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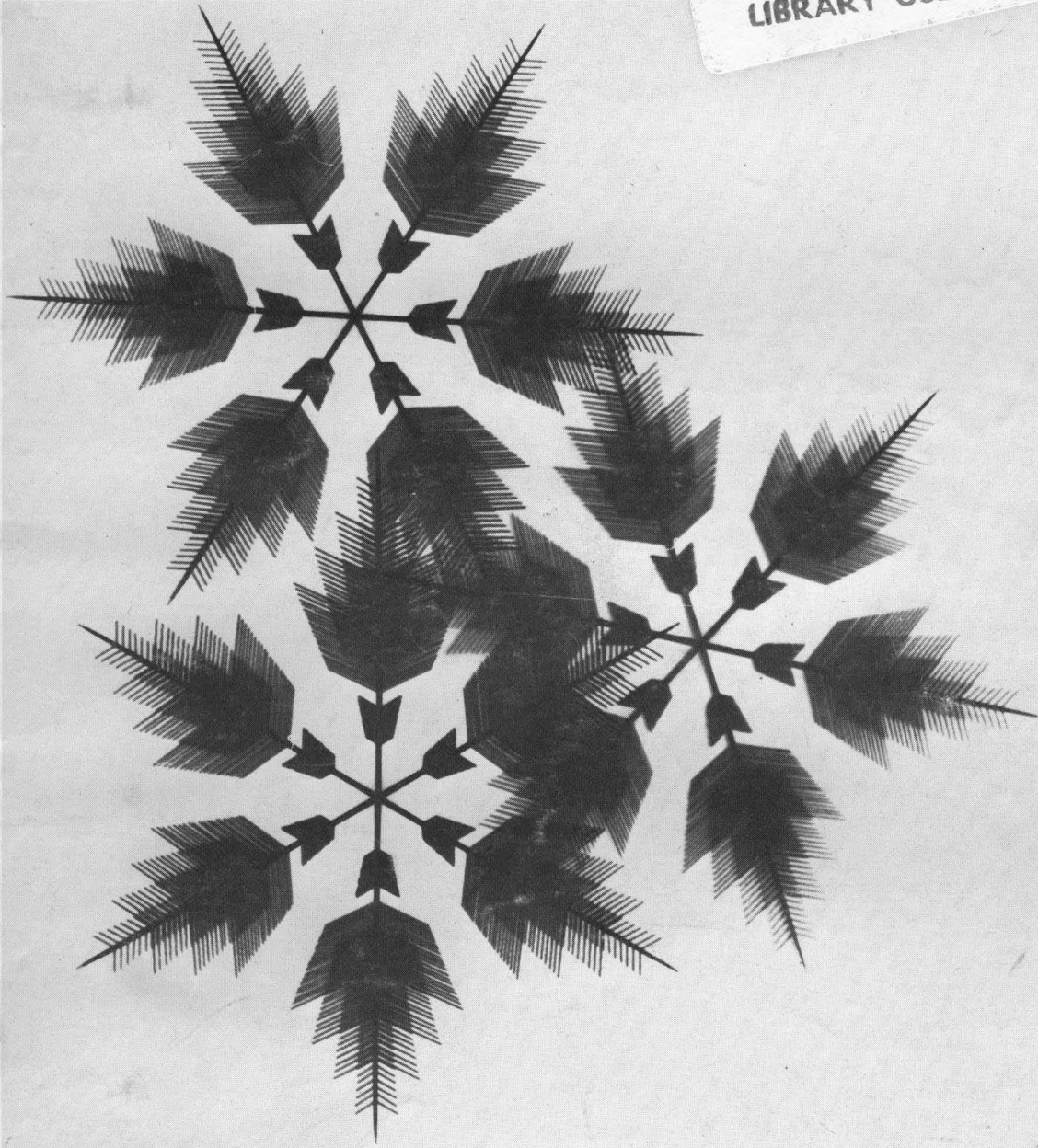
computers
and people

formerly *Computers and Automation*

SNOWFLAKE VIGNETTE   by Judy Kintzinger and Grace C. Hertlein

MULTI-ACCESS FORUM

"MAY I HAVE YOUR CREDIT CARD NUMBER, PLEASE?"

Ed Burnett
Ed Burnett Consultant
176 Madison Avenue
New York, NY 10016

In "The Evolution of Telephone Connecting" by William J. McLoughlin, Jr., published in the September 1974 issue of "Computers and People", on page 18, in the last sentence appears:

> One wonders how long it will be before voice controlled computers will be saying "May I have your credit card number, please?

As it happens this is already in force in Canada where the computer is asking for data which can be checked against the file, such as the address of the individual or the telephone number of the individual, and if this number coincides, an order can then be placed. If there is any fumbling, the computer has also been trained to say, "Just a minute. I'll have one of those fabulous computers known as a human clerk get in touch with you." This is now being done by Sears and others up in Canada.

BOX NO. vs. P.O. BOX NO.

Rush Harp
Yankee Town Pond Road
Box 69
Bearsville, NY 12409

I am a consistent admirer of your philosophy and magazine. However, your "Garbage In, Garbage Out" and "Computers Don't Make Mistakes" views lead me to mention a glaring error which is consistent with human beings:

> Your magazine is addressed wrong to me: "P.O. Box 69," instead of "Box 69".

Most box numbers are in a post office, for people who live and work in cities. However, not so, out here in the boondocks. P.O. Box 69 is another party than I am. Box 69 Yankee Town Pond Road is my own pet number. Nowhere or at any time does any of my correspondence say P.O. Box, but it is a consistent insistence of my publishers to include it. I love your magazine and hate to have the copies fall into other hands, due to your error.

Keep up the political assassination reporting. I am attempting to spread the word.

Editorial Note: Rush Harp's copies are now addressed "Box 69" and not "P.O. Box 69". We regret the error. *P.S.:* Computers OFTEN make errors! -- E.C.B.

COMPUTER ART EXPOSITION ISSUES FOR 12 YEARS

Irene Angelico
Centre for Interdisciplinary Studies
Concordia Univ.
2010 Mackay
Montreal, P.Q., Canada

I am giving a course on the relationship of art and science in the twentieth century, and will devote some time to computer art. If you would send me reprints of the 12 annual computer art expositions (or issues if reprints are not available) ... I would be most grateful.

Editorial Note: Reprints are not available but back copies are, and they may be ordered from us.
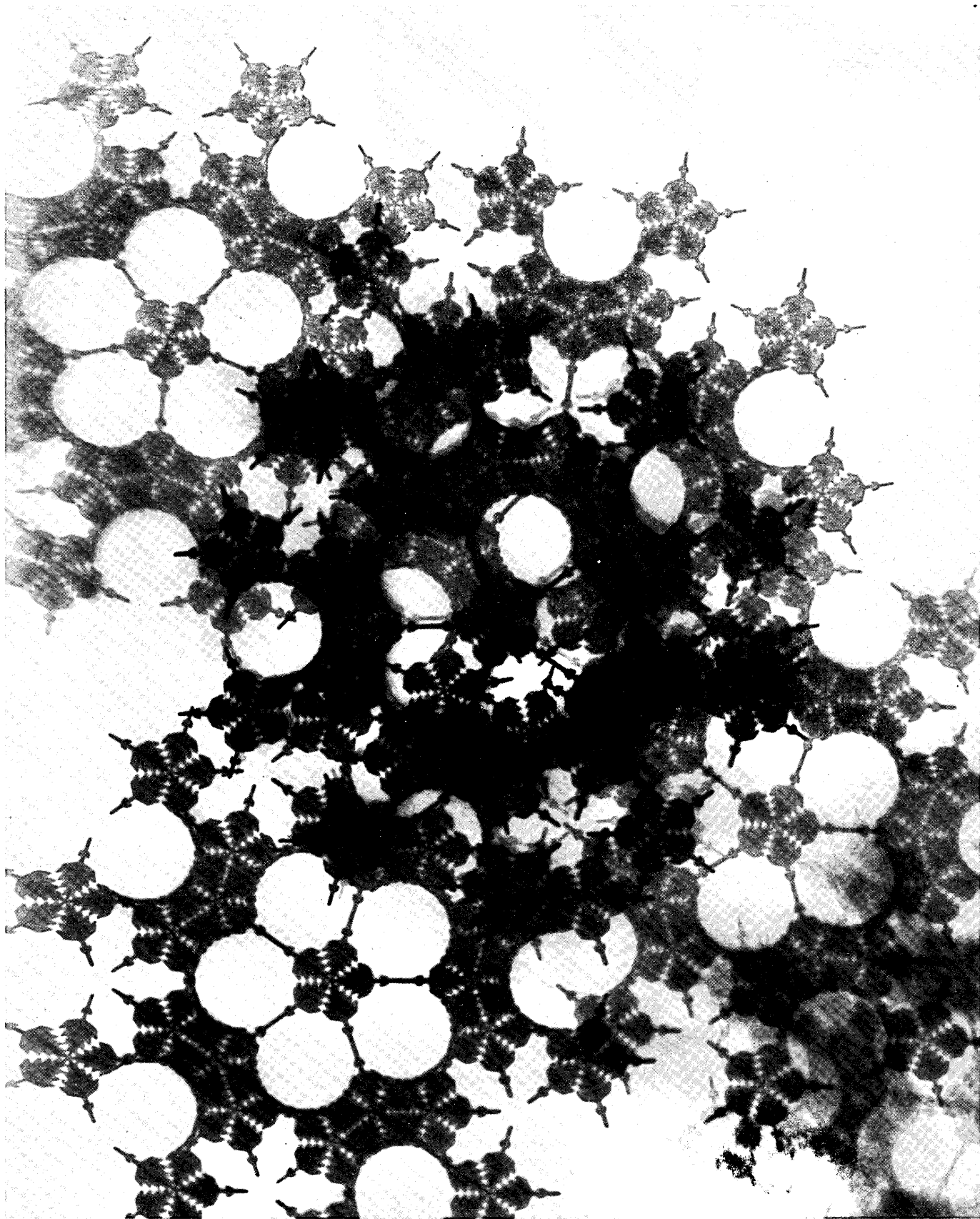
COMPUTER ART REPORT

Both the computer art on the front cover "Snowflake Vignette" and the computer art on page 3 "Apple Blossom Vignette" were made in the same way and produced in two stages. The first stage was carried out by Judy Kintzinger, a student in a computer art course in the summer school of the University of Iowa, Iowa City. In the first stage a design like a leaf or an arrow or a flower was produced by computer program, and then repeated in a rotated pattern; then the entire design, as a larger module, was again repeated in rotation and recorded on microfilm. The second stage was carried out by Grace C. Hertlein, art editor of "Computers and People," and instructor in Judy Kintzinger's course. In the second stage, the design was enlarged photographically and manipulated in various ways to produce several partially overlapping prints with different degrees of lightness and darkness.

SECOND INTERNATIONAL CONFERENCE ON COMPUTERS AND THE HUMANITIES — CALL FOR PAPERS AND ART

This conference will be held on April 3-6, 1974, at the Univ. of Southern Calif., Los Angeles, CA. Papers are invited relating to computer applications in the humanities (language, literature, music, history, archeology, culture, etc.) and in the areas of art and education. Abstracts should be sent to: ICCH/2, c/o Robert Dilligan, English Dept., USC, Los Angeles, CA 90007. Creative artists in any field of art are invited to send descriptions, slides, and abstracts to Assoc. Prof. Grace C. Hertlein, Computer Science Dept., Calif. State Univ.-Chico, Chico, CA 95926.

To register for the conference, write to ICCH/2, Founders Hall 407, USC, Los Angeles, CA 90007.

APPLE BLOSSOM VIGNETTE   *by Judy Kintzinger and Grace C. Hertlein*

computers
and people formerly *Computers and Automation*

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

ANNUAL INDEX FOR 1974

It is planned that the annual index for the 13 issues of *Computers and People* (including *The Computer Directory and Buyers' Guide, 1974*) will be published early in 1975.

If any subscriber needs an annual index urgently, before it is published, please write to Index Editor, *Computers and People*.
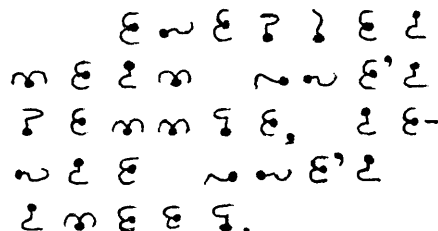
Key

[A]	—	Article
[C]	—	Monthly Column
[E]	—	Editorial
[F]	—	Forum
[P]	—	Picture

EDITORIAL

"CAN A COMPUTER BE CREATIVE?"

In a recent discussion a friend of mine conceded that a suitably programmed computer could be intelligent and a good solver of problems and a very good chess player, and more besides. But then he said:

> I subscribe to a denotation of thought as including the activity which we generally refer to as creativity, and this is a function which is currently denied to computers. They can do no more than they have been told to do, and obedience is not creativity. It is in the creative realm that man, the living agent, is inimitable -- thus far.

I looked up definitions of "create" and "creativity":

> create: to bring into existence; to bring about a course of action; to produce through imaginative skill; to design, invent, devise;
>
> creative: productive; innovative; formative; constructive; generative; having the quality of something created rather than imitated.

Then I read again parts of a famous essay "Mathematical Creation" by the great mathematician, Henri Poincare (1854-1912). In one place he says:

> What is mathematical creation? It does not consist in making new combinations with mathematical entities already known. Anyone could do that, but the combinations would be infinite in number and most of them absolutely without interest. To create consists precisely in not making useless combinations and in making those which are useful and which are only a small minority. Invention is discernment, choice.

A modern computer (which Poincare never knew about) can examine a million possible combinations in less time than a human being can examine a few hundred. Also, it can choose among the combinations, i.e., exercise discernment, according to stated requirements, at least a thousand times faster than a human being can.

So the argument, it seems to me, reduces to recognizing that there are really two kinds of creativity:

One kind we can call high-level creativity. This is the kind that probably my friend and Poincare are referring to. This is the kind displayed by an artist who uses oil colors to paint a portrait as good as Leonardo da Vinci's "Mona Lisa"; or a musician's use of a sequence of musical notes to compose a symphony as good as Beethoven's 5th Symphony. Nearly all human beings and nearly all computer programs are unable to display high-level creativity.

But some do. One instance of a computer program that displays high-level creativity is the checkers-playing program of Dr. A. L. Samuels of Stanford Univ. This program analyzes checkers situations in depth, and in addition learns from experience, and so this program has become a checkers champion; it plays checkers far better than Dr. Samuels, its author. This program is not "obedient" about checkers; it "knows" far more than Dr. Samuels does about checkers; it makes decisions for itself; and it revises and improves those decisions in the light of experience.

Second, there is ordinary creativity. Suppose a kindergarten teacher calls Johnny's pictures "creative". Well, a computer with a random number generator and a graphic output can do just as well producing a collection of paint splashes. Or suppose a road crew shuts off a bridge for repairs and posts signs here and there saying "detour". A computer can do as well or better in locating the signs.

A great many people and a great many computer programs can display ordinary creativity. When a human being like Paul Erlich (1854-1915) makes 606 trials for a drug to cure syphilis, and finds that No. 606 works, he is called creative. When a computer makes 23,793 trials and finds that the last one meets best all the requirements, it should be called creative also.

So the net conclusion to the argument, it seems to me, is this:

- ordinary creativity is within the reach of a great many human beings and a great many computer programs;

- high-level creativity is out of reach for almost all human beings and almost all computer programs;

- the proposed criterion "men are creative, computers are not" does not work, is not effective, to distinguish men from computers;

- a computer can be creative.

Edmund C. Berkeley

Edmund C. Berkeley
Editor

Languages Among Computers, Machines, Animals, and Men

Lawrence M. Clark
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Framingham Centre, Mass. 01701

"We are like fish swimming in an ocean of natural language. We are thoroughly immersed in that ocean, and often blind and ignorant about what lies outside of the part of the ocean that we happen to know."

Outline

Part 1. A Survey of Languages

1. Telling Computers What to Do
2. Listening to Computers
3. The Problem of Wrong Instructions
4. Artificial Languages for Instructing Computers
5. Ordinary Natural Language for Instructing Computers
6. Languages Among Machines That Are Not Computers
7. Languages Among Animals
8. Languages Among Men
9. Essential Features of a Natural Language

Part 2. The Designation of Meaning

1. Linguistic Constraints Upon Thinking
2. The Words for "A Group of"
3. The Misleading of Thought by Language
4. The Words for Mathematical Ideas
5. How to Improve the Designation of Meaning

The purpose of this article is to report on a number of aspects of language, to discuss some significant problems of designation of meaning, and to indicate some probable future developments in language. Computers make extensive use of language in order to fulfil their functions; to place computer languages in the perspective of languages in general may be helpful.

