT     24     PART DESC
 14  and  OUTPUT     "  stk "
 15  and  OUTPUT     5     BAL ON HAND
 16  and  OLF
 17  and  DLF
 18  and  REPEAT

no       1,020   abr BACON          desc SIDE OF BACON                 stk     25

no       1,050   abr CIDER          desc HOGSHEAD OF APPLE CIDER       stk      6

no       2,000   abr COFFEE         desc 2 LB BAG, KENYAN COFFEE       stk      9

no       1,040   abr CHEDDAR        desc BARREL OF CHEDDAR CHEESE      stk     12
```

BELOW MIN
PARTS LIST

PART NO.	PART DESCRIPTION	UNIT PRICE	UNITS	ON HAND	MIN BAL	LEAD TIME	USAGE YTD	SUPPLIER
1,040	BARREL OF CHEDDAR CHEESE	$10.000	1	12	15	60	42	AVON FARMS
1,050	HOGSHEAD OF APPLE CIDER	$25.000	1	6	8	55	30	ORCHARD
1,090	3 LB BAG CASTOR SUGAR	$1.800	1	20	25	15	45	REFINERY (SUGAR)
1,110	BAG OF CORNFLOUR	$0.770	1	20	30	10	56	MILLER
2,000	2 LB BAG, KENYAN COFFEE	$3.500	1	9	10	44	25	GRINDER □

The Future of Computing: Is the Sky the Limit?

Frederick J. Bethke
IBM
General Products Division
Palo Alto, Calif.

"The method of programming is not the natural method of the human mind."

Predicting the Future

Everyone would like to be able to foretell the future. One reason, of course, is our natural human curiosity. More importantly, a knowledge of the future can have obvious practical value.

In the world of computing, those who build hardware and design software support need products that will sell, and knowing the coming trends is a clear advantage, if not a necessity. Customers — those who may use these products or who wish to expand the scope and effectiveness of their existing systems — also benefit from being able to plan with an awareness of coming trends. So it is not surprising that we have had, and continue to have, numerous predictions of the future world of data processing. Prophets step forward at frequent intervals to share the results of their crystal gazing.

In the past, these predictions were almost uniformly rosy — even grandiose. Encouraged no doubt by the truly enormous growth of computing in the late 50's and 60's, forecasters saw no bounds to future expansion. The words of F. Steinberg — "the potential for the computer is unlimited" — were typical./1/ Computers would soon thrive everywhere, not only in business and industry, but throughout the "wired city."/2/ Each home would boast its own minicomputer: 2K in every cupboard. The family of the days to come would have a programmable calculator, a personal filing service, and access to centralized information systems. Language would be natural, everyday English — speak to your CPU and it will answer. Reservations existed only as the obverse corollary of this vision of unrestricted growth: vague fears that these powerful and omnipresent machines of the future would somehow take over.

Second Thoughts

One still encounters predictions of unbridled optimism;/3/ yet, soberer voices can now occasionally be heard. Those observing the realities of the early 70's know that the rates of growth have slowed, and that progress is now just as much in lateral spread as in innovative forward movement. What are the causes of this slowdown? Is it a temporary phenomenon, or will those early, super-growth days come once more?

One common lament is a paucity of able programmers. With a limited number of high-quality people available, a bottleneck is formed that inhibits progress, both in the development labs and in the field. Initially it was thought that the problem was a lack of training. But now, with colleges giving birth to computer science majors — indeed, some students being trained as early as high school — education is no longer a problem. Yet the difficulty, although ameliorated slightly, still remains. Good programmers are in short supply. Why is this so?

The Making of a Programmer

An answer involves the larger question of just what goes into making a good programmer. Much time and energy have been devoted to this issue, and that the inquiry goes on demonstrates that answers remain elusive. Is programming a matter of mathematical ability, of organizational skill, of careful training, of mental temperament, or of personality? Opinions vary. Some have even claimed that programming is an art. But placing the issue in the mysterious realm of the aesthetic sidesteps the question; it moves the matter outside the sphere of rational consideration and is really a tacit admission of nonunderstanding.

It would seem that at the heart of the problem lives a disparity: the method of programming is not the natural method of the human mind. Programming is linear, sequential. It involves a clear and explicit understanding of each discrete step in a procedure, and the precise ordering of those individual steps. The human mind, on the other hand, is by nature intuitive. Its calculations are often not self-conscious. It leaps multiple steps at a time, without knowing quite how. A clever but undisciplined fellow, the brain.

This means that programming does not come naturally to people. Programming involves learning to think in a new way — more carefully, more slowly. Try to recall those early days in programming school. For most people, the first exposure to programming, the first attempts at coding, are like trying to pitch a baseball with the opposite arm, or pat the tummy while rubbing the head. They are awkward, stiff and agonizing, unnatural. Simple exercises that one could solve in a minute mentally (perhaps with a few jottings on a scrap of paper) take hours to code. The mind is learning to think in a new way.

For some people, this new way of thinking — once learned — is pleasurable. They enjoy bringing the

mind's processes into the open, solving a puzzle, breaking the solution into the necessary discrete steps, and locking them into hard code. But these people are rare. Most humans find the tasks of programming difficult, foreign, or just downright impossible to perform.

Double Impact

This fact has a double impact on the future of computing. A limited number of potential programmers obviously puts a restriction on systems and applications development. But it also constricts the final marketplace. Any product that requires its customers to do any sort of even elementary programming will necessarily not have universal or even general appeal. The populace as a whole will never become users in any sense that involves programming effort on their part.

This is not to say that the amount of programming talent presently available is the absolute limit. There exists a grey area of latent potential, a segment of the populace who could learn to program (or who have learned) but who find it disagreeable. Given sufficient incentive, these prople could be added to the pool of developers and users. Offered perhaps the glamour of an airline pilot, the prestige of a surgeon, or the remuneration of an accountant, some additional talent could be drawn into the field. But to what extent is this practical?

