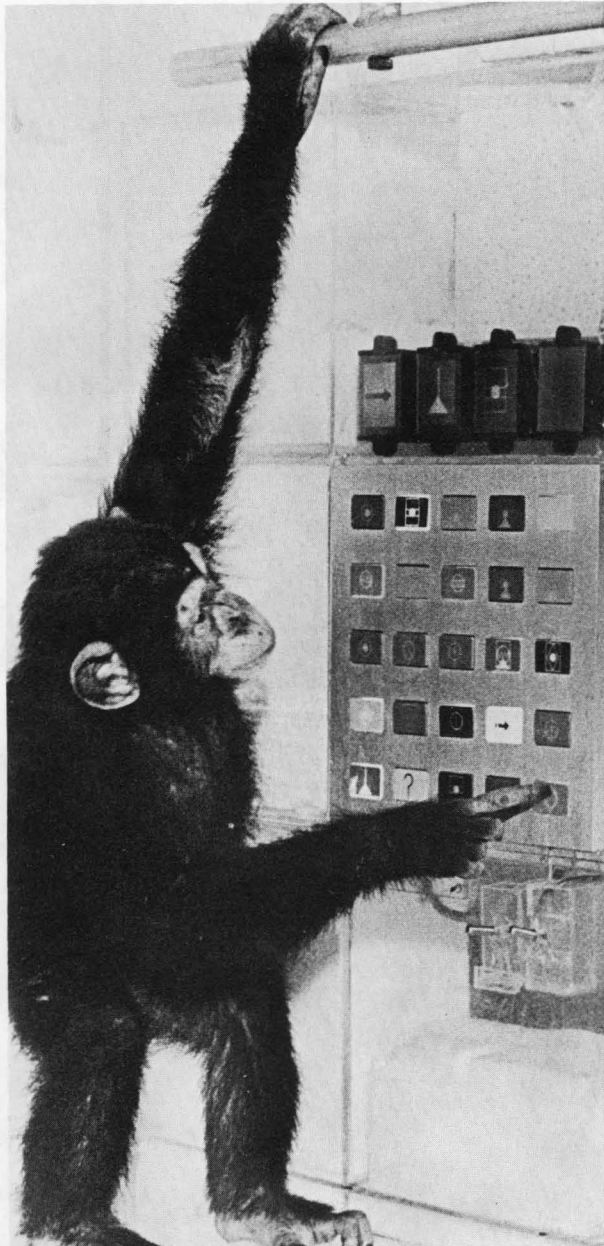


computers

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"PLEASE TIM TICKLE LANA"

Communication – Three-way: Chimpanzee, Man, Computer / *Larry B. Dendy, Ernest von Glasersfeld, and others*

Computer Privacy and Security / *Howard Campaigne and Lance J. Hoffman*

Computer Programming Using Natural Language – Part 2 / *Edmund C. Berkeley, Andy Langer, and Casper Otten*

Applications of Computers in Correspondence Schools / *Major Charles Ehin*

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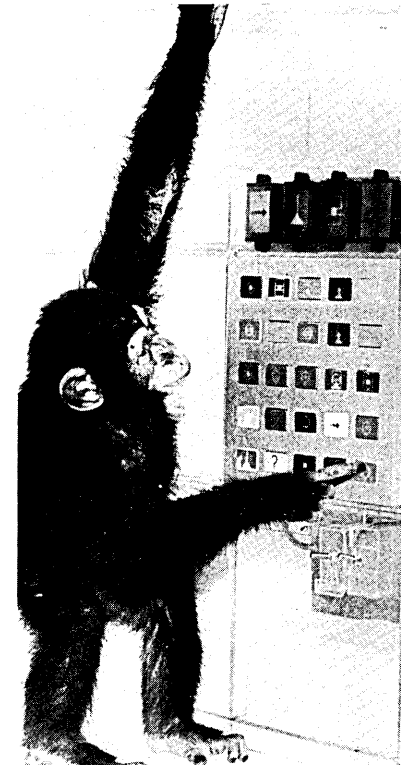
Corrections

For changes in "The Path to Championship Chess by Computer" by Professor Donald Michie published in the January 1973 issue of Computers and Automation, see page 36 of this issue (July).

In the June issue, the footnote of page 36 requires correction. This footnote should be corrected to read as follows:

Accessories After the Fact is the title of a book by Silvia Meagher published by Bobbs Merrill in 1967, accusing the Warren Commission and the various government agencies of criminally concealing the conspiracy to kill President John F. Kennedy. This article accuses the national news media of the same crime.

NOTICE: The official name of this magazine throughout 1973 is *Computers and Automation*. We expect to change the name officially as of January 1, 1974, to *Computers and People*. During 1973 from time to time, unofficially, and irregularly, we plan to use the name *Computers and Automation and People* as a way of informing our subscribers and readers of the intended change on January 1, 1974.



Front Cover Picture

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Key

- [A] — Article
- [C] — Monthly Column
- [E] — Editorial
- [F] — Forum
- [G] — The Golden Trumpet
- [NT] — Not Technical
- [T] — Technical

NOTICE

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High-Level Crime and the High-Level Criminal

The *Wall St. Journal* of April 24 published an article "Equity Funding Scandal Grows, Involves \$120 Million in Nonexistent Assets" by Priscilla S. Meyer, in which the following occurs:

Equity Funding Life Insurance Co. sold a package that involved both life insurance and mutual fund shares. The purchaser agreed to invest a certain amount of money in a mutual fund. The shares he got were then used as collateral for a loan from Equity Funding that was used to pay the premium on the insurance policy. . . . The company was selling the insurance policies for cash to the various reinsurers.

Someone at the company decided that it would be easy to create phony policyholders, sell them phony insurance, and peddle this to the reinsurers. . . . Not only were the policies phony but so too was a gigantic bunch of assets carried on the books of the parent Equity Funding Corp. These assets represented the loans allegedly made to Equity Funding Life policyholders . . . One source now says that about \$77 million of these loans are phony. . . .

The customers didn't exist. Their mutual fund shares didn't exist. The funded loans didn't exist. The phony customers' phony pledges of their phony fund shares to buy phony insurance ultimately became numbers on a computer tape, which then printed out phony assets for Equity Funding Corp.'s phony books. . . .

In *Parade Magazine* for May 6, appears an article "How to Bribe a Congressman" by the columnist Jack Anderson, in which the following appears:

Lobbyist Cyrus T. Anderson, convicted of paying Senator Daniel Brewster (Democrat, Maryland) "an unlawful gratuity" amounting to \$14,500, told the court that he funneled thousands of dollars, most of it in hard cash, from corporations and unions to various politicians.

What kind of people came to him for cash: "Senators, Congressmen, candidates for President of the United States" said Lobbyist Anderson. He was scrupulous, however, never to bribe anyone inside a federal building. "It was my understanding," he explained to the court, "that even legal political contributions can't be made in a federal building, much less ones that weren't going to be reported." Why do Congressmen want payment in cash? "They prefer," replied Anderson, "not to make public the sources of their incomes."

What are the reactions of most Americans to crime at these high levels? There is no question that their reactions are different to crime at the level of robbery of a store or holding up a bank.

"The real weakness in the moral position of Americans," wrote the sociologist and Progressive scholar Edward A. Ross in his book *Sin and Society*, 1907, "is not their attitude towards the plain criminal, but their attitude towards the quasi-criminal." The latter, he said, escape the condemnation of the public because their sins do not share in the Biblical simplicity of low-level crimes. The high-level criminal threatens the purse of large impersonal groups, not your purse and mine. Their kind of wrongdoing has evolved along lines that are parallel to the impersonal nature of industrial society, and so is left untouched by traditional

morality. The high-level criminal, Ross said, is characterized not by his tendency to do evil in a personal way but by his moral insensibility. "He is a buyer rather than a practitioner of sin," Ross said, "and his middlemen spare him unpleasant details."

Of course, high-level criminals are even more evil than their low-level analogues. This kind of criminal is the executive of a life insurance corporation who helps sell phony insurance policies to phony customers. He is an administrative aide who because of "loyalty to the boss" covers up the organizing and planning of: electronic eaves dropping; burglarizing; fake letters; false newspaper advertisements; manufactured "public" support for the bombing of Hanoi and Haiphong; etc. He is a former attorney general of the United States who when indicted says, "I did not steal any money". He is a former Assistant Secretary of Defense who says, "Any government has a right to lie to save itself".