1. Telling Computers What to Do

Anybody who approaches a computer is compelled to pay some attention to the subject of language. For if one intends to have a computer do something useful, then one regularly has to tell it what to do and how to do it; and this requires a system for giving instructions.

Now you yourself can avoid telling the computer how to do it -- by hiring a computer programmer, or buying a software package, or through some equivalent process. But still the person who does the programming or makes the software has to learn a system for instructing the computer, a language.

This requirement implies that you (or your substitute) has to learn a system for communicating with it. And a system for communicating is a language. So the subject of languages in general is intimately associated with the use of computers.

2. Listening to a Computer

The computer may respond to you with a single final answer, or it may respond to you not only with the answer but also with many intermediate answers and other pieces of information besides. In the case of access to a computer through a time-shared terminal or non-shared console, you can get so much response that you reach rather full and adequate two-way communication.

This is an important additional dimension of language; interaction. The computer says things to you and you say things to the computer. Interaction is far more satisfying to human beings -- most of whom love to talk. To talk to a computer and to have a computer talk back rationally can be thrilling. This experience "turns people on;" it is an experience that helps deprived learners learn. See the references "The Personality of the Interactive Programmed Computer"/ 2 / and "Computers in Inner-City Classrooms"/5/.

The responses of a computer can be of several styles. The least useful style happens when the computer types just a questionmark when it has not understood something as an instruction. Then you wonder what you might have said to the computer that it could not accept; and having come to some conclusion, you try a new command on the computer, to see if that works. A much better response from the computer happens when the computer types "Error 21," say, and then you look up error 21 in a numerical list of errors, find it, read the description, realize what you did that was wrong, and act differently. A still better system happens when the computer queries you, specifying different possibilities you might have intended, and asks you -- then you are able to choose among the possibilities, give the computer a correct instruction, and proceed.

3. The Problem of Wrong Instructions

Every now and then you find out that a computer has done exactly what you told it to do, but not what you wanted it to do.

If you had been talking to a clerk about a calculation, the clerk would have known from his prior experience that you could not have intended something that you said; and so applying his experience or general knowledge or common sense, he would have changed what you said to what you meant. Many rather famous

stories are told about how a computer did just what it was told to do but not what the programmer intended. One such story is of the Mariner space probe that was to fly by Mars and photograph it; but it missed Mars by a great distance because somewhere in the long series of instructions controlling it a hyphen had been typed instead of a space.

To guard against errors of language, logic, or human mistake-making, etc., many common sense procedures have evolved. For example in a system using interactive business programs, when a clerk is using a video data terminal to enter orders, on the screen may appear something like:

> Do you want to make any changes in this order? (Y/N).

Then the clerk looks over the figures, compares them with the incoming purchase order, and if he sees nothing wrong, he types N. Then the screen once more responds:

> Last call: are you really sure all the figures here are right? (Y/N).

Then presumably the clerk compares once more, and if it still appears that all is correct, this time he has to type Y. At that point and only then, the system accepts the data and enters the incoming order.

4. Artificial Languages for Instructing Computers

The need to instruct computers, to tell them what to do and how to do it, has been responsible for the development of a large number of artificial languages, probably more than 2000 in all. At the beginning of computers, for example in 1944 at the Harvard Computation Laboratory with the Harvard IBM Automatic Sequence Controlled Calculator Mark I, it was necessary to write instructions in fine detail. These were sequences of 24 ones and zeroes in bottom-level "machine language." These sequences of ones and zeroes controlled 24 corresponding switches at the tape reading station. As each instruction was read on 24 hole paper tape into the computer, the machine connected two locations A and B to the bus and performed operation C; each of A, B and C used eight one's and zeroes.

Then special purpose languages came into use, many of them expressed in "symbolic assembly language." This would "assemble" a program on a specific computer, and would allow the programmer to designate locations where particular data was stored by using its symbolic address rather than its actual address. Then "general purpose" languages were developed, such as FORTRAN (which was the first), BASIC, COBOL, PL/I, APL and a number of others, and probably over 300 more. These freed the programmer from the need to specify particular locations for the storage of each piece of information. These languages theoretically and often in practice could be used without change from one computer to another.

Some general purpose languages were developed to apply to restricted classes of problems, such as:

> AED, for Automated Engineering Design;
> SIMSCRIPT II, for large problems in discrete simulation;
> COURSEWRITER, for computer-assisted instruction in any field of knowledge; etc.

The languages for expressing algorithms (calculating rules and procedures) and the general purpose languages for instructing computers have interwoven with each other.

5. Ordinary Natural Language for Instructing Computers

For more than 25 years it has been widely believed and maintained that only rigorous, precise, exact language could be used for talking to computers and that human beings therefore had to become inhumanly exact and inhumanly logical in order to program computers. This is not true.

About 1972 Warren Teitelman, then of Bolt Beranek and Newman, Cambridge, Mass., developed a system DWIM which was a "front end" for using the general purpose programming language called LISP. LISP is hard to use because it is unusually fussy in insisting on properly matched pairs of parentheses (mathematical parentheses placed around expressions). He wrote a report "Do What I Mean: The Programmer's Assistant." He described a number of techniques incorporated in the front end which would "forgive" a human programmer for his mistakes. It would either automatically correct rather transparent mistakes, or query in regard to a suggested interpretation. In this way DWIM would remove much of the labor from the programmer, enable him to concentrate his attention on higher level issues, and become markedly more efficient in his use of LISP. See Reference 14.

Work in understanding ordinary natural language is going on at a number of laboratories including Mass. Inst. of Technology, IBM Corp., Stanford University, Xerox Corp., and elsewhere.

A series of articles on "Computer Programming Using Natural Language" has been published in this magazine. See Reference / 3 /. The evidence offered in these articles demonstrates that a computer program can take in a great variety of non-rigorous instructions (that are unambiguous), and produce rigorous instructions from them.

Some of the work in being exact in programming is being transferred from human program writing into human questionnaire answering, which is easier. IBM Corp. has a programming language called RPG II (Report Program Generator Model 2). In this language a good deal of the information for programming a computer to cover a particular business application consists of answers to a series of questions, yes or no. After all the questions have been answered, the series of yeses and noes are put into the computer system that makes programs (an RPG II compiler). That goes to work and produces the tailormade program that covers the needs of the particular business application.

So much for the present discussion of the state of computer languages. Let us turn now to considering languages in other areas.

6. Languages Among Machines that Are Not Computers

Many machines that are never thought of as computers also require a system for communicating between the machine and a human being, and between the machine and the environment. An ordinary motor car driven by an ordinary human being is such a machine. It contains many pieces of apparatus (odometer, speedometer, fuel gauge, oil pressure indicator, etc.) for communicating information to the driver, and for receiving instructions from the driver (steering wheel, gear shift handle, brake pedal, etc.)

Some machines act in complex ways quite independently of any human operators. Such machines detect information (through sensors) and perform actions that work on the environment (through acting elements

like valves, rods, bells, etc.). They all contain somewhere a black box (or more than one black box) where the incoming signals from sensors are appropriately associated with the outgoing signals to acting elements.

Such machines are often called servomechanisms or automata or robots. A very simple example of a robot is the heating system in an ordinary building -- with its thermostats, pilot flame, valves, relays, etc. A very complex example of a robot is the dial telephone system of North America. That may well be the largest and most complex robot ever made.

The languages spoken inside this robot are sets of ones and zeroes for some purposes, sets of tones (as in the touchtone telephone) for other purposes, and probably more.

Ordinarily in these languages there will be just one word or expression to express each idea or meaning in the same way as in mathematics, where the expression 2 is always used for the idea two. But when the dial telephone system starts talking to a human user, it will translate into one of the ordinary natural languages, and utter sounds. For example, nowadays when I dial a telephone number that has been changed, the system (doubtless a computer connected to a recording of a voice) tells me the digits of the new number, and a little later in the recorded message it repeats those digits once more.

7. Languages Among Animals

Many kinds of insects, birds, and animals have an important degree of language. One interesting source of information is the book "King Solomon's Ring" by the Austrian naturalist Konrad Lorentz. See reference/10/. A colony of jackdaws that nested on and near his house were able to do a fair amount of communicating on a number of subjects. Repeatedly one of the jackdaws, who was lonely, in her song seemed to carry on a soliloquy about "good old times," until finally one day her mate, a jackdaw who had been lost for a long time from the colony, returned from migration, and resumed his relationship with the colony and with her.

Ants succeed in conveying information to each other. The language appears to consist of different chemicals and smells that convey signals; probably also the motions of ant antennae convey signals. The number of possible choices of information to be conveyed is probably rather small, perhaps no more than several dozen. One August I observed an anthill which was eleven feet across, located near Nyack, N.Y. This anthill maintained herds of aphids on scores of leaves of bushes a hundred feet distant. The herds of aphids were tended by the ants. There were well traveled trails in the deep grass between the aphid farms and the anthill. Such organization implies a system of communicating information; and any such system is a language.

Bees undeniably have a language that conveys ideas. Some excellent studies by the Austrian investigator Karl Von Fritsch, have shown that bees convey to other bees the distance and the direction from the hive of especially attractive food. He began his experiments by setting out a dish of scented sugar water at a certain distance and direction from a bee hive. For two or three days no bees found the dish. Then a few bees did find the dish; he marked them with paint. Soon a great many more bees not marked with paint came to the dish of sugar water. He varied the location of the dish, and observed the behavior of the painted bees within the hive. The hive

had been made with a glass side; he could watch with red light invisible to the bees. The scout bees returning to their hive seemed excited; they carried out an elaborate "dance," which other bees detected with their antennae. The dance was either a round dance, or else a wagging dance; the number of rounds and the number of waggings in an interval of time indicated the relative distance of the sugar water. The direction of the sugar water was indicated by the direction of the dance of the scout bees, in this way: if the hive was horizontal, the direction of the scout bee's forward motion in the dance was the same as the direction of the food; if the hive was vertical, then the direction of the dance of the scout bee was at an angle from the vertical which was the same as the angle of the direction of the food from the direction of the sun.

According to investigators, birds have learned languages up to several hundred words; most of this learning is parroting, utterance without attention to meaning. The method of teaching a bird any words is affectionate and loving rearing of the bird in the way that a mother brings up her young. Occasionally, however, the bird will use words with their proper meanings, like saying "Don't go away" to the investigator.

Monkeys that live in families in the tropics apparently use a language consisting of maybe six to a dozen signals. Wolves that live in families and packs have a degree of language by which they give and receive information. See the book "Never Cry Wolf" by Farley Mowat./12/

Chimpanzees in captivity, according to some investigators, have about twenty words or signals. A story is told that one scientist having learned some chimpanzee language at the Yerkes laboratory made himself welcome at once among a group of chimpanzees in the London zoo by talking to them in chimpanzee language.

Chimpanzees also show evidence of being able to deal with nonverbal symbols. At the Yerkes Regional Primate Research Center, Athens, Ga., a chimpanzee named Lana has been "talking" with the aid of a computer and a new language called Yerkish created especially for her. She can make grammatically correct requests for food and entertainment by punching out sentences on a special vertical keyboard; and she can "read" in her language. See the report "Communication -- Three-Way: Chimpanzee, Man, Computer," Reference/ 7 /.

8. Languages Among Man

Of all the tools of human beings, language, equipment for communicating, is probably the most ancient and the most indispensable. In order for the members of a species to work together in complicated ways, language is necessary. In order for the young of the species to be trained, not only by examples and sensations, but also by ideas and commands, language is necessary. With language the adults teaching the young do not have to find and illustrate all the situations for instruction; some of the situations can be dealt with by words alone. Finally, the separate items of language can be used as markers, as counters, for the process of reasoning and thinking.

What is language? Basically, language is equipment for referring to and handling all the ideas, situations, and experiences that a society is interested in. Language deals with the experiences and situations that occur in the culture of that society.

What kind of equipment? In the case of nearly all human languages, the equipment basically consists of sounds that human beings can·utter and hear, and to which meanings have been attached by convention. The convention is an unspoken general agreement among the members of the society which is learned thoroughly as the young people grow up in the society.

The purposes of human language are: communicating, that is, conveying ideas, asking questions and getting answers; reasoning; describing strange ideas in terms of familiar ones; expressing emotions and feelings; expressing politeness and ceremony.

Language contributes so very much to the thinking of human beings that we are seldom aware of all that it does do. Beginning with our earliest years, language teaches us, educates us, focuses our attention, and commands us to deal with the ideas that language alludes to. Language provides hooks for hanging our ideas on, boxes for putting them in, and trays for moving them around. Language is a mirror of the thoughts we have, and it reflects them quite faithfully and impartially -- both when we are right and when we are mistaken.

The languages actually spoken by the groups of human beings all over this world have been studied to a considerable extent. An inventory of them as of about 1950 is as shown in Table 1.

Table 1

Area	Approximate No. of Languages Spoken
Europe and Asia	720
Africa	530
North America	240
South America	240
Total	1730

Among these languages there is a tremendous variety. Many of them make neat and felicitous distinctions which are absent in English; many of them ignore distinctions which are present in English.

9. Essential Features of a Natural Language

Amid all these variations, what is essential in a language?

Every one of the known languages is made up of sounds. The most convenient equipment for symbolizing ideas has always been the sounds that human beings could utter and hear. Other languages such as writing are secondary.

The sounds that occur in languages have been inventoried and studied. There are perhaps some 60 sounds and some 60 styles of modifying them, making mathematically 3600 combinations. These elements are technically called phones, and the study of them phonetics.

In any one language, a cluster of phones may be treated by the speakers of that language as having the same significance. In English for example, a cluster of different ways for letting air explode through the lips is designated as "b" and another cluster of similar sounds is designated as "p", and they are distinguished by speakers of English; in Dutch this difference is not observed, "p" and "b" are not distinguished.

In any language each cluster of sounds selected by the language as significant is called a phoneme,

and the study of them is called phonemics. Phonemes do not have meanings in themselves.

Every language can be organized into phonemes. The number of phonemes present in a language ranges from 17 in Tagalog, a language of the Philippines, to 45 in Navaho, an American Indian language of Arizona. There are about 40 phonemes in English, about 17 of vowel type, and 23 of consonant type.

In every language phonemes are arranged and assembled into words and word elements. Words and word elements are technically called morphemes, units of form; morphemes are those arrangements of phonemes which have meaning in the language.

Every language consists of a large set of words (morphemes). A collection of all the words (morphemes) in a language is a dictionary. A collection of all the meanings represented among the words in a language is a lexicon. Every known lnaguage has at least 5,000 words, and English, the largest language, contains over 500,000 words.

Every language recognizes single complete linguistic utterances -- which are often called sentences, although that term is not inclusive enough.

Every language has rules for assembling words and word elements into utterances. These rules are called grammar and syntax. Every known language has intricate grammer; some languages have grammar much more intricate than others. English has lost most of the old grammar that it used to have. This was a fortunate result of social conditions in the 300 years following the Norman conquest of England in 1066.

Every language has the power to express a large part of any situation occurring within the social culture in which it belongs. In addition it has the power to create new expressions. Thus as the culture of a society develops and changes, and new ideas need to be referred to, these new ideas also may be expressed.

Every language summarizes experiences that are not the same but are much alike into single words or expressions that are, to the extent of the summarizing, vague. For example, nearly every language has a word for "the sun"; and all the different manifestations of the sun at dawn, at noonday, at sunset, in clouds, or in clear sky are summarized and lumped together under one word, the word for "sun." But in at least one American Indian language, that word also refers to "moon"; the word in fact means "large shining heavenly object," and speakers rely on the context to show which one of the two they mean.

Every language has devices for classifying situations and experiences so that they can be described using a finite number of expressions. The devices for classifying situations and experiences vary greatly from language to language. Some of the classifications are obligatory and some are optional. It is reasonable to believe that the language that has the fewest obligatory classifications is the best. English has at least six obligatory classifications: they include number, gender, case, tense, and some other particulars.

Latin has more. For example, in Latin you cannot say "Who did it?" without specifying the gender of "who" and the number of "who." So there are four ways of saying this, and the speaker must decide which one to say. Even in English we may be re-

quired to specify "animate or inanimate." We run in-
to the problem when we have to say "who or what made
this letter?" In Chinese, one does not have to spe-
cify singular or plural unless one desires to. In
Chinese, the word for "horse" means "horse" or "hor-
ses"; optional words tell the listener whether the
speaker refers to one or more horses. Chinese in
this respect is certainly better than English.