A second limiting factor is also at work. Successful programming necessitates not only exercise of a particular type of intelligence, but also a thorough knowledge of the application itself. Without understanding the nature of the problem to be solved, there can be no hope of a functional program. Someone coding for an insurance company needs to know how the insurance business works. Someone writing a program for a bank must understand that aspect of banking. A process control program for a foundry requires a knowledge of those particular procedures. No one can write a meaningful program without understanding precisely what the code should accomplish, and how it can be of use to the work at hand.

Thus there is a double burden on the programmer. He must have the ability and willingness to program, plus an intimate knowledge of the area in which he will work. This means that the burden on future development is intensified. It is difficult enough locating people with programming talent. When this rare skill must be found coupled with application knowledge (or willingness and ability to acquire it), we are faced with a limiting factor of significant magnitude.

Generalized Programs

It might be argued that these difficulties are overcome by taking top-notch, knowledgeable programmers and having them develop generalized application programs usable in a variety of situations. Create systems that can be easily adapted (goes the theory), and users need have little programming skills: some quick modifications, a few filled-in macros, and they're on the air. Build "smart" interactive programs that take the burden off the amateur user's shoulders by anticipating his confusions and mistakes.

But the savings in these approaches can be illusory. While general-purpose programs have the value of eliminating duplicate effort, this saving is offset to some degree by the overhead required for the build-in adaptation and customization procedures. And interactive programs for an inexperienced public expand enormously when their builders try to anticipate all the possible user errors and difficulties and combinations thereof.

Programming can be defined as canned intelligence; and the intelligence has to come from somewhere. If procedures are designed so that end users need do little thinking, then a corresponding increase of effort has to be supplied by the development shop. The broader and more general and flexible an application becomes, the larger it must be, the harder it is to write, and the greater must be the understanding and talent of the developers.

The generalized approach does have some positive value in that the work is put into the hands of the most professional and capable person; one high-powered programmer can outproduce (in terms of both volume and quality) several of moderate ability, and a whole gaggle of lowly strugglers. Yet the fact remains that there are only so many A-level, double-barrelled talents available, and even these people have their practical limits. They can produce only so many lines of code each year.

Limits Imposed by Complexity

This factor inhibits the rate of growth, but it sets no limits on the ultimate goals that can eventually be achieved. Yet there is another element to be considered, one which does set an absolute boundary to the future of computing. This is the factor of complexity. Some analysts have recognized that developments in our field are growing increasingly more complicated./4/ They conceive of complexity as a retardant that slows the rate of development.

This is certainly true, but it misses the more important point: complexity represents an absolute limit. To be useful, to be meaningful, a program has to be understood. Its creator has to comprehend exactly what it will do in all cases. When a program becomes so large or so complex that no single designer can wrap his mind around the whole, then there no longer is a program in any positive sense of the word. Such nonprograms can of course be built, and even made to run, but these unpredictable code monsters will be essentially useless or even dangerous. Since they are in toto beyond comprehension, it will be impossible to tell if their operational actions are "right" or "wrong". Large programs can be successfully built by teams, where individual members are responsible for (and only understand) their own parts. But at the head of this team there must stand one person whose intellect grasps the whole. If the program grows to the point where its breadth exceeds the elastic powers of this single mind, then we have entered the realm of jabberwocky.

Granted that a certain level of complexity sets an absolute limit beyond which programming cannot in any meaningful sense progress, how close are we now to that point? How much larger and more intricate can our systems grow before even our finent programmers lose sight of the land? Certainly bugs can be found in a large number of present-day programs. Can they be attributed to carelessness and haste and eliminated with better development technique and control? Or is this evidence that we are already beginning to reach the outer limits, and in some cases going over the edge? This question is not to be answered here, but is one that needs answering.

(please turn to page 30)

Word Processing and the Computerized Office

Elizabeth deAtley, Editor
"Investments in Tomorrow"
Stanford Research Inst.
333 Ravenswood Ave.
Menlo Park, Calif. 94025

"Repetitive typing was the feature that particularly attracted the first users of the word processing typewriter, but more and more organizations are buying it because of its text-editing capabilities."

Remington and Sons, Gunsmiths

The office typewriter, first introduced by E. Remington & Sons, Gunmakers, about 100 years ago, gained such rapid acceptance that by the turn of the century most of the clerks who had been copying documents by hand were typing them or had been replaced by others who were doing so.

Now, as we enter the last quarter of this century, the office world seems to be on the verge of a second and equivalent period of "future shock", based on the computer and spearheaded by the "word processing typewriter".

The Computerized Office

For a few, the computerized office is old hat. They can do things like send instant messages to remote colleagues by computer terminal. Or consult a library housed in a computer across the country. Or read the mail that has stacked up for them back at the office from a portable terminal in their hotel room. They use computers routinely to sort their mail, help them compose documents and look up citations for them.

But these people work under very special circumstances. Many, for example, work for Department of Defense (DoD) contractors and have access to the ARPANET, which was built under the sponsorship of the Advanced Research Projects Agency (ARPA) of the DoD and interconnects computers all over the world into a single network.

For the average worker, the office environment has changed little since the days when the ideal "typewriter" measured 36-26-36 and had blue eyes. On a business trip, the executive still has to phone his secretary and have her read or send his office mail to him via the U.S. mails. And the typists still type letters by hand, make corrections on the typed copy, put the letters into envelopes and drop the envelopes into the mail slot.

Cost of Typing

More important, since 1900, the cost of typists' labor has increased much more rapidly than has their productivity. Yet equipment that might increase this productivity has only recently begun to gain acceptance in the traditional office environment.

The typewriter, in particular, is such an integral part of the way people do their work in offices that changes in its look, feel or other characteristics are resisted. Computer keyboards, for example, have not replaced or even threatened the typewriter, although they are generally quieter and at least potentially faster.

But the electronic revolution is coming to the office just as it has already come to the accounting department, the news room, the stock exchange and the airline reservation counter. In many commercial offices, new equipment has already changed the boss's relationship with his secretary and the way secretaries do their work. In a few years, the computer may make even more profound changes in the working habits of the boss himself.