The high-level criminal rejects the crude instruments of street crime, but with recent advances of technology has gathered together a more efficacious arsenal. His tools of violence include: diverted campaign contributions carefully collected in cash and "laundered" by passing them through bank accounts in Mexico; the programs and operations of the organization's computer; the interstaff memo and special "Gemstone" stationery; the offer of the directorship of the Federal Bureau of Investigation to a judge in charge of an important trial in which the government is prosecutor; etc.

The high-level criminal understands the difference in public esteem between those who do the burglarizing and the implanting of electronic bugs, and those who merely order it; he seeks to place bureaucratic distance between himself and the evil committed under his auspices. He admits to no more at any stage of the news than he has to. First, he calls what goes on a "bizarre incident". Later, he calls the explanations he has previously given "inoperative". Finally, he says he acted to conceal crime because of "the interests of national security".

Dr. Samuel Johnson, English lexicographer, essayist and poet, in 1775, said "Patriotism is the last refuge of a scoundrel". Today's Madison Avenue translation of "patriotism" is "national security".

The antidote to high-level crime is enforcement of the laws, the removal of criminals from power and authority, and the indignation of honest and courageous Americans who are resolved to have a better and a more honest society. We have had such a society in the past. It is time to have it again.

And incidentally such a society is good business: it costs much less and produces much more. It would give more employment, less inflation, lower taxes, less fictitious and more real security, etc., to every American. For it costs a lot of money to have criminals in charge of a computer, a life insurance company, or a society.

Edmund C. Berkeley Thomas A. McLaughlin
 Edmund C. Berkeley Thomas A. McLaughlin
 Editor Assistant Editor

Communication — Three-way: Chimpanzee, Man, Computer

Part 1. Introduction

Larry B. Dendy
Public Relations Office
The University of Georgia
117 Terrell Hall
Athens, Ga. 30601

"The animal can 'read' in her language and make grammatically correct requests for food and entertainment."

A chimpanzee named Lana at the Yerkes Regional Primate Research Center is "talking" with the aid of a computer and a new language created especially for her.

The animal can "read" in her language and can make grammatically correct requests for food and entertainment. Later on the scientists hope to carry on a conversation with her.

Lana "speaks" by punching out sentences on a special vertical keyboard. The requests are answered by a computer, which will grant them if the sentence is grammatically correct and refuse them if Lana makes a grammatical mistake.

The research project is sponsored by the National Institute for Child Development and is conducted jointly by researchers from the University of Georgia, Georgia State University, and the Yerkes Center at Emory University. Seven scientists from the three institutes have been working on the project for more than a year.

Communication

Dr. Ernst von Glasersfeld, a psychologist at the University of Georgia, designed and implemented Lana's special language. He explained:

"We wanted to find out if, in a controlled environment, chimpanzees, gorillas and orangutans can be taught to communicate spontaneously through the use of a language-like system for their own purposes. Through this we hope to find out something

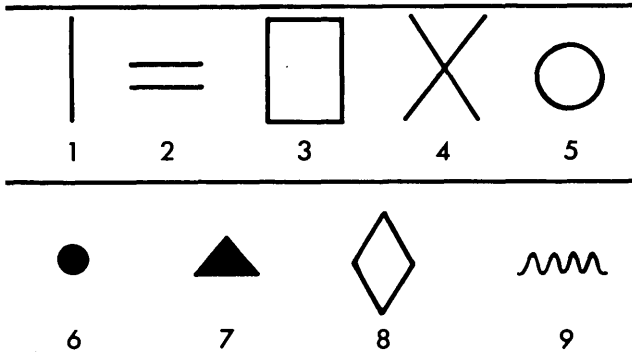


Figure 1. The great majority of the lexigrams which Lana uses are made up of the 9 single design elements shown here.

significant about the basic problems many children have in learning their language."

Von Glasersfeld said the scientists were interested in two levels of communication. First, they wanted to see if the apes could convey wants and needs, for which they would receive material rewards. Then, they wanted to see if the apes could be taught to communicate without the promise of material rewards — to describe something, to "talk" about something they did not necessarily want.

"If they can do that," said von Glasersfeld, "then it might be possible to get them to ask questions. It might be possible to set up a facility for man-to-ape and ape-to-man communication and maybe even ape-to-ape communication."

Several attempts to teach non-human primates to speak English have failed because the animals' vocal chords are not equipped for the modulations and emissions necessary to produce English word sounds, von Glasersfeld said.

However, two studies made during the past six years have proved beyond doubt that, when apes are given an effective visual communication technique, apes can express various requests and can learn some of the essential parts of linguistic communication.







<p>Elements 2, 4, 7 Orange</p>  <p>BLANKET</p>	<p>Elements 1, 7, 8 Orange</p>  <p>BOX</p>
<p>Elements 1, 5, 6 Red</p>  <p>NUT</p>	<p>Elements 5, 9 Red</p>  <p>WATER</p>
<p>Elements 1, 3, 8, 9 Blue</p>  <p>TO BITE</p>	<p>Elements 1, 2, 3, 5 Blue</p>  <p>TO GROOM</p>

Figure 2. Samples of Lana's lexigrams. The numbers indicate the elements of the lexigram; the colour is indicated in the right-hand top corner, the "meaning" underneath.

The Language "Yerkish"

One important question von Glasersfeld and his colleagues wanted to examine was what factors influence or restrict the apes' ability to acquire a language. To make the study objective and error-free, the scientists created a special language called Yerkish, and designed and built a computer-controlled facility in which to teach it to apes.

The language Yerkish is built from nine simple figures — a vertical line, an equals sign, a rectangle, a caret (or inverted v), a large open circle, a small black circle, a black triangle, a diamond-shaped figure, and a horizontal wavy line. (See Figure 1) By superimposing these figures on each other, the scientists have created graphic symbols that they call lexigrams, that stand for various concepts.

For example, an open circle intersected by a wavy line means "water". A vertical line intersecting a black circle enclosed by an open circle is the symbol for "nut". (See Figure 2)

"Words"

The present computer system can handle 256 lexigrams or "words". So far the scientists have created 125 lexigrams. To avoid ambiguity, each lexigram has only one specific meaning; this is unlike English, in which most words have more than one specific meaning.

The symbols are on a vertical keyboard (see Figure 3) attached to a computer that has been programmed to deal with the language. Above the keyboard are seven small projection screens on which the symbols indicated by pressing keys appear in the sequence in which they are pressed.

In order to "talk," Lana must activate the system by pulling a bar above the keyboard. She must punch out the proper lexigrams in the proper sequence to make her request and then end the sentence with a period symbol.

"Grammar"

The computer will accept only sentences that are grammatically correct in Yerkish. If Lana makes her request correctly, the computer automatically triggers a dispenser that gives her what she has asked for. If she makes a mistake, the computer sounds an error buzzer, erases all symbols from the screens, and Lana must begin again.

An example of the sentence structure she must follow is, "Please machine give me a piece of banana". Instead of "banana," she can indicate "orange, candy, raisin, water, milk" or other foods. She can also ask for music, a picture, a short movie, a toy, and for the window to be opened.

The computer makes a totally objective judgment of Lana's linguistic performance. This eliminates the possibility that human prejudices or sympathies or errors in regard to Lana will interfere with training her or judging her progress or her competence.

The computer records all Lana's efforts for later study by the scientists.

The researchers know that Lana has not simply memorized the proper sequence to punch on the keyboard because, when they change the position of the

lexigrams, she consistently picks out the right ones in the right order to make a grammatically correct request.

"Reading"

Further proof that she "reads" and understands the visual symbols is shown when the chimp accidentally hits the "please" key while hanging onto the activating bar. If she notices the "please" symbol on the screen, she does not strike the key again but continues to add her request to it.

Also, if one of the scientists punches the first two or three keys of a sentence, Lana can finish it correctly.

The fact that she notices and understands the visual symbols is important. This encourages the scientists to hope that eventually they can ask Lana questions and engage her in conversation.