Classifications that make no difference in the
social culture of the people speaking the language
will not be found. Classifications that are impor-
tant in their culture will be fully worked out. For
example, in Latin there were two words for "uncle";
these were "atruus" or "avunculus" depending on whe-
ther the uncle was the father's brother or the moth-
er's brother. But in English this distinction is
almost never thought of, much less registered in
separate words, because in our culture it is very
unimportant whether an uncle is via the mother or
the father.

The devices used for expressing grammar vary from
language to language. Some languages use order al-
most to the exclusion of other devices. Some use
suffixes or prefixes that tell which terms belong
together, the principle of concord. For example,
Edward Sapir, a former professor of languages at
Yale, gives an example from the Bantu language of
Africa. He says:

> In such a sentence as "that fierce lion who
> came here is dead," the class of "lion,"
> which we may call the animal class, would
> be referred to by concording prefixes no
> less than six times: -- in "that," in "fierce,"
> in "lion," in "who," in "came" and in "dead."

Distinctions which are considered obligatory in
one language may be almost missing from another.
For example, the distinction as to "definite" or
"indefinite" which in English we must always express
by "the" or "a" or in some other equivalent way is
missing from Latin, although Latin does have demon-
stratives. And of course in the English of news-
paper headlines, this distinction also disappears
as in "man bites dog" -- writer and reader alike
take it as part of the context, to be reasoned out
only if important.

Distinction as to parts of speech varies greatly
from one language to another. Most languages however
have noun-like and verb-like forms. Some languages
push adjectives into verbs, others push them into
nouns. We have no single verb for "is red," although
we do have a single verb that means "becomes red,"
namely "reddens." In some languages all adjectives
are verbs in this fashion.

Franz Boas, a great anthropologist, said that
some principles of grammar are the same all over
the world. He says:

> The relational functions of grammar have cer-
> tain principles in common all over the world.
> Here belong for instance the relations between
> subject and predicate, noun and attribute,
> verb and adverb, and the relation of the ex-
> perience to the speaker (the self) and to
> others -- that is, the relation expressed by
> the pronouns I, you, and he. The methods by
> means of which these and other relations are
> expressed vary very much, but they are neces-
> sary elements of every grammar.

Part 2. The Designation of Meaning

1. Linguistic Constraints Upon Thinking

In spite of the enormous richness of developed
modern languages, of which English is perhaps the
best example, natural language constrains, bends,
distorts, that which we may want to say.

Sometimes we cannot say what we want to say with-
out inventing new words and new forms of expression.
The English language actually adds about 1000 to 3000
new words, new uses of old words, and new expressions
to the language in every calendar year. A fine re-
port on these words introduced since 1963 is in the
book by Clarence Barnhart. See reference/ 1 /.

Edward Sapir (1884-1939), an American anthropolo-
gist, and a professor at Yale University, linguist,
and author, once wrote as follows, regarding the
important influence of language on human beings:

> Human beings do not live in the objective
> world alone, nor alone in the world of social
> activity as ordinarily understood, but are
> very much at the mercy of the particular lan-
> guage which has become the medium of expres-
> sion for their society. It is quite an il-
> lusion to imagine that one adjusts to reality
> essentially without the use of language and
> that language is merely an incidental means
> of solving specific problems of communication
> or reflection. The fact of the matter is
> that the "real world" is to a large extent
> unconsciously built up on the language habits
> of the group. ... We see and hear and other-
> wise experience very largely as we do because
> the language habits of our community predis-
> pose certain choices of interpretation.

In a basic sense, human beings deeply need more
adaptable, less conventional patterns in their
minds, so as to think better. We need to escape
limitations from culture, history, language, propa-
ganda, etc. Consider George Orwell's remark in
"1984" (published by Harcourt Brace, New York, many
editions):

> The purpose of Newspeak was not only to pro-
> vide a medium of expression for the world-
> view and mental habits proper to the devotees
> of Ingsoc, but to make all other modes of
> thought impossible.

2. The Words for "A Group of"

Let us take a specific example of linguistic con-
straint. Suppose we read a short report, first in
one style, then in a second style:

> One afternoon in August, John Jones drove
> away from New York in his car, surrounded by
> a mob of other cars. Flying overhead was a
> drove of airplanes. Soon he overtook a travel-
> ling circus, passing a swarm of elephants, a
> flock of dogs, and a bevy of trucks. As the
> sun set, he saw in the west a herd of rosy
> red clouds.

In the second style, here is the same report:

> One afternoon in August, John Jones drove away
> from New York in his car, surrounded by a group
> of other cars. Flying overhead was a group of
> airplanes. Soon he overtook a travelling cir-
> cus, passing a group of elephants, a group of
> dogs, and a group of trucks. As the sun set,

he saw in the west a group of rosy red clouds.

In this example, we see what happens when we deliberately scramble the customs of English in using words that mean "a group of," words like "mob, drove, swarm, flock, bevy, herd." English contains forty or fifty such words with different connotations. For example, "swarm" implies "a group of bees or insects" and "herd" implies "a group of large animals." Of course, there is almost no logical sense in varying the word meaning "a group of" depending on the kind of thing being grouped. But as long as writers want to write "good usage" and prefer to obey present happenstance usage in regard to words like these, so long will the expression of logical ideas be clouded, and thinking be constrained, bent, by the language of "good usage."

3. The Misleading of Thought by Language

Benjamin Lee Whorf (1897-1941), a graduate of Mass. Inst. of Technology, worked as an engineer in a fire insurance company in Hartford, Conn.; but a great deal of his avocational research and thinking was in the field of language and linguistics. The following passage is taken (with minor changes) from his article "The Relation of Habitual Thought and Behavior to Language" included in "Language, Culture, and Personality: Essays in Memory of Edward Sapir," edited by Leslie Spier, published by the Sapir Memorial Publication Fund, Menasha, Wisconsin, 1941:

((Beginning of Quotation))

An accepted pattern of using words is often prior to certain lines of thinking and forms of behavior. A man who assents to this statement often sees in such a statement nothing more than a platitudinous recognition of the hypnotic power of philosophical and learned terminology on the one hand, or of catchwords, slogans, and rallying cries on the other. To see only thus far is to miss the point of one of the important interconnections which Sapir saw between language, culture, and psychology. It is not so much in these special uses of language as in its constant ways of arranging data and its most ordinary everyday analysis of phenomena that we need to recognize the influence it has on other activities, cultural and personal.

In the course of my professional work for a fire insurance company, I undertook the task of analyzing many hundreds of reports of circumstances surrounding the start of fires, and in some cases, of explosions. My analysis was directed toward purely physical conditions, such as defective wiring, presence or lack of air spaces between metal flues and woodwork, etc., and the results were presented in these terms. Indeed it was undertaken with no thought that any other significances would or could be revealed.

In due course it became evident that not only a physical situation as physics, but the meaning of that situation to people, was sometimes a factor, through the behavior of the people, in the start of the fire. And this factor of meaning was clearest when it was a LINGUISTIC MEANING, residing in the name or the linguistic description commonly applied to the situation.

a. Empty Gasoline Drums. Thus, around a storage of what are called "gasoline drums," behavior will tend to a certain type, that is, great care will be exercised; while around a storage of what are called "empty gasoline drums," it will tend to be different

-- careless, with little repression of smoking or of tossing cigarette stubs about. Yet the "empty" drums are perhaps the more dangerous, since they contain explosive vapor. Physically, the situation is hazardous; but the linguistic analysis according to regular analogy must employ the word "empty," which inevitably suggests lack of hazard. The word "empty" is used in two linguistic patterns: (1) as a virtual synonym for "null and void, negative, inert," (2) applied to analysis of physical situations without regard to, e.g., vapor, liquid vestiges, or stray rubbish, in the container. The situation is named in one pattern (2) and the name is then "acted out" or "lived up to" in another (1), this being a general formula for the linguistic conditioning of behavior into hazardous forms.

b. Limestone. In a wood distillation plant the metal stills were insulated with a covering prepared from limestone and called at the plant "spun limestone." After a period of use, the fire below one of the stills spread to the "limestone," which to everyone's great surprise burned vigorously. Exposure to acetic acid fumes from the stills had converted part of the limestone (calcium carbonate) to calcium acetate. This when heated in a fire decomposes, forming inflammable acetone. Behavior that tolerated fire close to the covering was induced by use of the name "limestone," which because it ends in "-stone" implies noncombustibility.

c. Pool of Water. A tannery discharged waste water containing animal matter into an outdoor settling basin partly open. This situation is one that ordinarily would be verbalized as "pool of water." A workman had occasion to light a blowtorch nearby, and threw his match into the water. But the decomposing waste matter was evolving gas under the wood cover, so that the setup was the reverse of "watery". An instant flare of flame ignited the woodwork, and the fire quickly spread into the adjoining building.

Such examples, which could be greatly multiplied, will suffice to show how the cue to a certain line of behavior is often given by the analogies of the linguistic formula in which the situation is spoken of, and by which to some degree it is analyzed, classified, and allotted its place in that world which is "to a large extent unconsciously built up on the language habits of the group." And we always assume that the linguistic analysis made by our group reflects reality better than it does.

((End of Quotation))

4. The Words for Mathematical Ideas

One of the clearest examples of the need to break away from the restraints of ordinary natural language is the development of mathematical words for mathematical ideas. The special linguistic ways in which mathematicians talk about mathematics have developed for more than 2000 years.

For example, the formula
$$A = \pi r^2$$
is the mathematical form for the English statement
    The area of a circle is equal to 3.1416 ...
    times the square of the radius of the circle.
A formula which has had a name for more than 2000 years is the Pythagorean Theorem:
$$h^2 = a^2 + b^2$$
In English this is:
    The area of the square constructed on the
    hypotenuse of a right-angled triangle is equal
    to the sum of the areas of the squares con-
    structed on the base and on the altitude.

These are examples of the brevity and perspicuity of mathematical language, which is a forerunner of much of the language used for describing algorithms to be used on computers.

Mathematics is very largely a language that has three special properties. First, its chief subject matter is certain kinds of abstract elements -- numbers, lines, points, etc. -- and the relations of these elements. Second, its chief property is that it makes use of very efficient symbols, symbols that one can calculate with to a vast extent. Third, its chief purpose is to determine necessary consequences from given assumptions.

All these properties are of course present to some extent in ordinary language. In ordinary language, you can talk to some extent about numbers, lines, points, etc., and their relations. In ordinary language, you can even calculate to some extent. And, using ordinary language, you are often interested in deducing the necessary consequences of some suppositions. Accordingly the difference between mathematics and ordinary language is partly a difference of quality, but also a difference of degree. It is reasonable to believe that if you have a desirable property in mathematical language, you may be able to arrange the same desirable property in language.

We have mentioned calculation. What do we mean by it? We mean that we can manipulate symbols according to rules that pay little attention to meanings, and that when we come out with results at the end of the process of manipulation, then our symbols often apply truthfully to real situations. People can and do calculate with ordinary words, even when they are not sure of the meanings of these words. Here is an example taken from "Language and Communication" by George A. Miller:

> Suppose we learn on good authority that all mantelops are lespeads and that all lespeads hile. We can conclude immediately that all mantelops hile, and that any grimpet that does not hile certainly is not a mantelop. There may of course be lespeads that aren't mantelops, so hiling is not a sure sign of mantelopicity.

Then he says:

> The fact that we have no idea what we are talking about does not stop us from talking. We simply operate on names and properties according to the rules governing the use of logical terms.

And he might very well add, though he did not say so, that the reasoning is perfect, and that all we have to do to get truthful uses of the statements about "mantelops, lespeads, hiling, grimpets" is to interpret the words in suitable ways.

5. How to Improve the Designation of Meaning

How shall we improve the designation of meaning? and the description of reality so that we can more faithfully describe it and deal with it?

Of course this is an old problem. Many people work on it both consciously and unconsciously from time to time. A person who coins a new and useful expression is helping in this process. In the United States some time in the 1830's the expression "OK" was coined. No authority is quite sure of the derivation. Now the word is internationally used, and

everywhere understood and accepted. It filled a need. And it is much clearer than "yes" and "all right."

There is continual competition in language between different expressions for closely related ideas. The competition often produces two words where there was just one before. "Of" and "off" for example are both derived from the same word. Differentiation is the name given to the linguistic process.

The movement for the liberation of women has produced the word "Ms." (pronounced "miz") so that a woman can be addressed politely without the designation of whether or not she is married. This is obviously a useful and democratic improvement and probably is permanent. Correspondingly, "spokesman" and "chairman" have sprouted the words "spokesperson" and "chairperson." Whether these three-syllable words offered in place of two-syllable words will survive is a question; but the words might survive.

Perhaps the most important process for improving the designation of meaning is paraphrasing, translating from one set of words, often with highly colored overtones, into words that are much more neutral and avoid those overtones. "Shit" becomes "excrement". "Pigheaded fool" becomes "stubborn and foolish person". "The morgue" of a hospital becomes "Ward X".

Paraphrasing -- translating expressions into other expressions that "say the same thing but say it better" -- is a key process.

A computer can do paraphrasing. When a program is written in FORTRAN, the computer by means of what is called a FORTRAN compiler can paraphrase that program into a machine language program that will enable that computer to solve that type or problem.

The program "DWIM," "Do What I Mean," mentioned above can do paraphrasing. It will accept many variations of computer input from a human being and convert them all into a single standard computer input. This is the early seed of a great development in computer applications.

We are like fish swimming in an ocean of natural language. We are thoroughly immersed in that ocean, and often blind and ignorant about what lies outside of the part of the ocean that we happen to know.

The development of computer paraphrasing of expressions, statements and discourse in ordinary natural language will take us a long way. Like lung fish we shall climb out of the ocean, and begin to obtain a much greater and more correct picture of the world, eventually including land, atmosphere, and space.

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The Frictional Interface Between Computers and Society

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"We all must cease to make wrong decisions on a large scale because mankind can no longer afford it. Mankind's resources are highly limited, and we can no longer squander them." — V. A. Trapeznikov

For purposes of this article I propose a simple and perhaps novel classification of computer applications -- in three classes.

The Computer Advises

Applications that do not lead to decisions affecting humans directly -- Examples come largely from the field of numerical computation, the earliest category of usage. Computational results that might tend to prove or lead to a theory; calculations for spaceship or missile design (they don't have to be built or launched); programs for playing games, or associating payoffs with strategies, etc. We may term such computation "advisory."

The Computer Proposes Decisions

Applications with computational results that lead to decisions by humans -- Some of these can get very close to integration into human affairs. For example, someone may be denied credit or refused an employment opportunity. It has turned out, in much practice, that the human decision to be taken may be perfunctory or mindless. Nevertheless there is recourse, no matter how time-consuming and difficult it may be, and regardless of what body of law may need to be enacted to protect people in such circumstances.

The Computer Decides, and if not Countermanded Acts (the Robot)

Applications where the computer has been previously programmed to take a decision and take an action, and will in fact act unless countermanded in time -- Examples are online patient monitoring, control of nuclear power plants, air traffic control and collision avoidance systems, automatic transportation systems (i.e., BART, in San Francisco), and automobile braking and antiskid systems.

Tremendous Increase of Robots

The hardware developments of about the last three years leading to microprocessors on chips, portend a tremendous increase in the third class of application. And this is why we must be on guard as to the propriety and systems aspects of such applications. Applied to automobiles, such applications could be extremely critical. One is reminded of power-steering, a boon when it operates, perhaps, but a definite danger when power fails or is turned off.

A pair of questions indicates a possible dilemma:

Q: Does technology exist to integrate computer components very closely into human affairs?

A: Yes. For an example, see the 1974 US automobiles, which will not operate unless seat belts are fastened.

Q: Are system design and good practice manuals available for such a level of technology, and/or is suitable indoctrination and education available in our educational institutions?

A: Emphatically NO! This fact is frightening enough to suggest a moratorium on such developments until we understand the tool better.

Inoperable Robots

Consider the announcement of an experimental device which requires matching a certain procedure before you can start your automobile. The intent, and certainly an obvious usage, is to preclude drunken drivers from operating vehicles. But suppose that you are extremely shaken because your wife has just been killed, and your child needs to be taken to the hospital. Could you start the car then?

Or consider the case of online patient-monitoring reported in Datamation magazine of 1972 October. The programming was correct but the computer was not 100% reliable. This, as we know, is taken care of by having a customer engineer to fix it. But nobody remembered to find out whether the customer engineers would always be available over the weekend, and speedily. As reported, a patient died because confusion in the human system caused the computer to remain inoperable.

Space Effort Experience in Overriding Robots

Certainly the US space effort has gathered ample experience in the matter of letting computers decide, when they are capable of it, and of overriding them sensibly when it is shown that they were programmed incorrectly or without consideration for all eventualities and malfunctions. We see many spin-offs from the space effort with respect to products, but very little in methodology which could be so very applicable to computer usage.