Word Processing

Paving the way for this computer takeover is the so-called "word processing" typewriter. First introduced by IBM in 1964, this machine is much like a standard IBM Selectric typewriter. It has two added capabilities, however, that greatly increase the typist's potential productivity — but at the cost of changing her procedures and those of the executives she serves.

These capabilities, for which the user pays anywhere from $5,000 to $15,000 more than for a standard Selectric, are memory — usually in the form of magnetic cards or tape — and logic circuitry.

Together these capabilities allow the machine to translate the typist's keystrokes into machine-readable form, record this material in memory and manipulate it in various ways to yield new text, such as corrected pages.

Magnetic Recording

The keyboard is standard, but typing on it produces not only a paper copy but also a magnetic recording that can be automatically searched and selectively edited. When all the changes have been made on the magnetic recording, the typist feeds it

---

Based on "Typewriter with a Memory Paves Way for Computerized Office" in *Investments in Tomorrow*, Winter 1975, Issue no. 14, published by Stanford Research Institute.

through the typewriter, producing a clean paper copy at full speed for the typewriter. This not only saves the time required for manual retyping — which may have to be done several times during the course of preparing a long document — but also eliminates the risk of introducing new errors in unchanged text during retyping.

Final Review

It also minimizes the chances that a document will fail to pass the final review step. Tom Humphrey, a senior research engineer who has conducted extensive studies of large document-processing systems, including SRI's, estimates that in a typical manual system, up to 25 percent of the documents reviewed after final typing are returned to some earlier stage of production, often at greatly added cost. Apparently either the originator gets cold feet when he sees the document for the first time as intended recipients will see it, or else the entire process has taken so long that new information has become available.

With the automatic retyping capability, the percentage of rejects at the final production stage is cut down to 10 to 15 percent, Humphrey says. Such a system allows the originator to see the document in closer to final form earlier in the process and to work with clean copy at every step of the operation. It also shortens the production cycle so that new information is less likely to become available before the document is completed.

Boiler Plate

Another advantage of the word processor is that it facilitates the formation of a central library for standard passages or "boiler plate" that can be reused many times. Once such boiler plate has been recorded on magnetic cards or tape, it can easily be added to the library. When a text originator needs a similar passage, he merely dictates the standard passage number and the desired changes. The typist then locates the tape or card containing the passage and feeds it through her word processing typewriter, keyboarding only the changes.

Alan Purchase, a senior industrial economist who has just completed a two-year multiclient study of office equipment, says that repetitive typing was the feature that particularly attracted the first users of the word processing typewriter — largely such firms as insurance companies and law offices that make heavy use of boiler plate. But more and more, organizations are buying the machine because of its text-editing capabilities. He points out that two word processors, effectively used, can do the work of three or more standard typewriters. According to to Humphrey, users who replace standard electric typewriters with word processors report typical savings of $1 to $2 per final printed page.

The word processor is expensive, however, and to achieve these savings, office procedures have to be changed so that the equipment can be fully utilized. As a result, most users have formed special word processing groups to handle the work of several originators. Because of their greater productivity, the secretaries specialize either as full-time typists or as administrative support personnel. The originators deal with each secretary according to her specialty, often dictating to a machine. A typical procedure is to dictate by telephone directly to dictation equipment in the word processing center.

Disappearance of the Private Secretary

Although the originators may miss the convenience and prestige of having a private secretary, this arrangement offers some attractive compensations for them as well as for the secretaries. The originators can dictate whenever they wish, obtaining a second, third or fourth clean draft without fear of antagonizing the typist. And the secretaries have greater choice as to the type of work they do, as well as more opportunities for advancement. Instead of rising or falling with one executive on the corporate ladder as private secretaries do, they can choose among various career paths.

Those who prefer to be full-time typists do not also have to answer the telephone or make coffee. Because of the complexity of their equipment, they compete against their peers on the basis of technical proficiency, like the keyboarders (largely male) in the printing and publishing industry.

The administrative support personnel can choose to specialize in reception, research, scheduling and a variety of other activities that can lead into lower management positions and on up the ladder.

Market for Word Processors

The market for word processors is growing rapidly. According to Purchase, there were 200,000 such machines in use in the U.S. at the end of 1974, and he expects the number to double in 2 to 3 years. By 1980, he estimates, 10 to 15 percent of the typewriters used in business will be word processors.

A number of companies have entered the word processing market recently. In addition to IBM. there are more than a dozen other word processing typewriter manufacturers, including Xerox, which introduced its initial product in October 1974. And other office machines, such as copiers, dictation equipment and communication systems (including the telephone), are all being changed to make them a part of this market.

In the next two to three years, Humphrey says he expects this activity to lead to major changes in both equipment design and office procedures. He points out that the recent drop in the cost of electronic components makes it reasonable to think of replacing the word processing typewriter with an assembly of electronic components (keyboards, printers, and electronic display screens), tied together by a microprocessor or minicomputer. Such an assembly is potentially more productive than the word processing typewriter, he notes, because the various functions of keyboarding, printing and display can be going on at the same time. With a typewriter, the keyboard, for example, is idle while automatic typing is in progress.

To justify the cost of such an assembly today, Humphrey estimates that the work load would have to be large enough for 4 to 8 word processing typewritters. But he notes that the cost of electronic components is dropping relative to that of the word processing typewriter. By 1978, he believes, an assembly of such components will be fully cost competitive on a one to one basis with the word processing typewriter.

The Word Processing Department of Tomorrow

There are of course many possible views of tomorrow's office. Humphrey's is as follows: He

visualizes a word processing department in which each typist's desk would have a small, attractively designed keyboard with an electronic screen capable of displaying the last few lines of text.

The typists would not have to hit the carriage return at the end of each line. Instead the machine would break the lines automatically. And there would be no paper to change. To make minor corrections as they typed, the typists would refer to the small display. For more extensive text-editing after keyboarding, they could view a page at a time on a TV-type screen shared with one or more of their associates. To make a correction, the typist would merely point (with an electronic pointer) to the desired spot on the screen, type in the new words, and the corrected page would appear immediately on the screen.