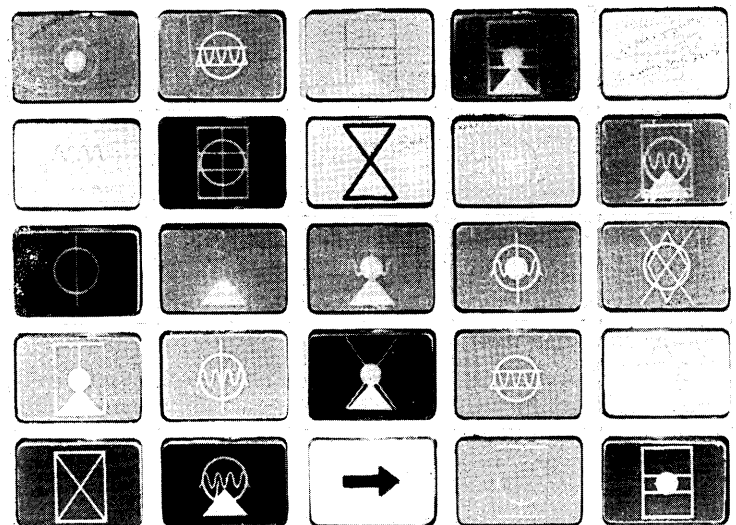


Figure 3. Photographs of the 25 keys of the keyboard which Lana uses are here shown with actual intervening spaces removed. The board at this time displays 25 lexigrams (see tabular statement below). Some lexigrams shown are: no. 5, PERIOD, no design, solid yellow; no. 9, PIECE, elements 1, 5, 6, 8, orange ground; no. 20, WINDOW, elements 2, 7, 8, orange ground; no. 23, PLEASE, black arrow, yellow ground. (The word lexigram here is used to include "sentence modifier", but sentence modifiers are NOT composed of the regular design elements.)

PROJECTOR	MILK	BLANKET	SHELLEY	.
TOY	TO GROOM	NO	PIECE	MUSIC
OF	MACHINE	MOVIE	M & M	CHOW
TIM	JUICE	DIFFERENT	MILK	WINDOW
TO MAKE	WHAT	PLEASE	OPEN	TO GIVE

The upper right frame contains the sign for a period, which Lana uses to finish her sentences.

"Knowledge"

Lana now knows between 35 and 40 lexigrams. (See Tables 1 and 2) New ones are being introduced. When she can produce a certain number of sentences correctly and can learn a new lexigram and use it correctly in a new sentence, "then she will have achieved productivity — the ability to form a correct sentence with new words," said von Glasers-

feld. "That is one of the requirements of language competence."

Table 1
LEXIGRAMS OF LANA, MAY, 1973

Following is Lana's actual vocabulary, i.e., the lexigrams she is using correctly as of May, 1973:

APPLE	MOVIE
BANANA	MUSIC
BLANKET	NO
CHOW	OF
COME (activity)	OPEN
DOOR	PIECE
GIVE (activity)	PLEASE
GROOM (activity)	ROOM
INTO	SHELLEY (name of experimenter)
JUICE	
LANA (in instructions to her)	TICKLE (activity)
MACHINE	TIM (name of experimenter)
MAKE (activity)	TO
MCM	TOY
MILK	WATER
	WINDOW

"If she responds correctly to questions," he continued, "then we will be able to test how far her conceptual mechanism conforms to the conceptual mechanism humans use and express in language."

Other members of the group working with von Glasersfeld are: Dr. Duane M. Rumbaugh, former vice-director of the Yerkes Center and now head of the psychology department at Georgia State University; Dr. Josephine Brown, professor of psychology at Georgia State; Piero Pisani of the University of

Table 2
SENTENCES OF LANA, MAY, 1973

1. Sentences actually used by Lana:

PLEASE MACHINE GIVE BLANKET
JUICE
MCM
MILK
TOY
WATER

PLEASE MACHINE GIVE PIECE OF APPLE
CHOW
BANANA

PLEASE TIM TICKLE LANA
SHELLEY

PLEASE TIM GROOM LANA
SHELLEY

PLEASE TIM COME INTO ROOM
SHELLEY

PLEASE MACHINE MAKE MUSIC
MOVIE

PLEASE MACHINE MAKE WINDOW OPEN

2. Sentences she responds to:

PLEASE LANA COME TO DOOR

PLEASE LANA GROOM TIM
SHELLEY

Georgia's Computer Center; Prof. Harold Warner and graduate students Charles Bell and Timothy Gill of the Yerkes Center.

Part 2. A Computer Mediates Communication with a Chimpanzee

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"Until very recently it was considered a self-evident proof of man's uniqueness among the fauna of this planet that he had developed and was using the sophisticated communication system we call language."

A computer has recently been employed to explore the possible linguistic capabilities of an ape (Rumbaugh *et al.*, in press). Sponsored by NICHD at the Yerkes Regional Primate Research Center of Emory University, a team of specialists in the areas of psychology, primatology, psycholinguistics, computer systems, and bio-medical engineering, from the Yerkes Primate Center, Georgia State University, and the University of Georgia, is studying language-relevant behaviors of a two-year old infant chimpanzee called Lana.

The purpose of the project is twofold. First, to develop an ape-machine-man communication system for the exploration of the linguistic potential of apes; second, to gain, in the course of that exploration, insights into the processes of concept formation and language acquisition that may prove useful in the design of remedial programs for retarded children and, generally, for basic linguistic incompetencies in humans.

This article primarily intends to describe the computer-controlled test facility that was designed for the above purpose.

Background

Until very recently it was considered a self-evident proof of man's uniqueness among the fauna of this planet that he had developed and was using the sophisticated communication system we call language. As a result, it was assumed that other species, because they had not developed such a system, must also be incapable of using it. Indeed, Chomsky (1968), drawing on the Cartesian dogma of mind-matter dichotomy and the consequent split between man and all other living organisms, went so far as to assert that language was to be considered dependent on man's species-specific genetic endowment.

During the last five years this belief has been severely shaken by two studies. The Gardners (1971) succeeded in teaching Washoe, an infant chimpanzee, enough American Sign Language (the language traditionally used by deaf mutes) so that Washoe can now communicate requests and even some spontaneous comments in this medium. Independently, David Premack (1971) trained Sarah, again a female chimp, in the use of an artificial language made up of coloured plastic symbols that can be arranged into sentence-strings on a magnetic board. According to his reports, Sarah is now able, among other things, to answer questions, to handle negation, and even to respond correctly to instructions that involve a condition ("if ... then").

Both these studies show that chimpanzees, though they do not get beyond a relatively simple signaling system when left to their own devices in the wild, can indeed learn to use a nonvocal language-like means of communication and can acquire at least some parts of what linguists call "linguistic competence" (Ploog and Melnechuk, 1971). How much of this they can acquire, however, is still an open question.

Objective Records

Two things seem essential in an attempt to throw more light upon this question of competence. The syntax of the language to be acquired by the experimental subject must be rigidly defined before the subject's performance can be assessed; and the assessment of the subject's performance must be made in an objective manner.³ We therefore decided to take the evaluation of grammaticality or well-formedness of the subject's linguistic output out of the hands of a human observer and to let a patently unemotional and unbiased computer decide whether or not the linguistic performance of the subject was correct according to the pre-established rules of the language.

Using a computer to monitor and evaluate the subject's entire linguistic production at once provides another advantage: the computer has no difficulty in keeping a complete record of all interactions for subsequent analysis and investigation. Human observers hardly ever achieve such absolute completeness in their records, and, in long-term studies, they tend to constitute a forbidding cost.

As it functions at present, our communication facility comprises four main elements.

Yerkish, an Artificial Language

Yerkish is a visual language using graphic word-symbols we call "Lexigrams". The computer implementation can hold a vocabulary of 250 lexigrams, fifty of which are actually being used at the moment. All lexigrams are two-dimensional designs consisting of one, two, three, or four constant design elements. There are nine design elements and three colours (yielding seven discrete colour combinations) chosen for their discriminability and combinability (see Fig. 1).

Lexigrams are word-symbols in that they designate concepts. They mostly correspond to English words but, unlike English words, they are strictly univocal; i.e., each lexigram has one and only one definition or meaning.

The rules governing the formation of sentences in Yerkish are defined by a correlational grammar derived from the correlational grammar of English

(von Glasersfeld, 1970). Correlational grammar differs from traditional grammars in that (a) its word-classes are based on a semantic or conceptual classification, not on morphological surface characteristics of words; and (b) its syntax is based on a detailed specification of relational concepts and their applicability to items of the conceptual word-classes, rather than on the very generic syntactic functions or connectives of traditional grammars. Thus, instead of the usual word-class "noun," Yerkish has at present 15 lexigram-classes of items that can function as "subject" in a sentence; instead of the usual word-class "verb," there are ten lexigram-classes of items that designate different activities; and instead of the traditional "subject-verb" function, Yerkish now has nine "correlators" (out of a total of 29) representing conceptually different "actor-activity" relations.

As a result of this concept-sensitive syntax, word combinations such as "(the) banana eats" or "Lana drinks (a) banana," which according to traditional grammar would be syntactically correct and only semantically deviant, are inadmissible according to the correlational syntax of Yerkish.