Computers as a Boon

Now, I like computers. I believe that they are presently more beneficial than harmful to society, and that this ratio can be increased if we take careful consideration and plan for their best and proper usage.

If I were fatalistic, I should feel that they have arrived just in time to save us from our enemies, who are ourselves. In 25 years as a programmer I have never faced a day of working with computers without pleasant anticipation.

I also like a fire in the fireplace, but not arson. Both fire and computers are tools accessible to all of society in some form, and society uses such basic tools in many ways, some deemed good and some bad.

Fire was an early tool, useful for hollowing out logs to make vessels, to make transformations in food, and to heat enclosed air. It was also used to burn vegetation and trees, sometimes accidentally (which was thought bad) and sometimes deliberately, to clear for planting (which was thought good).

Side-Effects, Unanticipated

A major difficulty in analyzing the contribution of a tool is the inability to categorize, in an absolute way, its uses as being good or bad. This is not philosophical, but only to remind us that we make these judgments of good and bad in the narrow context of our mores and morals, which are in turn conditioned by our accumulated knowledge and analysis of the workings of our world. We have learned a little more of those workings lately, not because we sought the knowledge so much as because it has been made painfully evident to us that there is more or less coupling between all the elements of our world.

I quote from an interview with Dr. Carl Hammer of Univac, regarding a conversation with V. A. Trapeznikov, acting Co-Chairman of the United States and Russian Joint Commission on Scientific and Technical Cooperation: "He told me, as he told President Nixon one day earlier, that 'we all must cease to make wrong decisions on a large scale because mankind can no longer afford it. Mankind's resources are highly limited, and we can no longer squander them' ... we must develop not only national but international models for improving our decisionmaking processes. Decisions which at this time are made on a political or emotional base, neither way will produce optimal results."

So I touch on some bad uses of computers only to illustrate the problems to overcome by legislation, education, and professionalism to make computers serve us better.

Mind-Amplifying Factor

Carl Hammer says "We have already built into our society a mind-amplifying factor of 2000 to one. Behind every man, woman, and child in this country (the US), there stands the power of 2000 human beings. The responsibility of any data processing manager of today, of the computer scientists ... is so enormous that even I cannot envision it. It is the greatest challenge that has ever faced mankind."

Power it is, in elemental form. IBM's recent advertising stresses "think of the computer as energy." Theoretically, the computer is vast power at the service of people, to be used as the imagination of the people leads it, subject of course to limiting legislation.

Knowledge Power

But let us not be lulled by any advertising into thinking that the energy is just like electricity. Computer power is work power, but it is also knowledge power, of the kind that has been used throughout history for aggrandisement as well as the good of the people. In a time when technology stands at bay, it will be well to consider the dangers of computer misuse in prejudicing the population against a valuable tool, and of misuse by corrupt or ignorant officials.

There are no known instances of computers voluntarily stopping normal work to perform illegal acts without direction by humans. Consider the science fiction capability of walking through matter; we have seen it in the cinema, usually used to get into the bank vault or perform some other evil deed. But in the cinema it was a power accorded only to a few, being so technically difficult. Computer power is available widely, and we must not be surprised that some people should turn it to their own ends in disregard of the general benefit of society.

Jerry Schneider: Crook, Then Security Consultant

Consider the case of Jerry Schneider. There is no problem with mentioning his activities. He sent an abstract of a paper that he wanted to present at the 1973 National Computer Conference, telling about how he tapped into a computerized ordering system and stole something like $1 million of telephone equipment by having it delivered to a telephone company van bought at auction. The computer program, not knowing how to bill and get payment, ignored it as being within loss limits. When turned in by an employee, Schneider spent two months in jail and was back in business as a computer security consultant!

There is no question but that computer power may be abused by individuals. It may be so used by larger entities, such as corporations, to fool or defraud. It may be so used even by governments, however wittingly.

Redressing the Balance

Dr. Henry Bruck of M.I.T. spoke of this at ACM 70, in a talk entitled "To Redress the Balance." His thesis was that computers, because of cost and training investment, were more likely to become the tools of government and big business than the general public. Countering the argument that minicomputers, microcomputers, and hand calculators are available to individuals at low cost, he said that it was a fallacy to assume that this meant that computer power was available to the general public for this reason. Shovels for a penny are useless unless one knows how to dig, and has arms. It is the usage skill that is important.

He thought that modifying education so that imparting basic computer skills (and problem-solving techniques) would be given as much emphasis as learning one's own language would be unnecessary overspecialization. Nor would the answer be to reduce usage by government and business, for we have ever more need for decisionmaking information that is more likely to be accurate and complete, taking into account the overall advantage to people. However, he saw no reason why computer services could not be provided to the citizenry through public institutions.

I agree. There are many opportunities for compu-
ter services to be provided by municipalities and/or
private ventures. One can imagine data banks that
could serve as advisories for human action and choi-
ces. There is an experiment in Los Angeles where
the computer serves as a general counselor for a
multitude of services. Consumerism could be served
in a great many ways -- product safety and efficien-
cy, comparative shopping, financing aid for major
purchases, reminders for preventive maintenance, etc.

Thus there are many ways to redress the balance
by making computer power really available to every-
one in a direct manner and without having to learn
how to program. There is a need, however, for a
certain amount of "computer literacy" in order to
feel comfortable with such usage.

Mystique of Computer Authority

As a tool, the computer has become commonplace
with a rapidity exceeded by no other, even the auto-
mobile. This has caused some disallocation and un-
ease, which the practitioners have not been able to
avoid. Most major tools, when introduced, have had
their custodians, and then their guilds or profes-
sions that, from gradual experience, added to the
body of law and practice those safeguards for usage
that appeared necessary from gradual occurrences of
misuse.

This did not occur with computers, and perhaps
we did not even use the time that was available to
us, so caught up were we with the mystique and power.
Certainly we did not familiarize people generally
with computers; instead, they were publicized as
"giant brains," and the mystique grew into "authori-
tativeness."

One of the main problems with authority is that
it can be blamed. Surely you all know many examples,
but I shall add a few to your knowledge.

Perhaps it is a worldwide phenomenon. One calls
the store that has made a mistake in the bill, the
bank that has not returned the cancelled checks, the
association that has blacklisted your credit -- and
the voice replies "I'm sorry, sir, but we have a com-
puter now ...".

The Allen Piano Co. Lie

The Allen Piano and Organ Company of Phoenix ad-
vertised by radio that its computer had made a mis-
take in ordering inventory; they were now overstocked
and were therefore holding a sale. I wrote the com-
pany a letter, on behalf of the Association for Com-
puting Machinery, offering to fix the computer or
program so it would not make such a mistake anymore,
on condition that "if it developed that a human was
at fault," and not a computer, they would so acknow-
ledge this in their subsequent broadcast advertising.
Datamation magazine followed the story -- it turned
out that the Allen Piano and Organ Company DID NOT
HAVE a computer, nor did they use any computer faci-
lities.

Note the convictions of the advertisers that a
computer would give authority to their spurious claim
of overstocking.

The No-Apostrophe Lie

One Mr. D'Unger, not of the computer community,
wrote to several companies maintaining mailing lists
containing his name, either for billing or solicita-
tion, asking them to please spell it correctly. Not

DUNGER, and not D UNGER, and not Dunger (for those
with lower case capability). He received several
replies, all saying that it was unfortunately impos-
sible with their computer equipment. Learning of
this from his letter to Computerworld, I called sev-
eral of these data processing departments, to find
in each case that the print chain was in fact an IBM
chain that did have the apostrophe on it, but that
they had not bothered to use it! It seems to me that
a man's name is a dear possession, and not one to be
treated cavalierly under cloak of computer authority.

The Bank Lie

I once visited a home where four elderly women
were playing bridge. When they found out that I was
in the computer profession there was a chorus of hor-
ror stories. Then one brought out a letter from her
bank, with a handwritten apology from the teller for
the shortcomings of the computer. I was on the spot.
To save face I called the bank vice president to see
what could be done. They didn't have a computer
either!

The Authority of the Computer
as an Accomplice

The computer is a convenient means of implicitly
or explicitly covering activities that run from il-
legal to self-serving, intentional or unintentional.

The notorious Equity Funding scandal will certain-
ly become a classic, even though the exact ways that
it was perpetrated will take some time to discover.
We know, even now, that it was a pyramiding opera-
tion, and that computers were used to give authority
and extra layers of protection from discovery. Many
corrective actions could arise from the case, such
as new emphasis on EDP auditing. It appears that
perhaps as many as 200 people were involved in col-
lusion.

The University of Michigan has a research service
that projects the effect of various decisions and
actions upon the GNP (Gross National Product) and
its growth, with respect to the State of Michigan.
The results could easily be given in regular type-
written (or typeset) reports, but they are not! A
computer printout accompanies the report to give it
AUTHORITY. The set of results that I saw seemed
both spurious and misleading, and perhaps others
could have detected this had they been as unawed by
computers as I am.

Perhaps there may come a day when the US augments
its Environmental Protection Agency with a Human Pro-
tection Agency. Then, taking the lead from the pres-
ent requirement to make notification on cigarette
packages that "cigarette smoking is dangerous to
your health," it could order that each computer-
printed page be preceded by:

> "WARNING -- these answers were produced by a
> computer, and could be hazardous to your
> health!"

Of course I am being facetious about the overkill
which does not seem to diminish smoking anyway, but
I do recall the following case.

"Sorry General, Three Years of Wrong Answers"

Univac was attempting to sell the US Army an 1107.
The benchmark process included a compilation and run
of a certain FORTRAN program. The 1107 compiler prin-
ted a diagnostic indicating an entry into the middle
of a DO loop. The General in charge indicated that

this was impossible, as they had been running that same program for three years, and asked a programmer to examine the situation. He returned in a short while and said "Sorry, General. Three years of wrong answers."

The Computer as a Sewage System

A well-known truism of computer usage is "Garbage in, Garbage Out." But what happens when we put perfectly valid data in? Can we get it out again? Can someone else do so? If it does come out, is it legible?

We still live in the computer era where 90% or more of the data depends entirely upon the associated program to be turned into information. The data description of COBOL is a start to improve this, but why should the description be appended to the program rather than to the data itself?

Do you need a program to read a book in the library? At ACM 70, Dr. John Richardson of the US Dept. of Commerce said "Information Conserves Resources Through Better Decisions," but some of the valuable data that we need to make those better decisions is not, in fact, retrievable, exchangeable, or digestible. It cannot be turned into information. Indeed, one of the major findings in the various studies of data banks is that the sum of many small data banks is not a large data bank, at least not yet, contrary to the fears of many. And yet there are good as well as harmful reasons to consolidate data. If, for example, the US Congress had two reliable pieces of information -- 1) how much it was costing to not grow cotton, and 2) how much it was costing to promote the use of cotton -- the very juxtaposition might give rise to some better decisions. The organizing power of the computer depends completely upon legibility and interchangeability of data.

Incompatibility of Data Banks

A classic example is the situation that arose when the EPA (US Environmental Protection Agency) was formed by consolidation of several diverse groups, each with its own information systems. When they tried to consolidate the data as well, surely one of the main reasons for the coalescence, they found out that data could not only not be exchanged between various components, but not even between several computer systems in the subdivisions of the agencies! And, of course, the air masses travel over many states, each state with its own computers and monitoring systems, and each computer incapable of making decisions that would optimize for the entire country, much less the world -- if that possibility were permitted.

Illegibility of Computer Data without the Program

Examples of the illegibility of computer data without the program are countless. Dr. Fred Whipple, the astronomer, once mentioned that only 1% of his information from satellite and probe vehicles was being processed. I corrected him slightly to say "data," and he reiterated "information." I asked if anyone could process the tapes if the program were destroyed? He admitted that it would be impossible. "Data" it was.

The Las Vegas city police and county sheriff's department recently consolidated to form a "Metropolitan" Force. It will be many years before their computerized data files can also be consolidated to be of efficient use.

Of course this particular manifestation of swallowing of data and not giving it back to anyone else could be largely solved by using labels and data description on data media, so that the data can be self-descriptive. Congressman Brooks of the US has called for a "declaration of independence for data."

Computer Failure

Another way of not being able to get data out is to have the computer system fail. Integration of computer systems into human affairs demands extreme reliability. We all know this, yet there are many times when one is tempted by the power of the computer to entrust to it a function that has some deadlines. I am guilty of this myself. We use a computer for text processing and publication. The problem is that we are forced to share a computer that is used for software experimentation and new system software validation, or for benchmarking in various configurations. While the hardware may be very reliable, newly-developed software is, unfortunately, not -- and we have entrusted our total text to the disk files. When difficulties occur, no manual methods, however desperate and strenuous, can be employed to do a makeshift job. It is the ultimately perfect job or none at all; we are at the mercy of a system that must be fully operational.

The point of my story is that it is a human failing to be optimistic that the computer will be up! So one does not plan for back-up, duplicating files on another system, or batch methods that work even when timesharing is down. Now we cannot even reprocess the sewage. We have given the computer valid and useful data and cannot get it back until too late.

Some Actions to be Taken for Human Protection

Society long ago learned to impose minimum restrictions and educational or training requirements upon classes of workers whose operations affected the public safety or welfare. These constraints led to professions, with codes of ethics and a store of recommended practice often embodied in local law, such as building codes. Examinations by peers is a prerequisite to practice -- for doctors, lawyers, engineers, accountants, ad infinitum. Until now such restrictions have not been imposed upon the computer community; one can only suppose that the professions just mentioned did not materialize so abruptly before the social consciousness.

Some public exposure of malfeasances moved the legislature of the State of California to consider, in 1971, the certification of computer programmers as a class. This was given attention by the press and, together with the fact that the legislature was in a quandary, it was sufficient for assistance to be asked of AFIPS (American Federation of Information Processing Societies). AFIPS convened a System Certification Committee in 1972 February.

Certification of Programmers
and Handbooks of Good Practice

The committee arrived very quickly at the conclusion that there seemed to be no authoritative way to achieve certification. I proposed that a series of books of good practice should be conceived and constructed through AFIPS. This project is now underway. The first such book of good practice is on confidentiality and security, due to the very strong and justifiable interest in this topic at the moment, and is about to be field-tested. It is

largely in checklist form. As a minor note, the committee has changed its name to "Systems Improvement," to emphasize the fact that it does not feel that any form of certification is feasible yet.

Reliability of Computers

"Reliability for Integration into Human Affairs" was the title of one of the sessions of the 1973 National Computer Conference in the US. The session had a certain distinction. The other sessions were, by design, to reflect a "vertical" or "end use" orientation. Here I deliberately chose, in planning the program, to take a further step, to see what aspects of computer systems design were common to many end uses for the specific reason that they were directly integrated into human affairs.

The panel included representatives from air collision avoidance systems, online patient monitoring, online power plant control, credit systems, ground transportation, and merchandising. Many of these applications are of Type 3; power control against blackout, for example, requires a response faster than a human can achieve. Air traffic control is another; in the 1980's there are expected to be 5000 people always in the air above Los Angeles, in 700 craft! The representative gave two major requirements:

- Predictable reliability should be astronomical.
- There should be "bail-out" capability for whenever the system fails unpredictably.

"Fire-Drills"

This second point created much discussion. Many of the builders of complex computer-controlled systems found that the people that ran such systems were seldom able to practice fixing them. When they did fail, they were not properly capable of coping. It was suggested that holding "fire drills" for such systems was a basic element of good practice.

Searching for other elements of good practice, it appeared that none of the panelists or their design teams knew of any source or reference book to use for reliability aspects of computer usage, even though there was much commonality in their applications. There are some specialists in this field, such as Bob Patrick, but no body of knowledge is available generally. Patrick gives some examples of bad design:

- One computer installation had back-up tapes in a fire-proof vault, and "grandfather" tapes inside a mountain. But there was only one copy of the "run book" that told the operator how to read the tapes, and that was in the machine room, and would be lost in a fire.
- A military installation had high security, and was very protective of the data. To ensure good readability, the tapes periodically had the first 20 metres or so clipped. The problem was that these tape strips were thrown away, under custody of garbage men without clearances, and they had not been erased!

$300 Million a Year of Computer Crime

Donn Parker, who chaired the above-titled session, is an authority on computer-related crime. His estimate is that this now amounts to $300 million a year, and will reach $2000 million in the 1980's!

Dick Mills of the First National City Bank says that the bank has $8000 million per day in its interchange "pipeline," so that even a small leak drains a lot. It would seem that we are not being overcautious in insisting upon reliability in such "people-sensitive" applications.