For producing final copy after the corrections had been made, several typists might share a high-speed but relatively quiet printer, a phototypesetter or even an office copier.

Humphrey estimates that his system could improve productivity as much as 20 to 30 percent over a word processing typewriter. A major factor in this saving would be the increase in the typist's speed resulting from the elimination of paper. The carriage return, changing of paper and the noise of mechanical printing all tend to slow the typist down.

Increased Speed of Editing

Another factor that would contribute to this potential savings is the greater ease and speed of editing. Experiments have shown that a skilled operator can edit a document 1½ to 3 times faster on a good electronic display than on a word processing typewriter.

Clearly a cluster of word processing keyboards, display screens, memory and print mechanisms could be interconnected by telecommunications so that the units could be separated by long distances. This would allow mail to be sent by telephone lines from one company to another, just as data is sent today. Instead of preparing a final copy of a letter or document and stuffing it in the mail, the secretary would feed the magnetic recording into a device that would convert the information into a form that could be transmitted over the telephone lines. When it had arrived at the desired destination, the information would be printed out in hard copy or viewed on a screen.

IRS Experiment

The Internal Revenue Service is experimenting with such a system to prepare and transmit briefs in tax cases from local IRS offices to Washington, D.C., where a word processing typewriter at the IRS headquarters types up a final document for review and filing.

This telecommunications capability makes it economically feasible to add to the system large but physically remote computers that are capable of more complex specialized functions such as phototypesetting, storage of boiler plate or longer text-editing jobs — such as the updating of mailing lists.

Service bureaus specializing in such services have already sprung up in a few of the larger metropolitan areas. Their typical customer has one or more word processing typewriters inhouse that he used as stand-alone devices to prepare routine correspondence and short documents and connects by telephone lines to the service bureau computer for more complex operations.

Purchase expects this trend to grow rapidly. By the 1980's he believes enough communications typewriters will be in use to have an important impact on business correspondence.

Decrease of Costs of Data Communications

Largely responsible for this growth, he believes, will be cheaper and faster hardware and lower data communications costs. As postal rates go up, he says, high-volume data communications rates will become increasingly attractive. He explains it this way:

Until recently, the rates set by the Federal Communications Commission (FCC) and the Bell System were based on service usage. Thus a rural or residential user who used the telephone only occasionally paid much less in relation to the actual cost of the service than did a heavy business user in a metropolitan area. But when the FCC permitted specialized common carriers, such as MCI, Datran and Southern Pacific to compete with the Bell System in high-use metropolitan corridors, the basis for the rates began to shift from use to actual cost of the service. Purchase sees a continuation of this trend, with the result that businesses will pay proportionately less for service while rural and residential users will pay more.

Interface Software

Another factor that will encourage more extensive communications with remote computers is the development of software to facilitate the interaction between different computer systems. Normally two systems, such as a large computer and a small one, or two different programs even in the same computer, have different data structures and formats and use different computer languages. Thus if a system designer, for example, wants to go from one time-sharing program to another to help him design a particular system — like a carpenter going from one tool to another in the course of building a chair — he may have to use different computer languages with each program.

SRI has been one of the principal pioneers in developing the standards, data formatting and translation systems needed to eliminate this Tower of Babel. For 12 years, Douglas Engelbart, Director of SRI's Augmentation Research Center, and his colleagues have been developing a computerized "workshop" to augment the capabilities of professional workers.

Having developed a prototype coordinated workshop suitable for individuals and project teams, the researchers extended it to include a network-coupled distributed community when the ARPANET became available.

ARPANET users who have access to these tools can interact freely with computer installations anywhere on the net, provided they have made contractual arrangements with the host organizations. Thus they can easily move from one remote computer program to another in the course of carrying out their work assignments.

Spinoffs

This ease of interaction with remote computers may soon be available to business users generally.

Recently two commercial spinoffs of the ARPANET — Telenet, a subsidiary of Bolt, Beranek and Newman, and Packet Communications, Inc. (PCI) — obtained FCC approval to build public networks similar to the ARPANET that will allow different types of computer systems located wide distances apart to send and receive messages from each other.

Telenet has completed its first switching center in Washington, D.C., and, according to Stuart Mathison, Vice President of Planning, the company expects to have similar centers in 7 major cities by mid-1975. Present plans call for 18 centers by early 1976, he says.

PCI hopes to have service in 18 cities by late 1975 or early 1976, according to its president, Lee Talbert.

Packet Switching

Both companies propose to use "packet switching", a technology pioneered on the ARPANET. In this form of communication, messages are cut into pieces or "packets" of a given length. Each packet is then switched independently from one node of the network to the next along the best available route by means of switching computers at each node. When all the pieces arrive at their destination, a computer there reassembles the message and delivers it to the appropriate computer installation or terminal.

This switching technology is apparantly low enough in cost to make a distance-independent rate structure economically feasible. Both Telenet and PCI have proposed to charge only by the length of the message and not by the distance it is sent.

The repercussions of this type of service and rate structure on the business world are likely to be profound. □

Macdonald — *Continued from page 17*

Table 4 of course is the same as Table 3 except that each pair of digits is listed in the reverse order.

Table 5 contains so many solutions (44 in all) that often it will not be useful. So let us subdivide it, by considering what happens when the result of multiplying A by B (which is C) is multiplied once more by A; this information often appears in problems. For example, consider the multiplication:

```
        * * * * A
    x       * B C
      * * * * * x
    * * * * * C
  * * * * * *
  ---------------
= * * * * * * * * *
```

Here A times B ends in C, and A times C ends in a digit x. There are four cases: x equal to A, x equal to B, x equal to C, and x equal to D. The tables of the solutions follow. Again they enable the possible cases to be narrowed down rapidly and traced through easily. In symbols "A times B ends in C" may be expressed as "A·B = C".

Bethke — *Continued from page 26*

Summary

In summary, what can we conjecture about the future in our field? In what directions is it most reasonable to focus our efforts?