In the present implementation of the system (operational since December 1972) sentences are limited to a length of seven lexigrams and an end-sign equivalent to a period. A sentence is defined as the string of lexigrams between a start signal (triggered by the subject's grasping and hanging on to a bar above the keyboard) and the period sign.

Keyboard and Feedback Projectors

A keyboard of 125 keys arranged in five panels of 25 each (two such panels are operational at present) is the language input device of the system. Each key bears one lexigram. Depressing a key activates the corresponding lexigram entry in the computer's dictionary and transfers the semantic and syntactic representation of the designated concept to the workspace of the parser. Simultaneously the computer sends a code signal representing the design elements of which the particular lexigram is composed to an external decoding device which, in turn, activates one of seven projectors above the keyboard to reconstruct the visual lexigram by projecting the required design elements (one superimposed on the other) onto its ground glass screen. The lexigram of the first key that is depressed appears in the first projector from the left, the second lexigram in the second, and so on, so that the lexigrams forming the sentence appear in their linear sequential order from left to right above the keyboard.

Above the feedback projectors there is a second row of similar devices that can be activated by an experimenter outside the subject's chamber. Sentences sent in to the subject by means of these second projectors also go through, and are recorded by, the computer; thus it will be possible, eventually, to program the computer to respond in Yerkish to some of the linguistic input from the subject's keyboard.

Sentence Analyser or Parser

The grammatical analysis of input sentences is carried out by a reduced and suitably adapted version of the Multistore Parser (von Glasersfeld and Pisani, 1970) that constitutes the operational implementation of the correlational grammar of Yerkish. In the present system both a vocabulary of 250 lexigrams (half of which can be represented on the keyboard at any one time) and a grammar of max-

imally 46 connective functions and 46 conceptual lexigram-classes are contained in approximately 4000 bytes of central core in a PDP-8E computer. Sentences up to a length of seven lexigrams are accepted and are fully parsed in about one second. Every linguistic input is recorded in print-out and various data are added. Date and time of input, source of input (subject or experimenter), result of sentence analysis (correctness, type of error) are automatically recorded as well as the response, if any, on the part of the computer.

According to the outcome of the parsing, the subject also receives acoustic feedback as to the grammaticality of the input sentence; a bell sound indicates correctness; a buzzer, errors (optional).

Automatic Computer Responses

Requests for various types of food and drink, for a toy, for acoustic entertainment (primate vocalizations, different kinds of music), visual entertainment (slides or movies), and for opening the window (view of outside world) are handled automatically by the computer. If the request is passed as grammatically correct by the parser, the sentence structure, in conjunction with the lexical items involved, triggers a coding device which then sends a signal to the required dispenser or mechanism in the experimental chamber.

If more than six lexigram keys are depressed before the period sign, the parser triggers the error signal, records excess of length for the sentence, and blanks the feedback projectors. Similarly, if the period sign is activated and the parser has not found a coherent syntactic structure incorporating all the preceding lexigrams, the error signal is triggered, the erroneous sequence is recorded, and the feedback projectors are blanked.

Progress of the Subject

After several weeks of preliminary training in discrimination tasks involving single Yerkish lexigrams (roughly equivalent to the initial learning of single words in the human infant), then single lexigrams preceded by "PLEASE" and followed by "PERIOD," Lana was presented with fixed lexigram sequences representing simple requests such as "PLEASE MACHINE GIVE M&M." (M&M candies are still her favourite item!). One press would activate the whole sequence of keys and produce the reward. As soon as she became proficient at obtaining the reward in this manner, the sequence of lexigrams was split into two groups which now had to be depressed one after the other. When this was learned, a further split was made, and so on, until all lexigram keys had to be depressed singly and in the correct sequential order before the reward was delivered. This training method was used because it seemed to be the best approximation to children's use of "holophrases" (i.e., one word where an adult would say a whole sentence). It turned out to be extremely efficient. When the first properly functioning keyboard panel of 25 individual lexigrams was presented to Lana, she had little difficulty in maintaining the correct lexigram sequence of her requests in spite of the fact that the physical position of individual lexigrams in the keyboard was frequently changed. In other words, what she was learning was manifestly not a specific motor pattern, but actually the temporal or sequential order of the lexigrams.

This was further demonstrated by her ability correctly to finish sentences, the first two or three

lexigrams of which were activated by the experimenter. If, for example, the experimenter activated the lexigrams "PLEASE TIM GIVE ..." in the first three feedback projectors, Lana would complete the request by depressing the keys corresponding to "... PIECE OF BANANA" or "JUICE" or "M&M," and not keys such as "MUSIC" or "WINDOW OPEN," which would not have yielded a correct sentence (in Yerkish they would require the beginning "PLEASE MACHINE MAKE ..."). This unexpectedly quick discrimination of correct versus incorrect sentence completion has prompted a special, fully controlled and statistically evaluated study which is now under way (Rumbaugh, Gill and von Glasersfeld, in preparation).

At the moment, about four months after her first exposure to the system, Lana spontaneously makes a variety of requests involving sentences of six lexigrams plus period, and she uses three activity lexigrams ("verbs"), each of which requires the choice of a grammatical "object" that would be incorrect for the other two activities. In all, she is now using some 40 lexigrams.

On the whole, we have to admit that her progress has been considerably faster than we expected. Just now we are beginning to introduce her to "reading," i.e., to responding to Yerkish messages and instructions that are sent in to her by the experimenter. Her first reactions to this new mode of communication are promising — so promising, indeed, that we are beginning to wonder whether the technical work involved in expanding the vocabulary, the keyboard, and the automatic response mechanisms will be able to keep up with the expansion of her skills.

In spite of her rapid progress, however, we have not yet reached the point where we could gather evidence that a nonhuman primate is capable of interactive communication, i.e., capable of linguistically answering questions or participating in a conversation. All we can say at this stage is that, given Lana's preliminary demonstration of aptitude, success in that direction now seems a good deal more plausible than it did at the outset of the project.

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Computer Privacy and Security

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"Several firms are now marketing as standard products bulk memories which could store a one-page dossier on each of the 200 million citizens of the United States in . . . about 225 square feet. In one system . . . all of these dossiers could be available on-line, with an access time of approximately 6 seconds."

Computer systems have come a long way since the first large scale electronic computer was developed at the University of Pennsylvania in 1946. Today computer systems can perform millions of operations each second. They are used in process control, inventory management, information retrieval, war gaming, urban systems simulations, and many other diverse fields, in addition to relatively well-established areas such as payroll computation and account billing.

Along with this increasing use of computers in industry and government, a slow but steadily increasing public concern has developed over potential threats to privacy posed by the advent of the computer. Fears of "1984" or "Big Brother" have developed, as well illustrated by the Newsweek of July 27, 1970. Its cover features a computer system wearing an Uncle Sam hat and equipped with (as peripheral devices) a tapped telephone, videotape camera, sound recording tapes, microphone, and other listening or snooping devices. All of these are focused on one poor couple illustrated in a spotlight. This magazine sitting on every drugstore and supermarket rack in the country focused the attention of millions of Americans on privacy, data banks, and the computer — and its latent power for good or evil.

The worry that some members of the public have expressed about huge memory banks which contain personal dossiers is well founded, from the technological point of view. The technology for storing enormous amounts of data in computer systems is here. Several firms are now marketing as standard products bulk memories which could store a one-page dossier on each of the 200 million citizens of the United States in a small area — about 225 square feet. In one system already delivered by Precision Instruments, Inc., all of these dossiers could be available on-line, with an access time of approximately 6 seconds.

A later system, that of Ampex in Sunnyvale, California, has a $1\frac{1}{2}$ trillion bit memory which uses videotape recording techniques; it allows on-line accessing of the equivalent of up to 32,000 reels of tape or 350 IBM 3330 disks. This amount of memory is equivalent to over 30 double-spaced pages

per person for everybody in the United States. Average access time is under 10 seconds.

IBM has delivered a special order system, the IBM Mass Photodigital Storage System, which consisted of trays of film chips. Each small $3\frac{1}{2}$ mm. x 7 mm. ($1\text{-}\frac{3}{8}$ " x $2\text{-}\frac{3}{4}$ ") chip contained 4.72 million bits of memory (read-only after once written). In each cell was contained 151.04×10^6 bits and in an entire system one could have either 3.36×10^{11} or 1.0×10^{12} bits.

The average access time here was 10 seconds. One could write as little as one file per frame (there were thirty-two frames on a chip). There were 206,640 bits/frame and the bit size was 8.5×8.0 microns.

The Grumman MASSTAPE system can store 16 billion bytes in 16 square feet. Up to eight of these units may be combined to provide a trillion bit (128 billion byte) system at a cost of about .0001 cents per bit (= \$1 million).