Protective Measures Against Misuse:
Legal Measures: Safety Standards

There are many examples of laws for involuntary personal protection. Construction workers must wear hard hats; cyclists must wear leather and helmets. These are occupational protections enforced upon the individual presumably because he represents an investment by society.

The US Government has imposed certain requirements upon the manufacture of automobiles, i.e., to be constructed so as to withstand collision of X km/h without sustaining more than $Y in damage, or the like. The Government has stated that requiring such action is within its right to protect the safety of its citizens. It seems certain that the computer has a direct effect upon not only the safety of our citizens, but also upon other rights. It might thus be reasonable to demand that software and hardware should also be built to certain standards to protect these rights.

We are certainly going to have to build computer systems with facilities for confidentiality and security. Although there is no law on this, there is little doubt that US Government users will be demanding these features.

This area is covered comprehensively in "Legal Aspects of Computerized Information Systems," a US Govt. Report. See the Honeywell Computer Journal, Vol. 7, No. 1.

Voluntary Measures: Ombudsman

Dr. Harold Sackman, Chairman of the AFIPS Committee on Social Implications of Computers, called recently for a "computer user society of America." This was to be a computer citizen's group active in social reliability, for the reason that the computer community really gets to see the problems first, and has the responsibility to expose the problems to those who can treat them. The ACM owes much to the Scandinavian creation of the ombudsman; its ombudsman program has solved many problems of bad computer usage.

Power to Audit

There is a growing class of auditors versed in data processing, but we may have to take drastic measures to aid them. There are many current efforts for better methods for software construction. One hopes that increased simplicity will lead to more direct legibility and auditability of computer programs. Most programs are documented poorly, and I see only one hope of solution -- the program specifications, narrative documentation, and operating instructions must be integral! Using a block-structured language is vital to constructing auditable software. It also enables programmed devices to detect tampering with the running programs.

Handbooks of Design and Practice

Handbooks of design and practice are required to be available before computing can truly be a profession. Many computer societies are in various stages of using codes of practice and certification

of practitioners. One hopes that they will not stop short of general certification but will also adopt application-oriented certification in joint action with the professions of those applications.

We will have to equip our systems with performance measuring and evaluation capabilities. Wastage of resources has been considered an evil in other fields before this.

Recommendations

As custodians of the power source we have many responsibilities. When I planned the ACM 70 Conference, it was as a model for a National Computer Year, which could possibly be followed by an International Computer Year. A possible list of goals for such a Year could be:

- To consciously put computers in service for international goals; to increase public understanding of computers, their role and potential; and to emphasize the computer as servant by more humanized use and applications.
- To develop strategies for the best future use of computer systems (technological, social, educational, political, and legislative).
- To conserve, and maximize utility of, those existing and future intellectual resources known as data and programs, by finding how to utilize them on multiple equipment and in multiple applications.
- To aid government, business, and private decisionmaking by opening up new and more complete data for those decisions, and to facilitate the making of those decisions by reducing the information volume required (as opposed to data volume).
- To plan a closed cycle for redistributing work assignments between people and computers, for re-education prior to change of assignment, so that people can best fulfill their potential.
- To ensure that public safety and welfare are considered adequately when computers are integrated directly into human activity.
- To set up new and broad interdisciplinary paths for exchange of information among hitherto segregated organizations, and to foster their maximum involvement on an international scale.
- To plan the most economical and effective interaction between computing systems and other systems such as communications.

Interaction Between Computers and Society

It is not too soon for a comprehensive examination of the interaction between computers and our society. Two papers from the 1973 National Computer Conference support this view -- "The Social Implications of the Use of Computers Across National Boundaries" and "A New NSF Thrust -- Computer Impact on Society." NSF is the National Science Foundation of the US.

Easier than We Think?

I believe that it won't be so difficult for computers and society to adjust to each other if we really put our minds to making it happen.

In 1970 an Assistant Postmaster General of the US observed that a third of all first class mail is machine-addressed, but only 6% arrives on the post office docks in Zipcode order. He asked why the computerized address files could not be ordered by Zipcode as well as any other way? So I asked many data processing departments the same question. The answer was that they had not thought about it, and would just as soon do it that way.

It may be as simple as that.   □

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IBM Versus AT&T: Its Meaning To The User And The Public

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*"Observers now see IBM's entry into satellite communications
as a major threat to the computer industry."*

The subject of this article is IBM versus AT&T:
Could this be the heavyweight championship business
fight of the century? If so, what does it mean to
the user and to the general public?

Unnoticed Announcement

After the close of the stock market on July 3,
1974, the Dow Jones wire carried a terse statement
datelined Armonk, New York. International Business
Machines Corporation had just announced it was pur-
chasing controlling interest in CML, an authorized
domestic satellite carrier. The timing of the an-
nouncement was significant, for the weekly trade and
business journals had already gone to press and the
business and financial desks of the daily newspapers
were closed down for the long, 4th of July weekend.
It was hoped that the move would go virtually un-
noticed and unreported. It largely was.

Initial reactions were mixed. A number of ob-
servers felt that AT&T would at last face some major
competition and thus both the computer and the com-
munications industries would benefit. However, John
DeButts, Chairman of AT&T and an outspoken critic of
any competition with the Bell System, said that he
had discussed the IBM move with the chairman of IBM
and foresaw no problems. The president of IBM as-
sured the press that IBM was "not trying to put one
over the left field fence."

Major Threat to the Computer Industry

A few -- unfortunately a very few -- observers
now see IBM's entry into satellite communications
as a major threat to the computer industry, the com-
puter user, the telephone subscriber and, in the end,
as a major threat to our nation. I include myself
among this select, but rapidly growing group of vocal
dissidents. Our ranks now include the Department of
Justice, the Federal Trade Commission, Univac, Fair-
child, Western Union, Datran, RCA and others. I
would like to take this opportunity to share my
thoughts and some of my deeply felt concerns with
you.

Qualifications of This Author

First, however, let me submit my qualifications
so that you may decide whether my views are worthy

of your consideration:

- I have spent 20 years of my life as a
  specialist in the development of marketing
  and growth strategies for more than 50 major
  corporations, including some of our nation's
  largest.

- In the past year, I have testified before
  six Congressional committees as to condi-
  tions in the computer and communications
  industries.

- And I am probably one of the few people in
  the world that have read and studied the
  20,000 pages of internal IBM documents,
  studies and management committee minutes
  that have come to light as a result of the
  numerous antitrust suits against IBM.

- And just so you will have no doubt about my
  biases, I am told that I am very high on
  the "enemies" list at Armonk and moving up
  very rapidly on AT&T's. I have dared to
  speak out!

Now, let me give you one man's opinion as to
what is happening and, perhaps of more importance,
what's in store for you, the user of computers and
communications. First I will summarize and then
come back and discuss each aspect in a little great-
er detail.

AT&T, Heavyweight Champion

In one corner we have AT&T, the heavyweight cham-
pion of the world. It has revenues of $26 billion,
absolute control and ownership of the communications
system, 25 percent net income before taxes, and 14
percent growth. One worker out of every 80 works
for AT&T. AT&T has failed to be responsive to the
needs and desires of the marketplace -- especially
in the areas of business oriented voice and data
communications. This certainly comes as no surprise
to this audience.

The Federal Communications Commission has, since
the now famous Carter-phone decision in 1968, been
gradually opening up limited, specialized segments
of AT&T's markets to competition -- first intercon-
nect and then specialized terrestrial and satellite
carriers. AT&T has used every means at its disposal
to block the development of competition and maintain

its total monopoly power over all facets of the communications system. It has done this by refusal to interconnect, customer intimidation, and drawn out legal proceedings. At the moment, it is losing.

AT&T, through its teletype subsidiary, has encroached upon IBM's territory with the data speed 40 terminal. It has also started marketing OEM.

IBM, The Other Heavyweight Champion

Now in the other corner we have International Business Machines. It has revenues of $12 billion, 25% net income before taxes, 15% yearly growth, and $4 billion in cash. During most of the 1960s, IBM fell behind the computer industry in technology, especially in the areas of peripheral products, terminals, minicomputers and solid state devices.

In 1970, IBM lashed out at the independent peripheral industry -- the Telex's and Memorex's -- for it feared that the independents might, in time, become viable across-the-board competitors. And in the meantime, strategies were being put in place at IBM to recapture its accustomed 70% share of EVERY sector of the computer marketplace.

IBM's Overall Strategy

The elements of that overall strategy are now apparent. They include:

- F.S. (Future System): The fourth generation of computers will employ up to four parallel processors, mass storage and, in all probability, will be field expansible. A significant amount of maintenance will be performed by the user.

- System Q: A wholly new software system utilizing both conventional software as we know it and firmware. The system may be designed so that resource usage can be metered, with customers charged accordingly.

- Custom Terminals: A family of unique, application-oriented terminals using extensive micro coding, new IBM de facto standard protocols and mid-life enhancements.

- Data Security: In order to solve the data-privacy, security problem, automatic encryption will probably be an integral part of each element of the system. IBM is spending $40 million over 5 years to study this problem; only the initial results will be in the public domain. The design of the locks to access will obviously be proprietary -- no interconnect will be possible.

- Satellite Service: IBM -- preferably in collaboration with Comsat, but no doubt alone, if necessary -- expects to have a domestic satellite system operational within three or four years. Geared to government and business customers, it will be an integrated digital system with high speed data, voice and image capabilities. Unlike today's systems, it will not depend upon large ground stations connected to the user through AT&T local loops. Rather, the system, operating in the "X" band, will utilize a "multitude of customer dedicated antenna and only a few general-use ground stations." In essence, each customer will have an antenna on his roof.

- Carnation: To tie it all together, IBM will probably soon start marketing its "3750" electronic switching system in the U.S. A sophisticated PABX, the 3750 has been optimized for data switching but also has all of the features required for an integrated communication system, including "direct dialing, tie lines, data access, signalling, 60-cycle power, call directors, satellite connection and automatic overflow routing." Initially targeted at the larger user, where IBM has more than 65% of the installed base of computers, Carnation is expected to contribute $5 billion in revenues and over $1 billion in profit over the first five years of the program.

- Bundled Service: IBM's strategy for the computer/communications world of the 1980s envisions complete end-to-end control of the total business voice and data communications network. This total system will include a telephone instrument on your desk, an IBM PBX, IBM terminals, IBM CPUs, IBM mass storage devices and IBM word processors -- all tied together by IBM satellite. There will be relatively few "foreign or competitive devices" in the system. IBM will not disclose communication protocols nor electrical, mechanical and logical interfaces until well after the market is locked up. In addition, scrambling and encryption techniques will be utilized as an umbrella over the entire end-to-end system. After all, everyone knows that the only secure system is a sole-source system, right?

- Bundled Pricing: The opportunities to offer full end-to-end service allows IBM to bundle prices once more. By submitting a proposal to you that "solves your problem by providing a solution -- not boxes," IBM -- can as it has many times in the past -- freeze out any significant competition that might develop.

Loss of Control of Peripherals

I noted earlier that IBM had lost its control of the peripheral, minicomputer and terminal markets. I think the foregoing points make it clear that they are totally committed to regaining that control.

It's a beautiful strategy. I'm sure there are elements of it I haven't touched on, for the Telex documents are now two years old.

However, as you read the more than 4,000 pages of minutes of the top management committee meetings of Messrs. Watson, Learson, Carey and Opel, one thing becomes very clear. They sincerely and firmly believe that the computer industry and all of its extensions belong to IBM. Trespassing is forbidden. They were disbelieving and shocked that CDC would dare to offer a super computer, better than anything IBM had to offer, or could ever build. They found it inconceivable that customers flocked to Telex and Memorex tape and disk drives, or that Sanders was offering superior terminals. And the idea that independent software houses could increase the efficiency of an IBM system by 30% or more was pure heresy.

Dealing with Upstarts

Throughout the four-year period 1968-1972, they wrestled with the problem of how to deal with these

upstarts. An overkill psychology gradually set in: they started searching for techniques that would make it impossible for others to impact IBM's growth and profits. The orders went out: stop interconnection of non-IBM equipment; prevent software enhancement, and midlife kickers; change standards; lower prices where competition is faced, raise them where it is not; use object code and micro codes wherever possible; scare the customer; do whatever it takes -- but take it all.

As you know, they almost succeeded in their attempts to put Telex and Memorex out of business. Even if they wind up paying Telex $256 million in antitrust damages, IBM's internal calculations show it to have been a profitable venture. They were losing a whopping 6% to 8% of their market overall; they bought time to implement their other strategies.

"No-No" to Banks and Wall Street

Perhaps of even more importance, IBM made it quite clear to Wall Street and the banks that investment in a company that dares to compete with IBM on any terms but IBM's is a no-no.

The long range impact of this is just now beginning to show. The mere announcement of IBM's entry into the point-of-sale market forced Pitney Bowes' withdrawal, and I suspect others are soon to follow.

The mere announcement of IBM's satellite move has caused the financial community to re-evaluate whether additional capital will be made available to the other terrestrial and satellite carriers. Several will probably have to sell out to the giants if they are to survive.

In 500 IBM Top Meetings, Discussion of Responsibility to User: Just 3 Times

Before I leave this subject, I would like to make another observation about the deliberations of IBM's top management, as reflected in the Telex documents. During the course of over 500 meetings, each ranging from one to three days over a four-year period, IBM's top management discussed you, the user, and their responsibility to you only three times!

Many of you in this audience -- particularly the IBM employees present and the loyal IBM customers -- are undoubtedly thinking "What right has he got to knock IBM? They're a great company and they've done a great job." To you I say, I agree. IBM is probably one of the best managed, most aggressive companies in the world today. It has made many valuable contributions to the field of data processing and to our industry.

Innovations: By Other Suppliers, Not IBM

It has not, as it otherwise would like you to believe, been the innovator in this industry. Almost every major advance in the state of the art has first been developed and brought to market by others. IBM's world renowned laboratories may have already invented the products you will be using in 1990 -- but they are of no use to you. They will not be made available until IBM has first extracted every possible cent of rental income and profit from the equipment it rents you today.

Interconnection Strategy: As Difficult As Possible

Instead of taking a leadership role in the development of standards that would permit healthy competition to develop, IBM blocks and delays at

both the national and international levels. Like Ma Bell, its monopoly control of the market depends on making interconnection with the system impossible or, at the very least, extremely difficult and costly.

Lock-Out Techniques

AT&T has retained its absolute monopoly power over the communications market for more than ninety years through four relatively simple lock out techniques:

- Starting with a patent monopoly of Mr. Bell's invention, AT&T was able to monopolize the local exchange market. By challenging every other patent in the courts, it effectively delayed the development of competitive instruments for 15 years;

- By interconnecting their companies with Long Lines and then refusing to interconnect non-Bell independent companies, it killed off competition;

- By controlling all system architecture and by producing all of the equipment used in the system, it was able to prevent the development of industry standard interfaces and thus block interconnection;

- And lastly, by manipulating the weak and unsophisticated FCC, it was able to cast its anti-competitive practices into bronze in the tariffs that "regulate" the industry.

Monopoly Techniques

I think if we look at these four strategies in the context of IBM, we will quickly see some interesting parallels in their monopoly tactics:

- IBM started in the 1920s with a patent monopoly on punched card equipment, and it soon captured 90% of the market. The rest it shared with Remington Rand.

- As the fledgling computer industry developed, devices were needed for the input and output of data. What would be more logical than the punch card since it already contained much of the user's data?

- Remington Rand, however, under pressure from IBM, refused to sell peripheral equipment to the fledgling computer industry; and IBM would only sell at its full retail price and then only after its own customer's needs had been met.

- Needless to say, IBM soon had more than 80% of the installed base of CPU's under its absolute control.

- By maintaining a separate and distinct software approach from that of everyone else in the industry, IBM was able to control the upward migration of its user base. By controlling all system architecture -- hardware and software -- and by producing all of the equipment used in the system, it was able to prevent the development of industry standard interfaces and thus block interconnection.

- And lastly, by smothering the customer with tender love and affection -- lots of "free"

software and services -- and by keeping the
DP manager out of trouble with his boss, the
user remained largely unsophisticated and pas-
sive.

And, the pied piper led us down the road to Utopia.

Central Nervous System of the U.S. Economy:
In the Hands of One Company

We've been good little mice. IBM's revenues have
grown 15% per year, compounded, to $12 billion. More
than 70% of the installed base is still IBM. And no
competitior has been able to capture more than 5% of
the market except by picking up the lease base of a
fallen comrade.

We have, individually and collectively, placed
the central nervous system of our total economy in
the hands of one company. If IBM's field service or-
ganization were called in for a two-week refresher
or were unionized and struck, America would grind to
a total stop. No bank, airline, trucking company,
manufacturer, stock exchange or telephone company
would be able to function -- because as each day
goes by, each one becomes more interconnected with
the other and with the seven IBM systems out of every
10 systems in use.