First, it does not seem very fruitful to expect any immediate pie-in-the-sky. Progress will be hard-won and incremental, rather than immediate and spectacular. The limiting factors of complexity and a finite talent pool will tend to channel movement laterally into known areas rather than into great leaps forward. Emphasis will probably be on intelligent, prepackaged interactive systems for the public — not because such systems are quick and easy to build, but because they represent the line of least resistance.

The recent success of such systems as the supermarket checkers suggests that that type of machine and program combination might become a significant avenue of exploration: innovative hardware that removes some of the physical burdens from man, coupled with traditional, limited-scale programming.

A final caveat, however: these and any other forecasts should not be accepted unreservedly. The safest prediction is that man will continue to be that ingenious creature whose inventiveness keeps turning predictions upside down — in the world of computers as in the world at large.

References

1. "First Book of Computers", (Watts, 1969).
2. See, for example: R. Rusch, "Man's Marvellous Computer: the Next Quarter Century", (Simon & Schuster, 1971); C. Winston, "New Horizons for Communications", "Journal of Data Management", June, 1969; F. Seitz, foreword to "Purposive Systems", ed. H. Von Foerster (Spartan, 1969); and J. Martin and A. Norman, "The Computerized Society", (Prentice-Hall, 1971).
3. As examples: V. Farmer, "A Look toward 1985", "Computerworld", Feb. 27, 1974; J. Campise, "Data Processing: 1973: 10 Years", "Data Management", May, 1973; AFIPS 1973 National Conference, Session on Views of the Future.
4. E.G. Glaser, "The Myth Is Dead — Long Live the Myth", AFIPS 1972 National Conference (Fall), pt. 2. □

Table 6 A·B=C and A·C=A			Table 7 A·B=C and A·C=B			Table 8 A·B=C and A·C = C			Table 9 A·B = C and A·C=D			
A	B	C	A	B	C	A	B	C	A	B	C	D
2	3	6	4	2	8	2	5	0	2	4	8	6
2	8	6	4	8	2	4	5	0	2	7	4	8
3	7	1	9	2	8	5	2	0	2	9	8	6
4	9	6	9	3	7	5	4	0	3	2	6	8
7	3	1	9	4	6	5	6	0	3	4	2	6
8	2	6	9	6	4	5	8	0	3	6	8	4
8	7	6	9	7	3	6	3	8	3	8	4	2
			9	8	2	6	5	0	3	9	7	1
						6	7	2	4	3	2	8
						6	9	4	4	7	8	2
						8	5	0	7	2	4	8
									7	4	8	6
									7	6	2	4
									7	8	6	2
									7	9	3	1
									8	3	4	2
									8	4	2	6
									8	9	2	6 □

Announcing plans for a new quarterly magazine:

COMPUTER GRAPHICS AND ART

To all persons interested in:

Applied Arts and Graphics
Architectural Graphics
Cartography Systems
Computer Aided Design
Computer Assisted Instruction in Computer Graphics
Computer Graphics in Physics, Chemistry, Mathematics, and Other Sciences
Computer Graphics in Literature, Semantics, Fine Arts, Applied Arts, and Other Fields
Computer Graphics in Business, Industry, and Other Branches of Knowledge
Interactive Graphics Languages
Courses in Computer Graphics
. . . .

Dear Colleague,

At the present time we are exploring the possibility of publishing a new magazine on interdisciplinary computer graphics and computer art aimed at the college level. We need your feedback concerning the graphic interests that you have and that you know of. We want this magazine to be useful to you and your colleagues.

Accordingly, this is your invitation to submit material and to begin subscribing (or indicate your intention of subscribing) to

COMPUTER GRAPHICS AND ART

a new quarterly to be published starting probably in January 1976, and for which I have been asked to be the editor.

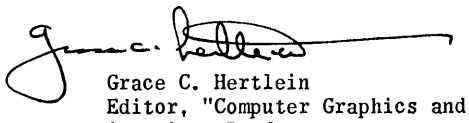
At the present time an advisory board of distinguished people and a group of contributing editors well known in graphic fields are being assembled. Your suggestions and nominations will be welcome.

You and your colleagues are cordially invited to submit papers, articles, computer graphics, photographs, reviews, computer art, ideas, etc. — no holds barred — for us to consider for publication. In addition, your suggestions about authors whom you would like to have papers from will be most welcome. One of our goals is to publish materials on computer graphics early; and then authors can more quickly establish their professional claims for origination of good ideas and programs. Every author receives permission to reprint his or her material unlimitedly, although the magazine is copyrighted by the publisher.

We look on subscribers as colleagues in a mutual effort, and not as listeners in a lecture room.

Your help and cooperation in this mutual undertaking is warmly invited and will be most appreciated. May we hear from you?

Cordially,



Grace C. Hertlein
Editor, "Computer Graphics and Art"
Associate Professor
Department of Computer Science
California State University, Chico
Chico, Calif. 95926

Here is your chance for feedback to us:

- - - -(may be copied on any piece of paper)- - - -
TO: COMPUTER GRAPHICS AND ART
Berkeley Enterprises, Inc., Chico Branch
555 Vallombrosa, # 35
Chico, Calif. 95926

( ) 1. Yes, please enter my annual subscription to the quarterly COMPUTER GRAPHICS AND ART:
( ) personal, $10; ( ) library, $15
( ) department,_____, $15
and bill me.

( ) 2. Yes, please record my intention to subscribe annually:
( ) personal, $10; ( ) library, $15
( ) department,_____, $15
and notify me when plans are firm.

( ) 3. I hope to submit for consideration for publication, material on the following topics:

_____ *A

( ) 4. I would be particularly interested in coverage of the following subjects:

_____ *A

( ) 5. I am interested in reading materials by the following authors:

_____ *A

( ) 6. Please send me further information on bonuses for subscribing:
( ) Computer Art Reprints
( ) FORTRAN IV programs for computer art
( ) Computer Graphics Bibliography

( ) 7. I suggest you send information to my friends and associates whose names and addresses follow:

_____ *A

8. Any Remarks or Comments?_____

_____

_____ *A

- -

Name_____Title_____

Organization_____

Address_____

*A - attach paper if needed

Computing and Data Processing Newsletter

WAREHOUSE OPERATION IN LIMESTONE CAVES USES COMPUTER

Donald B. Allen
Manager, Public Relations
General Automation, Inc.