As we have seen, the technology in memories is here. How extensive, then are the dossiers currently kept in computer banks? What data is kept in them and who has access to this data?

If we take a look at the panorama of data banks which exist today, we find that the United States has become a records-oriented society. Records are kept on our education, employment, credit, health, and in government files such as taxation and law enforcement. During the past two decades, as most government agencies and large private organizations have been computerizing their large-scale files, the American public has become concerned that because of the computer's enormous capacities far more personal data might be assembled about individuals than it had been feasible to collect before, and that at the same time there might be a decrease in an individual's ability to see and challenge records on himself.

The fact is that computerized data banks which contain sensitive information on people are not nearly as advanced as one might think after reading some of the literature warning of potential misuse

of these systems. The vision of a general-purpose total management information system providing key executives the information they need on a cathode ray tube at the touch of a button — the image so popular in much of the glossy literature of the 60's — is still just that — a vision. In practice, it is nowhere to be found in 1973.

More important, the most sensitive information — information which is text (character strings) rather than numerical values and which is therefore more likely to be subjective — is usually not going into computer systems. With the technology that has been available to date, it has simply been too expensive to store large amounts of text in most computer systems. For a combination of technological and organizational reasons, central databank developments are far from being as advanced as many public commentators have assumed. Organizations have so far failed to achieve the "total" consolidation of their information about individuals which raised civil liberties alarms when such goals were announced in the 1960's by various government agencies or private organizations.

Further, in computerizing their records on individuals, organizations have generally carried over the same policies on data collection and sharing that law and administrative traditions in each field had set in the pre-computer era. Where new law or practices have evolved to protect individual liberties over the past decade, organizations with computerized systems have followed such new policies as fully as those that still use manual files and procedures. Even the most highly computerized organizations continue to rely heavily on manual record keeping and retain in their paper files the most sensitive personal information they possess.

We should not infer, however, that organizational and technical limitations will hold down the amount of information in computer databanks forever. Precisely because of the technological advances in memories mentioned earlier, it is becoming economically feasible to store more and more data in relatively fast on-line memories. As the cost of these memories is driven down, more and more textual and subjective information is likely to be stored in computer systems.

Some areas where data banks with sensitive information on people already exist are law enforcement (e.g., the FBI's National Crime Information Center Computerized Criminal History file), retail credit bureaus (e.g., TRW-Credit Data Corporation's completely computerized credit history data bank) and state welfare system data banks.

These and other computer systems all reflect the age-old problem of resolving the conflict between privacy on the one hand and data acquisition for use in better and more rational decision-making on the other hand. One has to make trade-offs. If society desires better medical systems, speedy and accurate airlines reservation systems, less policemen shot when they stop cars, or faster distribution of welfare checks (just to give a few examples), it will have to give some "private" data to the computer systems which provide these advantages, and thus increase the risk of unauthorized disclosure in order to gain the benefits. Note that sometimes the risk is decreased in computer systems as opposed to manual systems. Data is often better protected in computer systems than in manual file folders presided over by flatter-prone clerks working for low wages in large offices.

As reported by the National Academy of Sciences Project on Computer Databanks in late 1972, "the real issue of databanks and civil liberty facing the nation today is not that revolutionary new capacities for data surveillance have come into being as a result of computerization. The real issue is that computers arrived to augment the power of organizations just when the United States entered a period of fundamental debate over social policies and organizational practices and when the traditional authority of government institutions and private organizations has become the object of wide-spread dissent. Important segments of the population have challenged the goals of major organizations that use personal records to control the rights, benefits, and opportunities of Americans. There is also debate over the criteria that are used to make such judgements (religious, racial, political, cultural, sexual, educational, etc.) and over the procedures by which the decisions are reached, especially those that involve secret proceedings and prevent individuals from having access to their own records. Computers are making the record-keeping of many organizations more efficient precisely at the moment when trust in many large organizations is low and when major segments of the American populations are calling for changes in values that underlie various social programs, for new definitions of personal rights, and for organizational authorities to make their decision-making procedures more open to public scrutiny and to the review of specific individuals involved."¹

The report identified six areas of priority for public action:

1. Development of laws to give the individual a right of access and challenge to almost every file in which records about him are kept by government agencies.
2. Development of explicit laws or rules which balance confidentiality and data-sharing in many sensitive private record systems which today do not have such rules. These include bank records, and travel and charge card records.
3. Limiting the collection of personal information and its use in such areas as arrest-only records in licensing and employment decisions; and selling of name and address lists collected by government agencies to mailing list sellers (unless the individual consents).
4. Increased work by the computer industry to make technological safeguards "available and workable products".
5. Reconsideration by Congress and the Executive Branch of the "current permissive policies toward use of the social security number". The report contends that a minimum level of trust must be maintained between American citizens and their government. "Under these conditions, adopting the social security number as a national identifier or letting its use spread unchecked cannot help but contribute to public distrust of government."
6. Experimentation with special information-trust agencies. For example, the handling of national summary criminal histories (rap sheets) might be taken away from the FBI and given to an independent national agency under control of a board which would have public representatives as well as law enforcement officials on it.

In its closing paragraphs, the report sums up the data banks and civil liberties problem as follows:

"If our empirical findings showed anything, they indicate that man is still in charge of the machines. What is collected, for what purposes, with whom information is shared, and what opportunities individuals have to see and contest records are all matters of policy choice, not technological determinism. Man cannot escape his social or moral responsibilities by murmuring feebly that 'the Machine made me do it'."

Safeguards for Security

To turn now to security measures in computer systems, one must first realize that most safeguards for privacy are not delivered as standard, off-the-shelf items when computer systems are bought or rented today; they do not come with the hardware or with the software. Usually little or no mention of privacy problems is made when the computer system is contracted for. If security safeguards are supplied, they are generally furnished as special optional items, tailored to each individual installation with commensurate cost to that installation. Since concern about the problems of personal privacy in computer systems is now just beginning to surface, manufacturers are just now starting to seriously address these problems. But today there is not one standard system — that is, one you can buy "off the shelf" with no optional hardware or software — which contains adequate privacy safeguards for personal data.

Probably the most important controls of all are administrative, not technical. Administrative controls determine what gets collected in the first place and to a large extent who it is disseminated to once it is collected. Even then, one should realize that no system will even work exactly as designed; we live in the age of the Xerox machine, and in the age of the information buddy system. This buddy system functions in any information system, and there will probably always be a few unauthorized leaks. Interestingly enough, computer systems are very possibly more secure than manual systems, since with the advent of the computer, people must be instructed in how to use the computer system. No longer is it the case that anyone who can read can open the file cabinet and scan his neighbor's folder.

Another important nontechnological control method is physical security. This can be very important and is often overlooked. One may be using all the passwords and other technological safeguards, but without physical security at the computer center and at the files, one's efforts will be for naught. There is quite a bit of literature around now on physical security, one of the best short works being IBM's booklet "The Considerations of Physical Security in the Computer Environment".²

Technical Methods for Security

Assuming that physical and administrative safeguards have been taken, one can now turn to technical methods for security in computer systems.

Authentication and Identification

Current software identification techniques are generally based on something the user knows, something he has, or something he is. Comparisons are made between the proper "something" and what the computer expects, and a decision to permit or deny access is made accordingly.

In the category of "something he knows", there are several techniques. Simple passwords offer protection against what might be called "casual" infiltration. They are used to protect files, records, data fields within records, or groups of these items. Once the computer verifies that a proper password can be associated with a given user, that user can obtain all the information authorized to that password.

While the simple password scheme is easy to use and inexpensive to implement, it requires the authorized user to remember the password and it can be compromised by wiretapping, electromagnetic pickup, or (more simply) an interloper discovering the password written down somewhere, such as on an office calendar, a scrap of paper tossed in the wastebasket, or on discarded console output. There is also an inverse relationship between the length of time a password is in use and the degree of security it maintains. For this reason, passwords should be changed aperiodically to thwart unauthorized users. Passwords should not be printed (echoed) at consoles; overprinting them there is not always effective. Passwords should also undergo some minimal encryption before being stored in computer systems.

There are a number of variations on password schemes. One of these which eliminates some of the disadvantages named above is the following. The user remembers a password as before. When signing on, he is requested by the computer to type certain characters of the computer's choosing. In this way the possibility of compromise by ribbon reading or wastebasket searching is greatly reduced. However, all the other disadvantages of the passwords remain.

One-time passwords can also be used. These protect against stolen password utilization because once a password is used it is no longer valid.