When you place this fact in context with IBM sa-
tellites, IBM PABX's, IBM point of sale, IBM elec-
tronic funds transfer, and IBM networks -- the impli-
cations are frightening indeed.

Again, the IBM apologists will say, "That's the
American system; IBM climbed to the top of the heap,
and more power to them."

Competitors: Half Starved for Capital

I say in response, IBM started at the top of the
heap in the 1920s, and since then it has used its
market power and control to keep its competitors
half starved for capital and its customers too blin-
ded by IBM's power and IBM's image to find their way
out of their cages.

It is said that ours is a very competitive indus-
try. I ask you, how competitive is a race between
Secretariat, five mules and 60 lame ducks? It's not
even fun to watch.

And that leads me to my last and final point:

But Competition is Healthy

Our system is based on the concept that the forces
of competition will assure the fullest employment of
our resources for the good of the many. Those who
succeed in winning the game are rewarded with profits,
which in turn they can plough back into the business
for the production of more beneficial goods. Or so
the theory goes.

What happens when the forces of competition no
longer work? What happens when the King of the Moun-
tain can -- through sheer muscle, sophisticated and
subtle anti-competitive practices (many hidden under
the guise of technology), political clout, and monop-
oly market control -- block the efforts of even the
strongest to climb the hill? What happens when the
RCA's, General Electrics, Bendix's, Honeywells, Lit-
tons, Philco Fords, Univacs and Singers finally give
up trying? What happens when the Carters, MCI's, Da-
trans, Telecoms, Storage Technologies and Stromberg
Carlsons of the future don't even get to try, be-
cause Wall Street and the bankers have learned you

can't beat IBM or Ma Bell?

Monopoly Means Higher Costs

Let me suggest what I think will happen. You
will have one source of supply for residential phone
service -- AT&T -- and your costs will skyrocket.
You will have one source of supply for worldwide
business information systems -- voice, data, data
banks and word processing, and all -- IBM, and you
will pay dearly. And your customer will pay dearly.

You will wish you had the problems that you have
today -- the problems of evaluating rapidly changing
competitive offerings in communications, terminals
and minicomputers. Regretfully many of you will
leave the pioneering to "the other guy." History
will probably repeat itself -- you'll try out what
data processing can do for you with an entry level
System 3. After it's too late, you will find that
it just won't interface with that better, less ex-
pensive terminal being offered by competitor A, or
that you can't process the combined results of your
suburban stores without adding more memory -- IBM
memory of course. And just as the 402 User became
the 1401 User and in turn became the 360-50 User and
the 370-158 User, you will find that you are in a
cage. The cost of conversion to get out will be
prohibitive, and your only choice will be to follow
(and pay) the piper.

In all fairness, much of what I have just said is
equally true if you are a beginning user of anyone's
mainframe. The Honeywell's, Univac's, and NCR's
would love to offer you standard interfaces -- they
know they can successfully compete on price and per-
formance. But if standards were adopted, they fear
IBM would take away what little of the market they
have. And IBM fears that the adoption of open in-
terface standards would "erode their market control
and lease base." And you, ladies and gentlemen, are
the victims.

Worse yet, you get it coming and going; for your
store has to pass the cost of the monopolists' pro-
fits on to the consumer -- and that's you again.
Is there any wonder as to why your paycheck buys
less each day?

Growing Resistance by Users to Higher Costs

The National Retail Merchants Association has
made a major contribution in the growing resistance
to the misuse of AT&T's monopoly power. Ma Bell is
in trouble. People finally have realized that the
only so-called "natural monopoly" is the wire, cable
and switching equipment in the local service area.
The customer should be able to choose and install
any properly certified terminal he wants on the end
of that pair of wires. The local operating compan-
ies should be able to procure Long Lines service
from anyone or all of the terrestrial and satellite
carriers at the lowest possible cost. The operating
companies should be free to purchase the equipment
they use in open and competitive markets. In short,
the telephone monopoly should be broken.

But IBM is going to bail them out. After all,
how could a poor little old restructured Ma Bell com-
pete with a giant monopoly like IBM? Perhaps of
greater significance, IBM will get the MCIs, Da-
trans, Western Unions and other competitors out of
Ma Bell's hair, so that just the two of them can
then compete like proper gentlemen -- at their ac-
customed 25% pre-tax net and controlled 14% per year
rate of growth.

Time to Stand and Fight Monopolies

We think the time has come to stand and fight on both fronts -- computers and communications. It's time you, the user, told your suppliers to grow up and put their childish games aside. It's time you told the FCC, Congress, AT&T and IBM that all interfaces, codes and protocols be fully disclosed -- both hardware and software -- and that they must be disclosed early enough to allow you to choose between the compatible and competitive offerings of at least three vendors, or you won't play.

Separate Pricing, a Key

You should insist that all elements of a product or service offering be separately priced.

It's interesting how they all proclaim that mixed systems can't be done, yet they interface overnight when NASA or some other significant purchaser mandates it!

The users and the public should ask the FCC and the Congress to mandate that all equipment purchased for use in the Nation's communications system -- be it local service, terrestrial or satellite -- be procured on an open competitive bid basis. Furthermore, there should be no joint or bundled marketing efforts between CML, IBM, the AT&T operating companies or Western Electric. All transactions should be at arms length. No strategies intended to lock you, the user, into a sole source system should be tolerated. Nor should anti-competitive and exclusionary tactics be permitted.

Do these things and someday you shall be free -- free to choose what's best for you and your company, not just what's best for AT&T's and IBM's profit and loss statements.

Retailing as an Example of
Strong Competitive Business

Perhaps I've hit too hard. If so forgive me -- but the National Retail Manufacturers Association is an audience that represents one of the few remaining examples of the free enterprise system at work in America today.

These firms, whether in furniture, clothing, or general merchandise, have not ducked under the protective umbrella of government regulation. They have not felt the palsied hand of bureaucratic regulation on their shoulder as have our railroads, our airlines, our trucking industry and our public utilities. They have not adopted accounting principles that guarantee bankruptcy if there is the slightest change in the status quo.

In the greatest traditions of the American free enterprise system, the retail business is a business in which anyone who chooses may participate: There are no major barriers to entry.

Retailers are free to succeed -- or to fail -- on their own merits. If they are sensitive to the needs and desires of the consumer; if they give him or her what they perceive to be a fair value; if they make doing business with them a pleasant experience -- they will grow and prosper and receive the rewards of a grateful society.

In retailing, the consumer, in his ultimate wisdom, is the final decision maker. If the retailer fails to satisfy his or her needs, he will fail.

There are not likely to be any guaranteed government loans to bail him out; there is no government agency to prohibit a more astute competitor from opening up across the street. They do not have monopoly control over all sources of supply of the products they sell, nor can they dictate style, fashion or taste all by themselves.

In fact, each day a retailer continues to prove the fundamental economic principles that we all learned in high school and college -- lower prices tend to increase volume and total profits. It would seem that our automobile manufacturers and other near monopolies have their own private set of economic principles. When business is good, they raise the prices -- when business is bad, they raise prices again. Why does the consumer put up with it? Because there is no place else to go -- there is no meaningful competition in the concentrated industries.

Crisis

The situation is rapidly approaching crisis proportions. The Arabs are very conservative investors -- they will put their money in land and in monopolies. After all, who knows better the power of a Cartel? So they will largely invest in the IBMs, AT&Ts, General Motors and other corporations dominant in their respective industries. The Arabs fully recognize that the economic importance of each of those companies to our nation and their large number of employees forces the politicians to see that the Government stands behind them as the employer and banker of last resort. Money invested in these companies is as good or better than money invested in Government bonds.

Our institutional investors have also learned this lesson and that's why we have a single tier market.

And their prophecy becomes self-fulfilling because everyone below the Fortune Top Fifty dies for lack of capital, and the wisdom underlying the "prudent investment" principle is born out. A handful of corporate giants will then control the assets of our nation. Heading the list will be our friends AT&T and IBM, the bluest of the Blue Chips.

Of course, the unions will have to increase their power in order to maintain equality, and Government will have to grow to maintain balance.

When the concentration of power is complete, where do you and I -- the disenfranchised voters, the taxpayers and consumers of our nation -- stand?

Please think about it.   □

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The Teaching of Computer Science:
Master of Science Degree

J. N. Snyder
Head of Department
Department of Computer Science
Univ. of Illinois at Urbana-Champaign
Urbana, Ill. 61801

*"Every educated person should have some understanding
of the principles on which computers operate."*

Here is a description of a new educational program
being offered by this department. We believe your
readers may be interested.

Purpose

Computers are playing an increasingly pervasive
role in our society. Therefore every educated per-
son should have some understanding of the principles
on which they operate; and many will need varying
degrees of skill in their use.

Many jobs will bring non-computer specialists
into positions where they should use computers.
Thus, to not expose today's students to computers
means giving them poor preparation for the world
in which they will have to live.

The objective of this new curriculum is to pre-
pare competent and well-qualified teachers of com-
puter science for undergraduate colleges, junior
colleges, vocational-technical colleges, and high
schools.

Admission Requirements

An applicant will be favorably considered for
admission if he: holds a baccalaureate or higher
degree equivalent to that granted by the University
of Illinois, has a grade-point average of at least
4.0 (on a scale with maximum 5.0) for the last sixty
hours of undergraduate work, and has had at least
one course in computer programming. Applicants with
an average below 4.0 but above 3.75 will be consid-
ered on an individual basis.

The Curriculum

The eight units of graduate credit required for
the degree are listed below. A unit is approximately
equal to four semester hours. If a student enters
the program with only one course in computer pro-
gramming, he may have to take one or two undergrad-
uate courses, also.

1) Computer Science (4 units):

CS 321, Information Structures
or CS 323, Machine Language and
System Programming II .... 1 unit

CS 333, Computer System
Organization .... 1 unit

CS/SE ED 357, Computer-
Assisted Instruction .... 1 unit

CS/MATH 367, Computer Application
to Problems in Mathematics .... 1 unit

2) Education (2 units):

ED PSYCH 311 and 312 .... 1/2 unit

Educational Policy Studies
(Two courses selected from
the group 300-307) .... 1 unit

3) Elective Sequence (2 units):

These elective courses are chosen with
the help of the student's adviser as a
sequence for specialization in some area
related to computer science, dependent on
the student's background and interests.

Teaching Project

In addition to the course requirement, each
student under the supervision of his faculty ad-
viser is also required to complete a teaching
project in computer science. This requirement
will normally be fulfilled in connection with
specified course work in the curriculum, the elec-
tives or individual study courses, or by virtue of
the student's current or past employment.

Some alternatives (all of which yield either
course credit or remuneration for the student)
are:

1. Service as a teaching assistant.

2. Past or present service as a teacher in a
   public, secondary, or community school.

3. The practice being required for state
   certification.

4. Preparation of PLATO material either in an
   individual study course or as part of a
   CS/SE ED 357 project.

5. Tutoring and/or grading under special
   circumstances.

Computer Science Courses

CS 321 -- Information Structures:

Lists, trees, and graphs; applications to string processing and pattern matching; storage allocation, and collection of unused memory space. Prerequisite: CS 201. 3 hours or 1 unit.

CS 323 -- Systems Programming:

The organization and structure of operating systems for various modes of computer use from simple batch systems to time-sharing/multi-processing systems is discussed. Prerequisite: CS 201. 3 hours or 1 unit.

CS 333 -- Computer System Organization:

Computer system analysis and design; organizational dependence on computations to be performed; and speed and cost of parts and of overall machines. Prerequisite: CS 201. 3 hours or 1 unit.

CS/SE ED 357 -- Computer Applications to Problems in Mathematics:

This course discusses many problems which can be formulated mathematically and lend themselves to computer solution. Problems are chosen from the following major areas: applied statistics, in particular Monte Carlo techniques and simulation; combinatorics; symbolic algebra; game playing and decision problems. Prerequisite: Junior standing and CS 121 or other Computer Science 100-level programming course; or the consent of the instructor. 3 hours or 1 unit.

Financial Assistance

Many graduate students in computer science receive some financial assistance while attending the University of Illinois at Urbana-Champaign. Many of these students are employed part-time as teaching or research assistants. To encourage students to make satisfactory progress in their courses of study, assistantships ordinarily are limited to one-half time.

For further information on financial assistance, the Master of Science in the Teaching of Computer Science degree, or other programs in computer science at the University of Illinois at Urbana-Champaign, please write to me. □

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6th Cumulative Edition, scheduled for 1975

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For the full entry form, see inside the front cover (page 2) in the November 1974 issue.

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NIXON, FORD, AND THE POLITICAL ASSASSINATIONS IN THE UNITED STATES

Richard E. Sprague
Hartsdale, N.Y.

"Any reasonable hypothesis about what is really going on based on the evidence at hand, has not been even remotely suggested by either Congress or the media."

The Pardon of Nixon

Gerald R. Ford pardoned Richard M. Nixon on September 8, 1974. Thus the latest act in a drama that began in 1960, unfolded. Many skeptical U.S. citizens nodded their heads knowingly and assumed Tricky Dick had made his "deal" with Ford, when he nominated him for Vice President. Evans and Novak\1/ assumed that Julie Nixon Eisenhower talked Ford into the pardon on grounds of poor Nixon health and family considerations. The Ford explanations of fears for Nixon's health didn't seem to convince very many news media people who saw a seemingly robust ex-president in San Clemente.\2/

The pardon seemed to most Americans and news editors, a gross error in judgment and a total miscarriage of justice. Once again, the United States as a whole was fooled. This time, both Nixon and Ford managed to pull the wool over the eyes of the public and to narrowly escape revealing what can be called "the entire rotten crust at the top of American power."

Any reasonable hypothesis about what is REALLY going on, based on the evidence at hand, has not been even remotely suggested by either Congress or the media. But here is a hypothesis which can be argued to be reasonable.

A Reasonable Hypothesis

A reasonable hypothesis about the situation leading up to the pardon, must begin with the relationship through the years between Gerald Ford and Richard Nixon; and it must go back to 1960, the year Mr. Nixon planned the overthrow of Castro's Cuba.

In 1960, Nixon was the White House action officer on the planning for what turned out later to be the Bay of Pigs invasion of Cuba.\3/

The Overthrow of Castro

Prior to that time Nixon had accumulated plenty of reasons to want Castro overthrown. The anti-Communist attitude was the reason on the surface. Underneath were Nixon's connections with the Mafia, and his friendships and financial holdings that were greatly damaged when Castro closed all the Casinos run by the mob in Havana.\4/ When Nixon and Kennedy debated about Cuba in the 1960 campaign, Nixon purposefully lied to the American people about U.S.

plans for an invasion.\5/ When he narrowly lost to Kennedy, it created a deep wound and he apparently spent much of the next three years planning what might be called revenge.

During the 1960 to 1963 period Nixon became well acquainted with a number of violent-tempered or cold-hearted Cubans and Americans, both inside the CIA and outside. They agreed with him that casting out Castro was highly desirable. One of these men was E. Howard Hunt.\6/ Another was Bernard Barker.\7/ A third was Carlos Prio Soccarros.\8/

The Cabal

In a perhaps separate effort of their own, these Nixon cronies and financial partners became involved with the Cabal that murdered John Kennedy.\9/ Whether Nixon was directly involved in the Cabal's planning for the assassination is still open to some question, although one researcher believes that he was.\10/ There certainly is substantial evidence that Nixon was out to sink Kennedy and Johnson, at least politically, and aimed to do so in Dallas immediately before Kennedy was killed. (See the section below on evidence)\11/

At any rate, whether Nixon was or was not directly involved in planning the assassination of President John F. Kennedy does not have to be settled here, because Nixon WAS directly involved in covering up the truth about who did the deed. Recently revealed evidence from the Nixon-Haldeman tapes indicates that Nixon knew the truth about the assassination when he suggested Gerald Ford for the Warren Commission.\12/

Ford and Nixon

The hypothesis then continues with the close personal friendship of Ford and Nixon in their days together in the Congress, when both were strong, ultra-conservative, "red white and blue," anti-Communist, "religious" members who thought and talked alike.

When Nixon realized that John Kennedy had been killed almost under his nose on November 22, 1963, in Dallas, Texas, by some of his Bay of Pigs friends, he decided to do everything in his power to cover it up and to bide his time until his powerful military and intelligence friends could get him placed in the White House. It took one more murder by the Cabal

(Robert Kennedy) to get him there, and still another attempted murder to keep him there (George Wallace).

Control Over Investigation of Assassinations

Control over the investigations of these murders was essential for Nixon and the Cabal. In order to guide a presidential commission away from the truth, the closed small circle of people who knew what had happened to John Kennedy had to be enlarged. Allan Dulles was no problem. He knew the cause was an intelligence-military Cabal from the day it happened, forward.