1055 South East St.
Anaheim, Calif. 92805

If Stone Age man were to return to central North America today, he might find it difficult to comprehend that someone actually has computerized some caves in Randolph Quarry, Clay County, Mo. near Kansas City, Mo. He could probably understand why, however. Just as he used the caves in this area 50,000 years ago as shelter for his family and food supply, so Space Center Kansas City, Inc. now uses these limestone caves for major warehouse space and for a distribution center for many of this country's largest food processors. The computer simply makes the job easier.

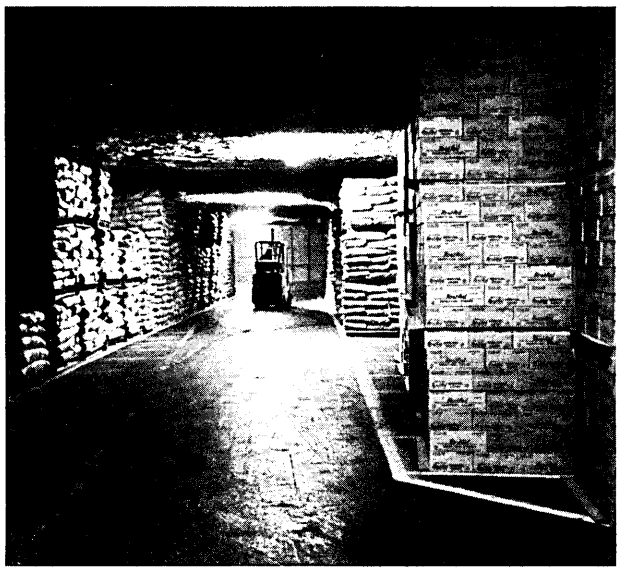
Geologists estimate the rock ledges in the area to be more than 560 million years old. The natural caves located 80 or more feet underground have been enlarged by man in the last 30 years via limestone mining operations that add another 100,000 square feet of warehouse space each year.

Space Center, Inc., is based in St. Paul, Minn. but their cave warehouse in Missouri has 1.2 million square feet of net usable storage space, including six acres of freezer space. The primary service offered in these caves is the storage of foodstuffs, since year-round temperatures range from 65-70 degrees and humidity can be maintained easily at 45-50 percent.

The volume of business handled is large, both because of the ideal storage conditions and because the warehouse is located near the geographic center of the United States — an important factor when considering the distribution of food.

Space Center Kansas City serves more than 20 major customers including General Mills, Hunt-Wesson Foods, CPC International, Proctor & Gamble, Pillsbury, General Foods, Ralston-Purina, and others. A tour of the caverns here reveals an impressive multi-million pound supply of cereals, sugar, gelatine desserts, tomato sauce, powdered fruit drinks, pet foods, frozen TV dinners, catsup, and numerous other common food products that eventually find their way to dinner tables everywhere.

The average weekly in/out volume is around 15 million pounds, which is handled in 300 trucks and 150 railroad freight cars per week. This implies a mountain of paperwork in the form of invoices, receipts, bills of lading, customer account records and inventory control records.



Underground Storage

The size of the paperwork load is the reason why the warehouse has installed an automated warehouse system from General Automation, Inc. The computer system consists of an 18/30 central processor with 8K words of core memory, three 512K word disk drives, a 300-line-per-minute printer, one console and one remote teletypewriter and a GE Terminet T300 for forms output. The configuration is sized specifically to the warehouse's needs, based on the number of customers for whom they store, the number of different items stored for each customer, the number of transactions for each, and other data.

System software is all Macro Assembler. Application programs are basically text-editing and file-management routines that provide a data base custom-designed for public warehousing. It includes a fully buffered, multi-terminal operating system. The speed with which the processor completes each task is usually one to two seconds and the user at the terminal never notices any delay.

The entire system was installed in late 1974. The redundant manual system was discontinued before the end of the year.

Clerical time has been cut by at least 25 percent.

As each customer shipment arrives at the cave warehouse, all information on it is entered into the

computer via a combination bill of lading and warehouse receipt input form, typed in by one of the clerk/secretaries. This includes: customer identification number; the date of the receipt; customer name and address; the route to be used for shipment; freight bill number; rail car or truck identification and seal number; customer reference number; and, finally, all data on the warehouse item and lot numbers, quantities and shipment weights.

This information forms the data base from which all succeeding transactions are handled by the computer. The inventory is tracked automatically and updated as new shipments arrive or as product is distributed. Some customers' goods are in and out as many as nine times a year, while others store goods for several months before distribution. This varies by commodity and customer.

As each customer requests shipment of his product, the computer handles the printing of shipping documents and invoices automatically upon entry of the order to ship.

There's no shortage of shipping orders. 100,000 cases of cereal or 250,000 cases of gelatine dessert don't last very long.

INFORMATION RECYCLING

Information International, Inc.
5933 Slauson Ave.
Culver City, Calif. 90230

Information recycling is a critical segment of man's knowledge. It is the application of computers and electro-optical technologies to improve man's control over information.

Information is kept on paper, film, or magnetic media. Frequently the form is suitable only for communication between machines. Much information exists in forms that computers cannot so far work with — printed books or hand-printed records, for instance. Most information is perishable — some is subject to almost constant change, like directories or catalogs. Keeping it current by previous manual techniques represents at best drudgery, at worst an impossibility. Some information is so complex that it can only be automatically processed — satellite-collected details of the earth, or seismic oil exploration data.

In short, information exists in many forms, and there are a wide variety of ways in which it can be used.

It is plain and clear that out-of-date or inaccurate information can be an annoyance to an individual or a disaster to a business firm. Most people recognize the dependence of business and of government on swift, accurate information — presented in formats that people can effectively use.