Further along the spectrum, many disadvantages of passwords are not present if the computer system requires successful execution of an algorithm for the authentication process. This is often called a handshaking procedure. Questions asked by the computer can be personal information ordinarily unknown to anybody but the authorized user (such as his brand of hair tonic). Alternatively, the user can be asked to apply a secret function to a pseudo-random number generated by the computer. The function is never transmitted in the clear over communication lines or typed on a console.

Electronic combination locks are also available (from, for example, Datalock³) where a touch-tone-like keyboard is used. The user must press the right combination to physically enter the area of the computer terminal.

In the category of "something he has", the user's photograph and signature can be attached to a credit card-like device. This prevents illegal users from easily passing a guard and getting to computers or remote consoles. These credit card-like devices come complete with threat-monitoring printer units. For example, one access control system is a locking and identification unit which is like an ordinary door lock and key except that the key is a binary coded printed circuit. A central printer can record the date, time, key identification number, and door number of each entry.

There are also some devices that allow access to a user based on "something he is". In this category we have the Identimat,⁴ which identifies individuals

by measuring hand geometry. This system claims 99.5 percent accuracy but the cost per station is relatively high. Experimental work has also been done on voice prints, though the results in this area are to date far from conclusive.

Another authentication method is the dial-up and call-back method. When data is desired by a user who is connected to the computer via telephone line A, a message is sent to the user asking him to provide the password of that data to the computer operator by voice over a different telephone line B. Alternatively, the operator calls the user back over phone line B to make sure the user is authorized and at the right place.

In addition to the authentication methods which are used to control access to files, or to the computer system itself, other methods are necessary to handle shared data bases and files which contain information needing different degrees of protection.

Compartmentalization Methods

Various technical methods for compartmentalizing computer memories are in use. By compartmentalizing, we mean those methods used to subdivide the memory into parts with different access privileges. We use the inelegant word "compartmentalizing" because words in more common use (e.g. partitioning or segmenting) are too closely linked to specific hardware. There are two types of compartmentalizing techniques; those which are necessary for the proper operation of the computer system (especially a time-sharing system) and those which are used to enhance information security in a shared system.

Hardware. In any multiprogramming, multiprocessing or time-sharing system each user must be prevented from disturbing the program or data of the others. Furthermore, a user should not be allowed to interfere with operations by improper or untimely input or output or halt commands. This latter restriction is generally obtained by denying to the user certain instructions which may be executed only by privileged programs such as the operating system. The former capability generally is provided by memory protection schemes such as relocation and bounds registers, segmentation, paging and memory keys.

The techniques mentioned in the preceding paragraph protect contiguous portions of (real or virtual) computer memory from alteration by an errant or unauthorized program. These hardware countermeasures do not, however, provide protection of a user file in auxiliary storage from unauthorized access. To this end, software schemes have augmented the hardware methods.

Software. Only a few installations are using the more sophisticated of the methods described below. Computer users are pleased (even astonished) when their programs work, and most — if they use any security protection at all — use simple passwords to guard their files. In many cases this level of protection is all that is justifiable. More detailed descriptions of some of the methods mentioned below appear in an anthology on computer security.⁵

A system involving concentric "rings" for protection developed at MIT has recently been announced by Honeywell as an upcoming product. It provides flexible but controllable access by a number of different users to shared data and procedures. On the negative side, as implemented, it requires hardware segmentation; and if a file has many different data fields with many different levels of access, the

swap times necessary to access each datum in its own segment cause prohibitive overhead. It also imposes a hierarchy on all information in the data base; this is not desirable in every instance.

Software compartmentalization below the file level is not in general commercial use. This is probably due in varying degrees to the obscurity of the methods, the lack of reliable information on overhead costs, and until recently, manufacturer and user indifference toward data security.

Privacy Transformations

Privacy transformations are reversible encodings used to conceal information. They are useful for protecting against interception on communication lines, neutralizing of electromagnetic radiation from terminals or computers, or wrongful access to data in removable files. This last threat is probably the most significant.

Simple privacy transformations are one of the most effective methods of preventing disclosure of data. Even if an infiltrator somehow obtains the data he must still decrypt it; often he does not have the time or resources to do this, and even if he does, he must decrypt a mass of uninteresting data just to find what he wants. It would usually be much simpler to bribe a legitimate user.

Example of a very simple (and fairly insecure) privacy transformation:

Cleartext: PLANES ATTACK AT 0500.

Key: 314163141631416314163141631

Ciphertext (using π as the "key" and "addition" as the method):

SMEOKV. EUZDDO.GW.4663A

Privacy transformations can be effected by either hardware or software. Scrambling devices which use group theory, pseudorandom number techniques and other methods are now available commercially from, for example, Ground Data in Ft. Lauderdale, Fla. and Technical Communications Corp. in Lexington, Mass. These boast hardware at the terminal and software or hardware at the computer. More detailed information on privacy transformations can be found in Kahn's excellent work The Codebreakers⁶ and in Hoffman's anthology.

Threat Monitoring

Software, when used in conjunction with administrative rules and compartmentalization methods which protect the operating system from unauthorized changes, can detect attempted or actual security violations, and either provide an immediate response (e.g. job cancellation or tracing procedures) or provide an ex post facto analysis. It can also record all attempts or all rejected attempts to obtain certain sensitive information, unusual activity of a given file, attempts to write into protected files, or excessively long periods of use. In fact the last is perhaps the only known method to cope with the fact that, given enough work and some prior information, it is possible to obtain a specific "dossier" from a "statistical" data bank — the "statistical inference problem".

The use of such software is called "threat monitoring". The log kept is also called an "audit log" or an "audit trail". The monitoring or auditing

provides a method for recording the identification of each request and the name of each requestor. The audit trail can be examined periodically by appropriate authority to determine if unauthorized access has occurred and then suitable steps can be taken.

Threat monitoring has a beneficial side effect; it often will help improve the efficiency of the system by recording widespread use of particular facilities. These facilities can then be altered to eliminate bottlenecks. Also, if some security restriction is unduly interfering with operations, threat monitoring should help pinpoint the offending restriction.

Costs of Countermeasures

General. There is almost no information available on the cost or overhead of security techniques for computer systems. Fixed costs of security controls are very dependent on the vicissitudes of the particular installation. These include the capital cost, the one-time outlay to get into operation, and the expenses of buying, building, or programming a system. These also include administrative costs such as costs of guarding doors, having telephones elsewhere, and perhaps even having some people devoting their time to penetrating the system.

Many of the costs of security are variable, even at a given installation. These costs depend on the frequency with which records are used, since this determines how often some safeguards are invoked.

In addition to these fixed and variable costs, there are other costs even harder to quantify; the development cost, the expense of experimenting and rejecting approaches before finding an acceptable one; the social cost of being secretive; the social cost of not being secretive; the cost of doing some functions manually because adequate security controls are not available in the computer system; and others. It is impossible to evaluate or even enumerate these latter costs.

Administrative Rules

Administrative rules do not come free; they take effort on the part of the administrators. Also, restrictions of access to tapes, documents, or other items must be enforced by employees who have other tasks to perform as well.

Such precautions as logs and artificial data for demonstrations cost money to generate and maintain, as well as requiring constant alertness. Accounting for sensitive punched cards, tapes, printed forms, carbon paper, and ribbons is not very expensive, but is not free either, for someone must be responsible that pains continue to be taken that this chore be done and done thoroughly.

Physical Security

The most elementary precaution is to control physical access to the system and its files. This means either arranging partitions and doors so as to limit the approaches and arranging for locks and keys, or else having personnel in the area night and day. The latter is very expensive if the workload would otherwise not demand it.

The costs of elaborate physical security measures vary widely, depending on the particular installation. Newspaper accounts have stated that the William J. Burns International Detective Agency data processing center in Briarcliff Manor, New York, has

been "soaked" with ultrasonic traps and other measures at a cost of about \$12,000. A recent Wall Street Journal account states that Data Processing Security, Inc. of Hinsdale, Illinois, "will put a team of consultants to work running through a 172-point (security) checklist and preparing a survey report for \$3,000 to \$5,000."

One can use double-door "buffer" systems with electric locks, magnet sensors and closed-circuit television to control access to computer centers. In contrast, locks and keys can also be obtained for under \$100.

Partitioning for security may mean somewhat inefficient use of space, another cost. Identification badges cost very little, but they do require someone to supervise, monitor, and maintain them, a half-time job for even a small installation. Very small installations can rely on personal identification.

Authentication Methods

Hardware in terminals which identifies the terminal or the user to the system is still an optional extra in most cases.