Earl Warren was a tougher nut. He had to be fooled and later on, talked into keeping silent "for the good of the country."

Gerald Ford's Book

To have a ring leader inside the Warren Commission was critical. It had to be someone Nixon could really trust. Someone who had at least the appearance of being honest and trustworthy to the people. Nixon called on his old pal, Gerry Ford. He convinced LBJ that Ford should be on the Commission.\13/

Then, the hypothesis continues, that Nixon told Ford at some point prior to January 1964 who killed JFK and why, and he convinced Ford that every effort should be made to make sure Oswald was found to be the lone assassin. Ford did an excellent job. He not only steered the Commission away from the facts \14/ whenever a key witness was interviewed or an embarrassing situation developed, he also nailed Oswald's coffin shut personally, by publishing his own book on Oswald\15/: "Lee Harvey Oswald -- Portrait of The Assassin". This, coming from the chairman of the House Armed Services Committee, served to firmly plant in the minds of Americans the idea that there was no conspiracy, that Oswald was THE lone assassin, and that the Warren Commission had done a good job.

Access to Power

From the day Ford's book was published, Nixon and Ford became totally beholden to each other. They also both became totally beholden to the members of the Cabal who were at or near the top of it or who were part of the small knowledgeable circle.

Other members of what will henceforth be called the inner circle, included J. Edgar Hoover, while he was alive, and Richard Helms.

Under this hypothesis, no one could be permitted to come into power in the White House, or the CIA or the Justice Department or the FBI, unless they were part of the inner circle and willing to keep quiet and help suppress the truth about the JFK assassination.

This inner circle widened, of necessity, when Robert Kennedy was killed, and Nixon became President. Both the people involved in killing Robert Kennedy, and Nixon's top aids had to be told the truth. This included Haldeman, Ehrlichman, Kissinger, and possibly others in the White House, and Mitchell. Mitchell also had the job of controlling Hoover's successors in continuing the cover ups. Mitchell was instrumental in stopping Jim Garrison's investigation of Clay Shaw and the rest of the Cabal and in totally discrediting Garrison.\16/ He was aided of course, by Richard Helms and others in the inner circle by thorough CIA support in the Clay Shaw trial cover-up efforts.\17/

Assassination Attempt Upon George Wallace

In 1972, the White House plumber section of the assassination Cabal decided, perhaps without Nixon's knowledge, perhaps with his approval, to assassinate George Wallace.

In this way, Nixon would receive ALL of the conservative vote. Again, the inner circle grew, and the debts grew. E. Howard Hunt and Charles Colson, along with Tony Ulazawicz, Donald Segretti and others, were in a position to make demands in exchange for their silence. The Hunt $1 million blackmail threat to reveal "seedy things" or "hanky panky," was never really explainable because he might talk about the Watergate or Ellsberg break-ins. Three assassinations, (JFK, RFK, Wallace) on the other hand would certainly be worth a cool million to keep one's silence. Again, the Haldeman-Nixon June 23, 1972, tapes are revealing.\18/ (See later section on evidence)

The Watergate Crisis

Now arrives the Watergate crisis. Nixon is trapped by his own tapes. The hypothesis continues that discussions with Haldeman, Mitchell and others mention the Kennedy assassination Cabal and the Wallace murder attempt. The Cabal and the inner circle are suddenly threatened as a group. The tapes can't all be destroyed because too many Secret Service people know about them. Haldeman and Nixon manage to erase one 18-1/2 minute section which is the most revealing about the assassinations, but the rest are still around. And who can remember exactly when telephone or Oval Office conversations may have mentioned the truth about the three murders?

Succession to Nixon

Nixon, sensing again the need for a successor who will keep quiet, calls on Gerry Ford when Agnew is forced out. The two of them, bound inextricably together by their mutual cover-up of the assassinations, work out a deal. Nixon nominated Ford as Vice President. The Senate, completely bamboozled by Nixon and Ford, did not ask Ford any important questions about the assassination's nor his performance on the Warren Commission. They did ask Ford about his book and he committed perjury two times before the Senate.

Nixon and Ford agreed that Ford will keep quiet if Nixon keeps quiet, and that if necessary, Ford will succeed Nixon if he is forced to resign, or be impeached, with an agreement for a pardon afterward. But, the most critical part of the arrangement is that those tapes revealing the truth about the assassinations be kept out of circulation. The two men must keep their cover-up going. Each is now fully culpable. When the Supreme Court ruled that the tapes must be turned over, it was then time to implement their agreed-upon strategy.

In addition, Jaworski, Colson, Mitchell, Kissinger, Haldeman, Ehrlichman, the Warren Commission, Hunt, Helms, Shaw and anyone else in the inner circle has to be bought off, pardoned, protected, or killed, to keep their silence.

Jaworski's Resignation

Leon Jaworski resigned and people ask why. The real answer again lies buried in the fact that Jaworski knows what has been going on. One way he knows is through the assassination conspiracy and cover-up information passed on to him by the Ervin

Committee and Cox. A second way is through his own involvement in 1964 in the JFK cover-up. In any case he will have to be taken care of.

Jaworski could be a problem, even though he helped with the JFK cover-up from the beginning. 19/ Hunt has already been taken care of by getting him out of jail, buying him a large estate in Florida, and paying him a lot of money.\20/ Helms can be counted on. Kissinger may have been a problem, but he agreed finally. His wiretaps were likely ordered to find out who knew about the assassinations. Hoover is dead. Clay Shaw was murdered.\21/ Out of the Warren Commission, Warren is dead. Boggs was killed. Dulles is dead. LBJ is dead. Richard Russell is dead. John Sherman Cooper was bought off by giving him an important ambassadorship. John J. McCloy is too old to worry about, and of course Ford is O.K.

That leaves Colson, Mitchell, Haldeman, and Ehrlichman, plus some other small fry. The Nixon-Ford strategy as planned with these men, must have involved pardons for all of them in exchange for their silence, especially Haldeman and Mitchell because they not only knew what happened to JFK, but took overt actions to cover-up. (Haldeman erased the 18-1/2 minutes of tape and Mitchell nailed Jim Garrison.) The pardons may have to wait until the trial is over, but they are agreed to in advance.

New Members of the Inner Circle

Newer members of the inner circle may cause some problems. They all have to know the truth by now. Rockefeller and Alex Haig must know and have agreed to silence. William Colby, William Saxbe, and Clarence Kelly know because of their access to the records; so they must have agreed to cover-up continuance.

Of extreme importance is Saxbe's and Kelly's control of the new trial and hearing coming up for Sirhan B. Sirhan and possibly an investigation of Arthur Bremer. Also Ford and his cronies in the House must knock out any efforts by Henry B. Gonzalez of Texas to start a new House Committee investigation of the JFK assassination. Haig seems to have been bought off by promising him a top NATO post in exchange for his silence.

In this hypothesis, Gerald Ford is stuck. He must remain committed to the Cabal and to Nixon. Whatever assassination the Cabal may undertake in 1976, he must close his eyes to it, and continue covering up.

Ted Kennedy, George McGovern, and Eugene McCarthy would have had very little chance of surviving the situation if they showed election promise in 1976.

Also the tapes must be controlled and edited at all costs. Nixon no doubt required help in listening to the tapes after Haldeman left and sorting out those in which assassinations and cover-ups were discussed. General Haig was logically the man he selected to do this dirty work. It is almost certain that no tapes could be turned over to Judge Sirica or to Jaworski with any assassination references left on them. One of the tapes demanded by Jaworski had such references. This is the recording made on June 23, 1972, in which Nixon and Haldeman are discussing Watergate, just six days after the break in.

The Nixon transcript of that tape turned over to Judge Sirica upon orders of the Supreme Court, shows many sections labelled unintelligible. It is a near certainty from three parts of the discussion that

day, that the critical sections were edited out by Nixon and General Haig prior to turning them over to Sirica and prior to making a transcript. Judge Sirica is the only person in the chain of possession of that tape who could be counted on to make a scientific analysis of the tape to see whether it was tampered with before he received it. The hypothesis would be confirmed if erasures or noise superimposed on sections of that tape were found by such an analysis.

With regard to the rest of Nixon's tapes which are still in Gerald Ford's possession and control, there may be many references to assassinations and cover-ups. Rather than go through all of them and edit or erase the critical material, it is much more likely that Ford will either turn them over to Nixon for total destruction, or sit on them forever without letting anyone not in the "inner circle" hear them.

The Evidence for This Hypothesis

The evidence supporting this hypothesis is as follows:

1. Nixon was White House action officer on Cuban invasion plans 1960. Source: "Compulsive Spy," Tad Szulc, Viking Press, 1974

2. Nixon was in contact with Hunt, and others during Bay of Pigs planning. Source: Nixon, Bay of Pigs & Watergate -- R. E. Sprague, C&A -- January, 1973

3. Nixon lied to the American people by his own admission about the Bay of Pigs during his TV debates with Kennedy in 1960. Source: "Six Crises" by Richard M. Nixon

4. Nixon was linked financially to the Mafia and the Cuban Casino operations before Castro took over. Source: "Nixon and the Mafia," Jeff Gerth, Sundance, December, 1972

5. Nixon was acquainted with Hunt, Barker, Martinez, Sturgis, Carlos Prio Soccarros, and other Watergate people and anti Castro people in Florida, and was financially linked with Barker, Martinez, and Soccarros. Source: "Nixon & the Mafia" and "Nixon, Bay of Pigs & Watergate"

6. Hunt, Barker, Sturgis & Soccarros were connected with the assassination Cabal in the murder of JFK. Source: R. Sprague -- several articles lately. CIA article, Nixon Bay of Pigs article, Bullets or Ballots

7. Nixon was in Dallas for three days including the morning of the assassination. He was trying to stir up trouble for Kennedy. Source: Warren Commission Exhibits -- Vol. 23, Pages 941-943

8. Nixon went to Dallas under false pretenses. There was no Board meeting of the Pepsi Cola Company as he announced his law firm had to attend. Source: Pepsi Cola Co. list of board meetings. Corporate Records

9. Nixon did not admit being in Dallas on the day Kennedy was shot and did not reveal the true reason for his trip. He held two press conferences on the two days before the assassination subtly attacking both Kennedy and Johnson and emphasizing the Democratic political problems in Texas. Source: Warren Commission Exhibits -- Vol. XXII, Pages 941-943

10. Research indicates that Nixon either knew in advance about the Cabal's plans, or learned about them soon after the assassination. Source: Trowbridge Ford, "Letter to House Committee on the Judiciary," Holy Cross College, Worcester, Mass. June, 1974.

11. Nixon proposed to Lyndon Johnson that Gerald Ford serve on the Warren Commission. Source: Trowbridge Ford, "Letter to Judiciary Committee"

12. Ford led the Commission cover-up by controlling the questioning of key witnesses and by several other means. Source: Trowbridge Ford, Holy Cross College, Worcester, Mass. "Letter to Judiciary Committee"

13. Ford helped plant the idea that Oswald was the only assassin and that there was no conspiracy, firmly in the minds of the American public by publishing HIS OWN BOOK, and titling it, "Lee Harvey Oswald -- Portrait of THE Assassin". Source: Ford's book, "Lee Harvey Oswald -- Portrait of The Assassin"

14. Ford purposefully covered up the conspiracy of the Cabal in the JFK assassination and also covered up the fact that Oswald was a paid informer for the FBI. He did this by dismissing the subject in his book as worthless rumor and by keeping the executive sessions of the Commission where Oswald's FBI informer status was discussed, classified Top Secret. Sources: Ford's book; The Assassination of President Kennedy -- Declassification of Relevant Documents from the National Archives; R. E. Sprague -- Computers & Automation, October, 1971

15. Ford continued the cover-up of his assassination cover-up when he was questioned before being confirmed by the Senate as Vice President. He lied under oath two times to the Senate Committee, thus committing perjury. He stated that he had written his book about Oswald with no access to classified documents. He lied about this because his book used classified documents about Oswald's FBI informer status. He lied when he said that the book was titled, "Lee Harvey Oswald -- Portrait of an Assassin." This was significant in 1973 because the public by then had become very skeptical about a lone assassin. By changing one word in the title, Ford made the book seem a little less like what it actually was; an effort to make Oswald seem to be the lone assassin. Source: Ford's book; Ford's testimony before the Senate Committee.

16. Jaworski aided in the JFK cover-up by sitting on evidence of conspiracy accumulated by Waggoner Carr, Texas Attorney General, whom he represented in liaison with the Warren Commission. He also stopped the critical testimony of Jack Ruby when he was testifying before the Warren Commission, and diverted attention away from Ruby's intent to reveal the conspiracy to kill both Kennedy and Oswald. Sources: Dr. Tuteur, psychiatrist who interviewed Ruby in his jail cell. "Psychiatric Examination of Jack Ruby" Mental Health, April, 1974, Vol. 58 #2, Washington, D.C.; Trowbridge Ford, "Letter to the Judiciary Committee"

17. Nixon became President in 1968 only because Robert Kennedy was killed by a conspiracy, involving the Cabal and the CIA. Nixon was well aware of the conspiracy whether or not he approved of it in advance. Sources: Investigation by William Turner and John Christian and FBI Report on RFK assassination.

18. John Mitchell and J. Edgar Hoover, joined Nixon and the lower level members of the Cabal in covering up the RFK murder conspiracy. They classified the evidence Top Secret and murdered several witnesses, plus controlling the Judge in the Sirhan trial, the District Attorney and the Chief of Police in Los Angeles during and after the trial. They still control these people plus the Los Angeles County Board of Supervisors. Clarence Kelley is now also involved. Sources: Same as above, plus L.A. County Board Meeting minutes and Baxter Ward hearings.

19. With knowledge of Nixon and the Cabal, the plumbers group ordered the assassination of George Wallace in 1972, to insure Nixon's election by picking up Wallace's vote. (About 18% in the polls). Source: Investigation by Committee to Investigate Assassinations and by William Turner, 1973-74.

20. J. Edgar Hoover and Richard Helms were aware of who killed John Kennedy and Robert Kennedy and helped cover-up both conspiracies. Sources: a. Richard E. Sprague, "RFK Articles on Conspiracy," Computers & Automation, Oct. 1970, Sept. 1972; b. Victor Marchettis's public statements -- December, 1973 -- about; c. Richard Helm's and Admiral Taylor's covering up Clay Shaws' CIA connections and paying his lawyers.

21. John Mitchell controlled the trial of Clay Shaw and the Garrison investigation and discredited Garrison by framing him in a New Orleans gambling case. Source: "The Framing of Jim Garrison," Richard E. Sprague, Computers & Automation, December, 1973.

22. Nixon and Haldeman discussed the assassination of John Kennedy, the conspiracy, Hunt's involvement, the possibility that Hunt might talk, the cover-up, the Bay of Pigs relationship between Nixon, Hunt and the other Cabal members, and the briefing Nixon might have to give anyone running against him in 1972, about these matters of "National Security." Source: Tape transcript -- Nixon and Haldeman -- June 23, 1972. The majority of the tape was transcribed as being unintelligible. But Nixon mentions Hunt possibly revealing "Hanky Panky," that we were not involved in OURSELVES. He was referring to Haldeman, Nixon and Co. All of the actions so far revealed in Watergate would not fit that description. The assassinations of JFK, RFK, and Wallace were undoubtedly what Nixon was talking about.

Nixon also says to Haldeman when discussing Hunt and Watergate and the other Watergate men, "It all goes back to the Bay of Pigs, you know." Then several "unintelligible" statements appear in Nixon's edited transcript. Finally, Nixon tells Haldeman he may have to "burden" the Democratic candidate, whoever it may be, by briefing him on those matters of "National Security" on which he was briefed by Johnson. The context in which this appears, surrounded by "unintelligible" remarks, indicates Nixon was talking about matters which would be very embarrassing and would have to be kept secret at all costs. This is the tape that was probably edited and erased partly by Nixon and Haig.

23. Nixon and Mitchell discussed the assassinations and the attempt to assassinate George Wallace. These discussions probably occurred mostly on Nixon's Potomac yacht, but some could be on the tapes. Mitchell executed orders to suppress the truth about these events. Source: a. Article by Martha Mitchell, McCall's magazine, September, 1974, with Mrs. George Wallace, discussing Nixon and plumbers hiring Arthur Bremer; b. Public statements by Martha Mitchell to Helen Scott, U.P.I., Spring, 1973, concerning conversations Nixon and Mitchell had on Nixon's yacht, about dirty things.