That is the essence of our business: Information Recycling. For more than a decade, this company has developed concepts and technologies for: capture; update; and publication.

Through the continuing process of information recycling, man's knowledge is ever expanding. Yesterday's data needs to be updated for today's users and again for tomorrow's. In the process, new visual information may be captured and combined with data already in computer form, to publish updated information.

Capture

Capture is the first of the three phases in information recycling; it is the step required to put information into a state which permits computer updating and publishing. It can be accomplished manually — or automatically.

Automated capture is the process of converting information from a visual form into a state the computer can process.

Our systems scan source information under computer control using character recognition techniques to capture text, or pattern analysis to capture pictorial information. A large Japanese corporation uses our Programmable Film Reader to scan X-rays for early detection of ulcers and cancer. Thus medical information which would otherwise be subject to limited analysis by the available specialists using manual methods is captures in a form which multiplies the effectiveness of their skills.

The most powerful Information International capture system is GRAFIX I. The system is initially applied to the automated capture of text, a process generally referred to as Optical Character Recognition (OCR). GRAFIX I is distinguished principally for its ability to read information which was not originally prepared for automated capture. Thus large bodies of published information become available for economic information recycling.

Up to now published works could not be easily republished if they needed correction or update. After such information is placed in computer form its update and republication is practical. GRAFIX I offers that prospect for legal records, government documents, scientific data and records of business transactions.

Update

Update is the editing, changing or merging of old information with new data. An engineer at his drafting table or an editor with pencil represent two conventional methods of updating. Neither is fast or economical in relation to the demands of modern society.

In our systems, editing is done from the screen of a television-like tube. Changes are made electronically. Errors are corrected in the same way.

One of the world's most sophisticated systems is incorporated in a system installed at a Navy facility in Florida. Here after capturing each of the over 17,000 technical manuals, the system provides the technical editor with less than ten seconds access to any individual page. Additions and deletions are entered by the editor through the keyboard with verification on the CRT display. Full recomposition of the revised manual is provided including the automatic generation of all indexes, tables, tables of contents, and lists of tables and figures.

Publication

Publication is the process which gives the computer-stored information a new recorded form. It may be books, manuals, directories or movies. It may be all of these, separately or all together. Our systems enable the same information to be published in many forms — microfilm, microform, movie, printing press plate or hard copy — for viewing, printing or reading as user needs dictate.

A telephone book can be printed in the familiar form for use by the phone customer. And, it may remain on computer tape for the billing department. It may be published on microfilm for the service department's use. At Northwestern Bell, our equipment is used to typeset a new phone book every other working day.

Republishing is not limited to directories and critical technical information. There can be economies in automatically republishing uncomplicated information that we rely on daily. In Britain, one of our systems was purchased to produce stationery for the National Westminster Bank. At the Bank, which has 3,300 branches, two to three thousand different pieces of stationery are personalized and printed each week — letterhead, envelopes, overdrawn notices, checks. Use of this system will permit branches to order for current needs instead of ordering a six-months' supply and carrying large inventories of preprinted items.

And the information, when it changes, will be ready for automatic, inexpensive recycling — again and again.

AEROFLOT TO USE GENERAL AUTOMATION MINI-COMPUTERS IN SOVIET MESSAGE SWITCHING NETWORK

John A. Dillon
General Automation, Inc.
1055 South East St.
Anaheim, Calif. 92805

Aeroflot, the Russian national carrier, has shown a spectacular increase in traffic, from 72 million passengers in 1970 to more than 90 millions in 1974. And the prospect for continued increase in demand on a great scale is good.

Such growth has posed numerous problems, including communications between various regional centers. So, a comprehensive $7.5 million computer-based network is to be installed by the Compagnie Generale de Construction Telephonique (C.G.C.T.) of Paris, France.

The network will be based on 23 C.G.C.T. DS6-400 hardware/software modules which are built around SPC-16/85 minicomputers from General Automation, Inc. These modules handle the tasks commonly associated with message switching, and real-time file interrogation and data base management. In addition to standard GA operating software, the system will include a complete network control package and a new high level language, ESPL-1, developed by C.G.C.T.

The network will include five major switching centers in Moscow, Rostov, Novosibirsk, Alma-Ata, and Sverdlovsk. These centers will handle some 4 million messages, or about 1 billion characters, per day. Each processing module will handle a minimum of eight messages per second.

This is the second minicomputer based network installed by C.G.C.T. in the Soviet Union. The first, valued at about $1.5 million, was purchased by the Soviet Merchant Navy MORFLOT for a country-wide communications system. Several other Russian governmental agencies are negotiating similar equipment purchases.

MULTISPECTRAL IMAGE ANALYSIS SYSTEM EXTRACTS OIL DATA, CROP DATA, ETC., FROM SATELLITE PICTURES

Margaret McCarvill
News Bureau
General Electric
1010 Barclay Bldg.
Bala Cynwyd, Pa. 19004

A new ground system that helps estimate food crops or locate potential oil deposits in images received from the LANDSAT earth resources satellite has been announced.

Called the IMAGE 100 Multispectral Image Analysis System, it consists primarily of an Image Analysis Console with a color television monitor, linked to a mini-computer. Image 100 allows a geologist, agriculturalist, or other specialist to process the satellite images while they are displayed on the TV monitor, and to determine his results immediately.

Images from the satellite's multispectral sensor are stored on either film or digital tape and then transferred to IMAGE 100. Seated in front of the console, the scientist or specialist controls all the functions of the system, and operating it himself, can selectively process data. In a matter of minutes, crops, geologic features, land use patterns, and other characteristics can be identified and classified throughout the scene.

The system gets more information from the LANDSAT data and gets it more rapidly than any existing prior technique. The system extends the specialist's ability to interpret the image and allows him to extract the maximum amount of information from the spectral data collected by the satellite sensor. In addition, the images can be analyzed in a fraction of the cost of other methods.