The ordinary password is an inexpensive method, well tested and perfected by much use. It can be implemented on existing systems without special hardware. The use of one-time passwords is not nearly so well known, is more secure, and involves little incremental software cost over the simple password, but it is much harder on the user, who must know either by memory or by algorithm the current password.

A handshaking algorithm is a much more elaborate procedure than any other involving the user. It takes more of his time, more communication line time, and more programming effort. It is, of course, more effective and worth what it costs to those who need it. Since the complexity of handshaking algorithm is adjustable to the requirements of any given system, the procedures can meet a large variety of needs, and offer much promise for the future. But for the same reasons, they can be arbitrarily expensive.

The use of simultaneous software keys from different terminals, which has been suggested as a very secure procedure, throws a quite demanding requirement on the coordination of the people involved. The cost of equipment and of software to do this is relatively low. But the necessity for the people involved to be at certain places at certain times will limit this procedure to very unusual situations.

The dial-up and call back method is relatively cheap for the protection it provides.

Compartmentalization Methods

Hardware compartmentalization of memory is necessary for the proper operation of any multiprogramming system; therefore that facility is free, so to speak.

The use of individual field authorizations is not widespread, and costs are not completely known. The incremental costs of methods which allow individual field authorizations are unknown, although they are clearly at least as expensive as those methods which do not allow them. Even if they cannot be made cheaper than the other methods, they still offer much promise because of their flexibility and comprehensiveness.

Privacy Transformations

Methods of encrypting are such that a good deal of security, measured by the amount of work required to break a cipher, can be had with only a modest increase in expense. Some recent work has shown that simple cryptographic encoding can be done at rates of about 50,000 bytes/second on medium-sized computers.

Products for encrypting transmission over vulnerable communication lines are currently available. Ground Data Corp. of Ft. Lauderdale, for example, was in 1972 selling such a system with immediate delivery for \$975; rental of the same unit was \$35 per month.

Privacy transformations lose much of their utility if an entire file must be decrypted and re-encrypted using a different transformation many times. This can happen if an installation has a large encrypted file and changes encryption frequently in order to maintain a high level of security. The computer time required by this can be quite considerable. Frequent passing of a large and possibly multi-volume file, the only effect of which is to change the encipherment, is nearly always prohibitively expensive. For this reason many experts feel that cryptography will not generally be used for encrypting entire data sets but will be used for transmissions over communication lines, where encryption and decryption are done only once. Frequent re-encryption of an entire file can be avoided by providing adequate physical security of the place where the file is kept and of the transmission channels, where applicable. Here, as usual, resources saved on one safeguard (privacy transformations) can be used to strengthen another safeguard (physical security) and thus achieve better results.

Threat Monitoring

The costs of threat monitoring are not known accurately now, but they are principally the cost of deciding what information should be kept in logs, the operating cost of examining those logs, and the maintenance of the software. Sufficient magnetic tapes or other storage on which to record the audit trails will be required, and additional system overhead will be caused by the recording of accesses and refused admission.

Summary

In summation, security of private or sensitive information in computer systems involves legal, administrative, physical, and technological controls. Often one can arrive at a desired level of security by trading off safeguards in one area (such as technological) to increase them in another (such as physical). In the final analysis, this decision must be made by each installation based on its own needs.

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NUMBLES

Neil Macdonald
Assistant Editor
Computers and Automation

A "numble" is an arithmetical problem in which: digits have been replaced by capital letters; and there are two messages, one which can be read right away and a second one in the digit cipher. The problem is to solve for the digits.

Each capital letter in the arithmetical problem stands for just one digit 0 to 9. A digit may be represented by more than one letter. The second message, which is expressed in numerical digits, is to be translated (using the same key) into letters so that it may be read; but the spelling uses puns or is otherwise irregular, to discourage cryptanalytic methods of deciphering.

We invite our readers to send us solutions, together with human programs or computer programs which will produce the solutions. This month's Numble was contributed by:

Andrew M. Langer
Newton High School
Newton, Mass.

NUMBLE 737

$$\begin{array}{r} \text{T O O} \\ + \text{S O F T} \\ \hline \text{Q Z U D} \\ + \text{W I L L} \\ \hline \text{D Z E T E} \\ + \quad \text{B E} \\ \hline \text{D O U Q L} \end{array} \quad \begin{array}{l} \text{I} = \text{W} \\ \text{B} = \text{F} \\ \text{L} = \text{T} \\ \\ \\ \text{4509 9291} \end{array}$$

Solution to Numble 736

In Numble 736 in the June issue, the digits 0 through 9 are represented by letters as follows:

$$\begin{array}{ll} \text{U, V, D} = 0 & \text{C} = 5 \\ \text{R} = 1 & \text{Y} = 6 \\ \text{H} = 2 & \text{E} = 7 \\ \text{A} = 3 & \text{M, N} = 8 \\ \text{T} = 4 & \text{S} = 9 \end{array}$$

The message is: The years teach much that the days never teach.

Our thanks to the following individuals for submitting their solutions – to Numble 735: Edward A. Bruno, N. Bergen, N.J.; John F. Gugel, Arlington, Va.; Felicitas Reich, Yonkers, N.Y.; Abraham Schwartz, Jamaica, N.Y.

Computer Programming Using Natural Language

— Part 2

Edmund C. Berkeley, Andy Langer, and Casper Otten
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"The name 'GENIE' comes from the famous genie or jinni of the Arabian Nights tales, who, whenever summoned out of his bottle by his master, the possessor of the bottle, replied, 'I hear and obey,' without requiring translation of the commands into any other language."

Outline

1. A Computer Program to Understand Manager's Instructions to a Clerk
2. Calculation Layout Language
3. First Illustrative Problem, Mean and Standard Deviation
4. Second Illustrative Problem, Loans and Interest
5. Third Illustrative Problem, Advertising Effectiveness
6. Future Dialog with a Businessman

1. A Computer Program to Understand a Manager's Instructions to a Clerk

This article is a continuation of the article "Computer Programming Using Natural Language" which was published in the June issue of Computers and Automation. But the present article has been written independently; though access to the prior article is helpful, it is not necessary.

The subject we are dealing with here is a part of the subject of "computer programming using natural language," and consists of a certain task. The task that we have set ourselves is called "Task F"; and it may be described as follows:

Produce a definite, efficient, and rather small computer program (let's name it GENIE) which will take in ordinary natural language specifying any one of many kinds of computer application problems, and which will put out automatically a computer program in a specified, regular programming language which will correctly handle any sample problem of that kind.

The name "GENIE" comes from the famous genie or jinni of the Arabian Nights tales, who, whenever summoned out of his bottle by his master, the possessor of the bottle, replied, "I hear and obey," without requiring translation of the commands into any other language!

The input that we give to the computer program GENIE so far consists of:

- (1) a manager's instructions to a clerk in ordinary natural language,
- (2) one or more worked numerical examples, and
- (3) a calculation layout form.

The final output that we obtain from the computer program GENIE is a computer program in a regular programming language, such as assembly language or BASIC. This output program has the property that it will handle correctly all the kinds of calculation specified by the manager's instructions, the worked numerical examples, and the layout form.

GENIE takes in a passage of ordinary natural language written with a very wide degree of freedom, and produces a computer program which will handle all the applications of a given kind described or envisioned by that passage. Thus the job of conforming to the rigorous requirements of writing a successful program in a regular programming language like BASIC or FORTRAN is largely lifted from the inaccurate human being, and delegated to the accurate computer under control of GENIE.

It must be emphasized that we are at the beginning of this project, with only a few examples successfully handled so far; but we see no theoretical barriers. And the next version of GENIE should be considerably more powerful than the current one.

In the prior article we presented one illustrative application problem in full. That problem was the calculation of the mean and standard deviation of a frequency distribution.

In this article we present two more illustrative application problems, showing what goes into GENIE and what comes out of GENIE. These two problems are simple problems in the fields of

- calculation of interest on loans and amount to be repaid;

— Statement to the press by Edmund C. Berkeley, Andy Langer, and Casper Otten on June 11, 1973.

We believe we have accomplished a breakthrough in programming computers.

We have taken ordinary instructions in natural language such as a manager would give a clerk in order to do a calculation, a worked example of the calculation, and the layout of calculation. Then, using a computer program which we call GENIE, we have produced an accurate computer program which will cause the computer to do all of that kind of calculation.

The work leading to this new result is an offshoot of research on computer-assisted documentation of Navy computer programs done under a research contract from the Office of Naval Research.

We are only at the beginning of a long road — getting computers to understand human beings speaking in ordinary natural language. But lots of people will no longer need to learn BASIC or FORTRAN or some other special language in order to tell a computer what they want it to do.