24. Gerald Ford now has possession of the most critical tapes when assassinations and cover-up were discussed. He will not let go of them or he will give them to Nixon. Source: News stories about White House keeping the Nixon tapes, August and September, 1974.

25. Jaworski can be counted on to keep the assassination material under wraps even after his resignation. He is already well aware of the evidence of conspiracy and cover-up in all three cases. (JFK, RFK, Wallace). Source: Discussions and meetings between this author and Watergate Senate Committee staff. Assassination evidence has been in Ervin Committee and Jaworski's possession since the summer of 1973. The fact that Jaworski has not introduced any of it is indicative that it will remain secret. His resignation would seem to be connected in some way with the "deal" between Nixon and Ford. It remains to be seen whether Henry Ruth, the new Prosecutor, can be controlled in the same manner.

26. Hunt has been taken care of and will keep silent. He is out of jail and living on a beautiful $100,000 estate in Florida with plenty of money, across the street from his Bay of Pigs friend, Manuel Artime. Source: Washington Watch newsletter, and correspondence from Tristram Coffin -- August 10, 1974.

27. Clay Shaw was murdered by the Cabal, undoubtedly to keep him from talking, now that the truth about his CIA position has been revealed by Victor Marchetti. He was embalmed quickly before the coroner could determine the cause of death. Evidence indicates he was killed somewhere else and then brought to his own apartment where he was found dead. Source: · New Orleans County Coroner's statement and eye-witnesses who were Shaw's neighbors. Zodiac News Service, August, 1974.

28. Hale Boggs, Warren Commission member was possibly killed by the Cabal. Boggs' airplane disappeared in Alaska. No trace of it was ever found and no explanation of how the plane could have crashed has ever been given. Mrs. Boggs has expressed doubts about it being an accident. Source: News Stories -- 1972-73.

29. Four of the seven Warren Commission members have died: Warren, Dulles, Russell and Boggs. Of the remaining members, Ford is President, John J. McCloy is retired and living in Connecticut and John Sherman Cooper is the new Ambassador to East Germany.

30. Richard Russell, Hale Boggs and Cooper believed there was a conspiracy in the JFK assassination. Russell and Boggs both said so publicly. They are dead. Cooper has said so privately.

31. Haldeman erased 18-1/2 minutes of a taped discussion with Nixon. This tape undoubtedly contained "National Security" matters. The fact that Haldeman did the erasing can easily be determined by tracing the trail of possession of the tape from the day it was taken out of the vault to the day the gap was discovered. Haldeman had the tape with the recorder alone for nearly 48 hours. No one else, including Nixon, had the tape alone long enough to do the erasing.

32. Ford and the "inner circle" contemplated pardons for Mitchell, Haldeman, Ehrlichman and possibly others who know the number one secret. Source: News Stories September 9-11, 1974. After public and private outcries stopped this maneuver by Ford, alternate arrangements will have to be made to keep them all quiet.

33. Ford's statements to the sub-committee of the House Judiciary Committee concerning his pardon of Nixon dodged the real issue. Only Elizabeth Holtzman asked questions coming close to the #1 secret. When she asked about a prior agreement, Ford said, "I have made no deal, there was no deal, since I became Vice President." Those last few words were not reported by the press, but a large number of Americans watched and heard him say them. Of course he spoke truthfully because the "deal" was made BEFORE he became Vice President.

Footnotes

1. Evans & Novak column -- September 12, 1974
2. Paris Herald Tribune -- September 12, 1974
3. "Compulsive Spy," Tad Szulc, Viking Press, 1974
4. "Nixon and the Mafia," Jeff Gerth, Sundance, December, 1972.
5. "Six Crises", Richard M. Nixon
6. "Compulsive Spy"
7. "Nixon and the Mafia"
8. "Nixon, Bay of Pigs & Watergate" -- R. E. Sprague, Computers and Automation, January, 1973
9. "Nixon, Bay of Pigs & Watergate" -- R. E. Sprague, Computers and Automation, January, 1973
10. Trowbridge Ford, Holy Cross College, several papers and articles
11. Warren Commission Hearings & Exhibits -- Vol. 23, Pages 941-943
12. Nixon Transcript of June 23, 1972, tape -- N.Y. Times, Aug. 6, 1974
13. Trowbridge Ford -- Article on Gerald Ford & Warren Commission
14. Trowbridge Ford -- Article on Gerald Ford & Warren Commission
15. Gerald Ford -- "Lee Harvey Oswald -- Portrait of the Assassin"
16. "The Framing of Jim Garrison," R. E. Sprague, Computers and Automation, December, 1973
17. "The CIA and the Kennedy Assassination" -- Unpublished article by R. E. Sprague
18. Nixon tape, June 23, 1972
19. Warren Commission Exhibits -- Testimony of Jack Ruby, Vol. V, Pages 181-213 and Vol. XIV, Pages 504-571. Also Trowbridge Ford article on Jaworski
20. Washington Watch and Triss Coffin letter, August 10, 1974
21. Zodiac News Service release -- August 20, 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*.

SIXWORDO

In this puzzle, the problem is to paraphrase a passage (a series of connected sentences) making every new sentence no longer than six words, the meaning to be just the same. According to the dictionary, to paraphrase means to re-state a text or passage giving the meaning in another form; in this case there is no requirement to change or alter any word — only the requirement of producing sentences no longer than six words. Usually, the number of sentences in the paraphrase is 4 or 5 times the number of sentences in the original passage.

SIXWORDO PUZZLE 751

Within any one context, the problem of designating ideas is relatively easy. Most ideas are tagged with single-meaning words. Ideas are then made clear and definite, and we reach the happy state in which we can readily calculate with idea-labels. In the game of chess, for example, the following words all have a neat one-to-one correspondence with ideas: "king, queen, bishop, rook, knight, pawn, black, white, board, square ...." In fact, the list of special words belonging to chess is only 30 to 40 terms long. The words belonging specifically to a given context can conveniently be called "brick-words"; and the remaining words which can be used in a great many contexts and which put brick-words together can conveniently be called "cement-words".
(Hint: One solution uses 27 sentences.)

MAXIMDIJ

In this kind of puzzle, a maxim (common saying, prov-erb, some good advice, etc.) using 14 or fewer different letters is enciphered (using a simple substitution cipher) in-to 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 PUZZLE 751

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 repre-sented 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) mis-spellings, or is otherwise irregular, to discourage cryptana-lytic methods of deciphering.

NUMBLE 751

```
    T H E
+   P O O R
─────────
=   R T H I
+   F E E D
─────────
= I E O P I
```

64438   124

NAYMANDIJ

In this kind of puzzle an array of random or pseudoran-dom 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 that 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 751

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

In this puzzle, the objective is to express a procedure for going in a given situation from given input to given output. The following conditions apply: the situation is a little off the beaten path and is interesting; the procedure is fairly evident and fairly short; the procedure is to be expressed in precise English words, with perhaps defined terms in addition; the procedure is to be completely and accurately expressed, i.e., the calculating procedure must work.

For the following puzzle, we hope to publish in the March issue the best solution received before Feb. 10 from a reader of *Computers and People.*

ALGORITHMO 751

Problem: State a procedure for going from a given number N to the minimum number M of tetrahedral numbers which added together will equal N. Also, state the solutions. *Input:* A number N from 1 to 1000. *Output:* (1) The minimum number M. (2) The solutions for M. *Example:* For N equal to 16, the minimum number M is 4. There are two solutions for 16: 10 + 4 + 1 + 1 ; 4 + 4 + 4 + 4.

Definition: The tetrahedral numbers are numbers of the form k(k+1)(k+2)/6, where k is a positive integer. The first six tetrahedral numbers are 1, 4, 10, 20, 35, 56, ... A tetrahedral number is so named because it counts the number of round balls composing a solid tetrahedron of round balls.

GIZZMO

The puzzle is to grasp relations between things that are not identified in the usual way — their names cannot be looked up in a dictionary — and then solve a problem involving them.

GIZZMO 751

While we believe that there are reasonable limits to what the HONTEMS of FLEENS should be in their entirety and to what an individual FLEEN should seek to encompass by way of a variety of HONTEMS, we do not consider these limits to be either crystal clear or uniformly applicable to any and all FLEENS. Many HONTEMS can improve FLEENS; certain contrasting HONTEMS in the same FLEEN can make the FLEEN both more interesting to its participants and more vital in its HONTEMS because some conflicts in points of view and methodology can be highly productive. The multipurpose FLEEN can be more exciting than the single-purpose FLEEN. However, we urge adoption of the many golden mean solutions between the extreme of the all-purpose FLEEN and the single-purpose FLEEN. Our caution is that a FLEEN can do too much as well as too little.

What is a HONTEM? What is a FLEEN? *(Hints:* 1. This puzzle is derived from a famous report by a famous foundation. 2. But there may be more than one solution.)

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

SOLUTIONS

MAXIMDIJ 7412: Even one enemy is too many.

NUMBLE 7412: The heart has also ears.

GIZZMO 7412: GOND: superstitious belief; ALUN: activity; ENGAD: object.

NAYMANDIJ 7412: Make row 2 even.

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

Our thanks to the following individuals for sending us their solutions to — **NUMBLE 7411:** Abraham Schwartz, Jamaica, NY.

Computing and Data Processing Newsletter

CAMBRIDGE MASS. USES COMPUTER TO FOIL SCHOOL VANDALS

Incidents of vandalism in Cambridge schools have dropped dramatically this year, according to Oliver Brown, assistant superintendent of schools.

"The combined efforts of the School Committee, police, city electricians, parents and residents have reduced damage costs from $3700 a month to $335 a month since the beginning of the year," said Brown.

A 12-point plan initiated last fall brought about a decrease from 37 incidents a month to about seven, Brown said.

Police also said that a man who bought stolen school goods, then attempted to sell them back to the School Department, was recently apprehended.

Each article of school equipment is now stenciled in code.

The vandalism has been computerized with each incident recorded, including all details, to show a pattern which police can follow up.

Date, time, place, how entrance was gained, the nature of the incident, and the cost of the loss are noted in the computer banks.

Through this method, school and police officials analyze where vandalism occurs and where vandals might strike again.

Parents, teachers and residents are made aware of the sites of frequent vandalism, and they give valuable assistance.

Electronic surveillance equipment has been installed in schools where vandalism occurs most frequently.

Police cruisers respond to school alarms in "one to three minutes," Brown said.

In another phase of the plan, locks in school buildings have been changed to make illegal entry by keys almost impossible.

As an added incentive, $1 for each student in each school has been set aside to pay for vandalism in addition to the normal educational funds.

Money not used for vandalism due to its decline may be used by each individual school for educational, recreational or aesthetic projects, Brown said.

Vandalism cost the Cambridge School Department $34,123 for the first nine months, but many of the thefts and much of the damage occurred before the new plan was implemented.

BRAILLE COMPUTER TERMINAL DEVELOPED IN AUSTRALIA

John Coleman
Australian Information Service
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New York, N.Y. 10020

A device which enables blind people to read information provided by a computer has been developed in Melbourne, Australia.

Mr. Tony Brown, 29, a blind electrical engineering graduate of Monash University in Melbourne and a member of the university staff since 1971, has developed the braille printing device to supplement the teletype machine which is normally used by computer operators to give instructions to and receive information from a computer.
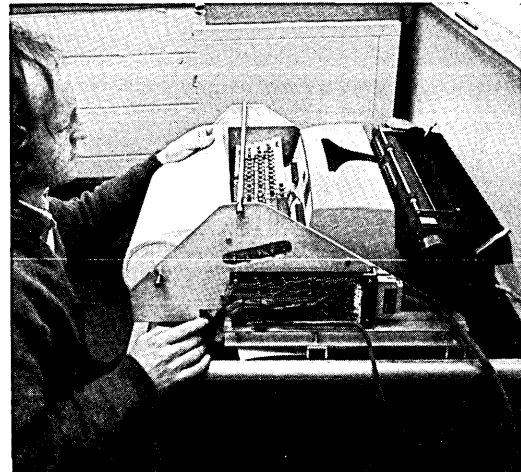
The machine consists of a standard teletype terminal with keyboard and print-out facilities, a braille typewriter which has been converted to automatic operation, and a mini-computer which receives information from the main computer, stores it and then converts it to a form which can be printed on the braille typewriter. The same information is also relayed to the standard teletype terminal printer.

The terminal was developed over the past two years as a part-time project by Mr. Brown in conjunction with the computer centre's director, Dr. Cliff Bellamy.

It was financed by a $A7500 grant from the William Buckland Foundation.

Mr. Brown, who has been blind since he was 18, said that other systems of braille computer print-outs had been devised such as using only the periods

on a standard printer; but that these tended to be difficult to program and to read.

The new terminal designed and built by the computer centre combines great flexibility with high quality of output.

The prototype model will undergo some refinement and then it will be tested by other blind computer programmers and with other computers.

THREE COMMUNITIES IN MASSACHUSETTS MAKE SAVINGS WITH COMPUTERIZED SCHOOL-BUS ROUTES

Massachusetts school transportation costs, which last year topped $55 million, have been forced sharply upward this year by inflationary pressures -- such as higher vehicle costs, increased oil prices and rising bus drivers' salaries -- not to mention extra court-ordered busing in Boston and Springfield.

But computerized bus routing has chopped more than $100,000 from 1974 school transportation budgets in Braintree, Brockton and Taunton.

School officials in those communities hired consultants to survey local traffic patterns, locations of students' homes and school destinations, then developed plans for more efficient use of school buses.

"The consultants did everything we asked and more," said Taunton School Supt. Edward Aleixo.

Aleixo said 57 buses formerly were used to cover 87 routes in the city. Now there are nine more routes but only 33 buses.

Taunton's savings may have been augmented by competition among four bus companies for a share of the contract. Each route was bid separately.

Long said the consultants proposed several alternate busing programs for Brockton. "We decided not to adopt staggered school closing hours," Long said, "but with more efficient scheduling we cut our transportation budget about 8 percent last year."

In Taunton, the cutback in the number of buses required adjustment of school starting times. The high school classes start at 8 a.m., middle school at 8:30 and elementary grades at 9.

In these and other communities with recently revamped schedules, school officials report there were some parental complaints during the early weeks of school.

Longer bus routes or double bus trips forced some students to leave home earlier than in past years.

Younger children on an early bus may tire more easily than older students, and they need extra supervision if they arrive at school 20 minutes or more before classes begin.

As more children are assigned to each bus, disciplinary problems may increase, and safety analysts may become concerned about standees.

"If you're going to save this much money, something has got to give somewhere," said Braintree's School Committee chairman, Mrs. John Grabosky, who added that Braintree's busing costs dropped from $368,000 in 1973 to approximately $253,600 this year.

Consultants' fees depend on the size of the school system and the extent of services required by the school committee.

Among the consultants which offer computerized bus routing are: LKB Systems of Syosset, N.Y.; Programmed Transportation of Penfield, N.Y.; Westinghouse Learning Corp., of Waltham; and Educational Coordinates, of Princeton, N.J.

Leo P. Turo, director of the state Board of Education's school management services, is skeptical about paying private consultants for bus scheduling.

Turo said his office assists public schools with scheduling, contracts, safety and other busing problems -- all without cost to the school system.

Hull School Supt. Richard Charlton said Turo's department helped his community write specifications for its transportation contract but did not restructure bus routes.

Some school officials reject use of consultants, contending that local school bus coordinators know their community and its transportation problems better than any outside consultant could in a few weeks.

One school official disagreed. "I don't think we could have done as well by ourselves."

Brockton's Girard Long said: "Most routes were set up years ago and only changed when buses became overcrowded. No one in the school department has time to plot the location of every student's home. If some company is equipped to do this and can save us money, why not take advantage of it?"

MANY RADIO MUSIC STATIONS ARE RUN BY COMPUTER

A current development is the automated radio station run by computer. According to Broadcast Magazine, more than half the FM radio stations in the country are now completely automated, with more scheduled to take that route in the near future. This magazine also reports that automation is making gradual inroads in the AM market.

Here's how a system works. A station hires a programming company and tells it what type of format is desired -- adult rock, beautiful music, top-40, etc. The programming company then chooses the actual music to be played and the order the songs are to be played in, based on what has been successful for other stations with the same format. The songs are taped and sent to the station, where they are simply put into the computer and played one after another automatically.

At some stations, even the commercials are taped beforehand. Then all a station has to do is to keypunch an order to the computer telling it when to use a certain commercial. It's done without a single human being ever having to touch the tape.

One general manager stressed cost as a major advantage of the automated systems. "One or two announcers to tape your commercials, a couple of people to be with the computer 24 hours a day, and there's your broadcasting staff."

To people who complain that an automated station has a "canned" sound, he replies, "These days the computers are so sophisticated that unless we tell people we're automated, they'd never know."