A number of clients including oil companies, agribusiness firms, federal and state agencies, and universities are using the IMAGE 100 system at the GE Space Division's Image Processing and Analysis Center in Boltsville, Md. The system has been used for large scale agricultural inventories, oil and mineral exploration, strip mine monitoring, water pollution studies, and measurement of urban growth in cities and suburbs.

Captain Jacques Cousteau visited General Electric's IMAGE 100 facility in Beltsville, Maryland recently, as a guest of NASA and the General Electric Company. The purpose of Cousteau's visit was to review the results of a real time experiment using LANDSAT data that was completed in November 1974. □

GAMES AND PUZZLES for Nimble Minds – and Computers

Neil Macdonald
Assistant Editor

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

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

NAYMANDIJ

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

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

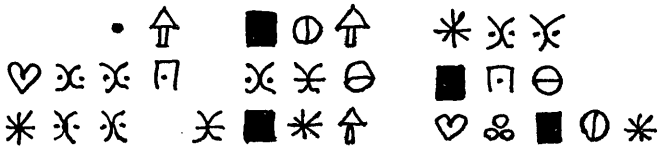
NAYMANDIJ 759

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

MAXIMDIJ

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

MAXIMDIJ 759



NUMBLES

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

NUMBLE 759

BEY = RFW

```
          K N O W
        x T H E E
        K R N T T
    K B N T T
    N T K K
  S O K W W
= S N H E L O K T
- S K L W N N S O
=   T H Y S E L F

63710  95895  77676  3951
```

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

SOLUTIONS

NAYMANDIJ 757: Make 7 touch 0.

MAXIMDIJ 757: Only you can shame you.

NUMBLE 757: Ignorance of the law is no excuse and lack of knowledge of science does not shield us from harm.

Our thanks to the following individuals for sending us their solutions to – **NUMBLE 757:** T. P. Finn, Indianapolis, Ind.; Frances LeVangia, Rochester, N.Y.; G. A. Strassburger, Decatur, Ga. – **MAXIMDIJ 757:** William Jines, Dallas, Texas – **NAYMANDIJ 757, NUMBLE 757, and MAXIMDIJ 757:** Manuel Juan, Oakland, Calif.

Monthly magazine, first issue May 1975:

"People and the Pursuit of Truth"

Some of the articles in the May, June, July, and August 1975 issues already published:

The Assassination of President Kennedy: The Involvement of the Central Intelligence Agency in the Plans and the Coverup / Richard E. Sprague

The "Oswald Window" (with Two Photographs) / Neil Macdonald

Substantial Evidence of Conspiracy Ignored by the Warren Commission / Mark Allen and others

Chile and Central Intelligence Agency Intervention, 1964-1973 / Hortensia de Allende

The Coverup of the Coverups: The Protectors of the Assassins / Richard E. Sprague

Zapruder Film Frame 413: Does It Show a Rifleman on the Grassy Knoll? No / R. B. Cutler

PURPOSE: Devoted to:

- facts, information, truth, and unanswered questions that are important to people, widely suppressed, and not adequately covered in the usual American press; and also to
- solutions to great problems that are functioning well in other countries, yet are almost never talked about in the usual American press.

PRIORITY SUBJECTS:

1) Political assassinations in the United States
2) The relation of the Central Intelligence Agency to the killing of President Allende of Chile
3) Concealed activities of the CIA, FBI, Pentagon, and other entities that are disruptive of the domestic affairs and rights of other countries and of the people of the United States

PREVIOUSLY PUBLISHED: for over four years, as an integral portion of *Computers and People* (formerly *Computers and Automation*). During this time more than 50 important articles have been published.

EDITOR: Edmund C. Berkeley
ASSOCIATE EDITORS: Richard E. Sprague, David Williams, Rusty Rhodes
PUBLISHER: Berkeley Enterprises, Inc.
815 Washington St.
Newtonville, Mass. 02160
ASSOCIATED ORGANIZATION:
Assassination Information Bureau
63 Inman St.
Cambridge, Mass. 02139

RETURNABLE IN 7 DAYS IF NOT SATISFACTORY

WHY NOT SUBSCRIBE?

HOW CAN YOU LOSE?

- The Watergate crimes and punishments have changed the atmosphere in the United States.
- Congressman Henry B. Gonzalez of Texas has introduced H. Res. 204 in the U.S. House of Representatives, calling for an investigation of political assassinations in the United States.
- Rusty Rhodes of "The Committee to Investigate Political Assassinations", Los Angeles, Calif., has collected more than 250,000 signatures calling for a new congressional investigation.

(may be copied on any piece of paper)

To: *People and the Pursuit of Truth*
Berkeley Enterprises, Inc.
815 Washington St.
Newtonville, Mass. 02160

1. ( ) YES, please enter my subscription to *PEOPLE AND THE PURSUIT OF TRUTH*
2. ( ) One year, 12 issues; U.S.A. $9.50, Canada $10.50, elsewhere $12.50.
   ( ) Two years, 24 issues: U.S.A. $18.00, Canada $20.00, elsewhere $24.00.
3. Student rate (enclose evidence):
   ( ) One year, 12 issues: U.S.A. $6.00, Canada $6.50, elsewhere $8.00.
   ( ) Two years, 24 issues: U.S.A. $11.50, Canada $12.50, elsewhere $15.50.
4. ( ) I enclose $ _____ *C ( ) Please bill my organization.

Organization _____
Purch. Order No. _____ Signature _____

RETURNABLE IN 7 DAYS FOR FULL REFUND IF NOT SATISFACTORY — HOW CAN YOU LOSE?

5. ( ) Any friends or acquaintances you would like us to tell about this?

Name	Address
_____	_____
_____	_____
_____	_____ *A

6. ( ) Any special request? _____ *A
7. ( ) Any remarks? _____
   _____
   _____ *A

Notes: *A = Attach paper if necessary. / *C = We are sorry we cannot enter subscriptions for individuals on credit.

Name _____
Address _____
City _____ State _____ Zip _____
Country if not U.S. _____