What we have done is like a proof of possibility in mathematics — the exhibition of a result that has certain properties.

The reason for our breakthrough is that we have been using a number of principles all together, mathematical, linguistic, grammatical, logical, practical, common sense, and so on. The solution to ordinary natural language programming seems to be easier when you use enough principles together.

If an ordinary clerk can understand an ordinary manager, then a computer program ought to be able to do as well. We have demonstrated that in several cases.

— calculation of the effectiveness of advertising.

We also discuss in a hypothetical dialog advantages and limitations of GENIE.

The concept of GENIE can, of course, be expressed in many versions. In the future GENIE surely will be programmed more efficiently than the versions we have worked out so far. But in the meantime the three illustrative examples constitute a demonstration, a proof, of the possibility of using ordinary natural language to program a computer, and a refutation to those who say such a thing is not possible.

2. Calculation Layout Language

GENIE has two outputs, deliberately. The first output is something like a set of formulas, describing what is to be done. We as human programmers regularly review this output, because we can understand it; we look to see if it makes sense and expresses essentially what is to be done. The second output is a specific computer program stated in a specified programming language which precisely performs the calculations needed. The only quick way to check this output is to try it on the computer with sample data and see if it produces the right answers.

The first output is expressed in a language that we call Level Two Language. Level Two Language is

really very close to what may be called Calculation Layout Language. This is a language which is used extensively in the business world in forms and on calculation sheets, to guide clerks and to tell the relations of the items on a form, and the relations of the column headings on a calculation sheet. This language uses words or numbers or symbols to express concisely (but not always completely or uniquely) the calculating rules being used.

An example of Calculation Layout Language is " $(4) = (1) \times (3)$," where the "x" means "times". (In Level Two Language, the corresponding statement is $(4) = (1) * (3)$, where the asterisk means "times"; the change is due to the necessity of distinguishing "x" as a letter of the alphabet and "x" as an ideographic symbol for "multiplied by".)

The statement " $(4) = (1) * (3)$ " asserts either one of two meanings depending on context. The first meaning is "Item 4 equals Item 1 multiplied by Item 3". The second meaning is "Each figure in Column (4) is equal to the corresponding figure in Column (1) multiplied by the corresponding figure in Column (3)". In business practices, these two meanings are distinguished only when the context so requires; ordinarily both meanings are considered "evident," "understood," "obvious," in making business calculations on layout sheets.

A characteristic feature of Calculation Layout Language (and Level Two Language) is the designation of items or columns by numbers written in parentheses. Occasionally Calculation Layout Language contains some abbreviations such as FICA meaning "Federal Insurance Contributions Act deductions," i.e., the deduction from pay under the Social Security system. At this time, GENIE is happy with any number in parentheses used as a name for a variable; but at this time GENIE would have to be told in a specific manner (it could not guess as an experi-

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Table: Probably Acceptable Vocabulary

— : Probably Unacceptable Vocabulary
(At This Time)

— : General Business Applications to Which the Program GENIE Might Apply First

Table 1 of Article

Calculating Interest and Amount to be Repaid —
 Manager's Instructions to a Clerk —
 Input to GENIE

1. To Fill in the Register (Form 2): Copy from Mr. Richard Roe's "Notice of Loan Granted" (Form 1): Loan No., 105; Register No. of Borrower, 777; Principal, \$1750.00; Rate, 7½%; Date Loaned, Aug. 1, 1972; Date Due, May 15, 1973.

2. To Fill in the Worksheet: Look up date of loan, Aug. 1, 1972, in Column 1 of Table 1 (see below), and find the number of half months, 14, and put that in Column 1 of the Worksheet.

3. Look up Date Due, May 15, 1973, in Table 1, and find the number of half months, 33, and put that in Column 2 of the Worksheet.

4. Next, fill in Column 3, which equals Column 2 less Column 1. The result is 19.

5. Then, divide Column 3 by 24 to get fraction of a year, .7917, and put that in Column 4.

6. Take the rate of interest, 7½%, in Column 4 of the Register, express it as a decimal to three decimal places, .075, and put that in Column 5 of the Worksheet.

7. Take Column 4 and 5 and multiply them and put the result, .05938, in Column 6.

8. Take the principal amount in Column 3 of the Register, and multiply it by Column 6 of the Worksheet, finding the actual amount of interest, 103.92, and put that in Column 7 of the Worksheet.

9. To Fill in the Due Payments Record: Column 1, Loan No., is the same as Column 1 of the Register, 105; Column 2, Number of Borrower, is the same as Column 2 of the Register, 777. Column 3, Date Due, is the same as Column 6 of the Register, May 15, 1973.

10. Column 4, Amount of Interest, is the same as Column 7 of the Worksheet, 103.92.

11. To compute Column 5, Total Repayment, find the sum of Column 4 of the Due Payments Record and Column 3 of the Register, which results in 1853.92.

enced clerk could) that a word like "FICA," not found in the "probably acceptable vocabulary," was being used for the name of a variable.

Clearly, if a calculation to be performed can be expressed in Calculation Layout Language instead of (or in addition to) ordinary English, we may be able in some cases to dispense with interpreting the "manager's instructions to a clerk". The one or more worked examples, and the calculation layout, however, will probably still be needed.

**3. First Illustrative Problem,
 Mean and Standard Deviation**

The first illustrative problem, which was explained in the prior article, was the calculation of the mean and the standard deviation of a frequency distribution. We showed a sample of manager's instructions to a clerk, a fully worked example, and the calculation layout (as expressed in

**Table 1 of
 Manager's Instructions for
 Second Problem**

Half Months Corresponding to Calendar Date

(1) Date in <u>1972</u>	(2) No. of <u>Half Months</u>	(3) Date in <u>1973</u>	(4) No. of <u>Half Months</u>
Jan. 1	0	Jan. 1	24
Jan. 15	1	Jan. 15	25
Feb. 1	2	Feb. 15	26
Feb. 15	3	Feb. 15	27
Mar. 1	4	Mar. 1	28
Mar. 15	5	Mar. 15	29
Apr. 1	6	Apr. 1	30
Apr. 15	7	Apr. 15	31
May 1	8	May 1	32
May 15	9	May 15	33
June 1	10	June 1	34
June 15	11	June 15	35
July 1	12	July 1	36
July 15	13	July 15	37
Aug. 1	14	Aug. 1	38
Aug. 15	15	Aug. 15	39
Sept. 1	16	Sept. 1	40
Sept. 15	17	Sept. 15	41
Oct. 1	18	Oct. 1	42
Oct. 15	19	Oct. 15	43
Nov. 1	20	Nov. 1	44
Nov. 15	21	Nov. 15	45
Dec. 1	22	Dec. 1	46
Dec. 15	23	Dec. 15	47

the example). This input going into a version of GENIE produced two outputs. The first output expressed the calculating rule in Level Two Language (Calculation Layout Language). The second output was a computer program in BASIC which computes the mean and standard deviation of a frequency distribution.

**4. Second Illustrative Problem,
 Loans and Interest**

For a second illustrative problem, we take a simple business situation. The amount of interest on a loan, and the total amount due to be repaid, are to be calculated, under the following assumed conditions.

Richard Roe grants loans for periods less than a year on various kinds of security at simple interest rates varying from 5% to 10%, to various parties. (See Tables 1 and 2.) He keeps a Register (Form 2) which shows: loan number; identification number of borrower; amount of loan that he grants; a simple interest rate per annum that he chooses; the date of the loan; and the date due for repayment. Roe always makes loans on the 1st or the 15th of a month, and always makes loans repayable on the 1st or the 15th of a month. His assistant does the calculations systematically on a Worksheet (Form 3). The date due, the amount of interest due, and the total repayment are posted in a Due Payments Record (Form 4). The instructions which guide Smith are shown in Table 1. A sample "notice of loan granted" (Form 1), and extracts from the Register, the Worksheet, and the Dues Payment Record are shown in Table 2, displaying worked examples. The contents of Table 1 and of Table 2 are the input to GENIE.

Table 2 of Article

Calculating Interest and Amount to be Repaid —
Worked Examples —
Input to GENIE

FORM 1: NOTICE OF LOAN GRANTED

1. Loan No.	105
2. Borrower No.	777
3. Principal Amount	\$1750.00
4. Rate of Interest	7½%
5. Date Loaned	Aug. 1, 1972
6. Date Due	May 15, 1973

FORM 2: REGISTER OF LOANS BY RICHARD ROE

(1)	(2)	(3)	(4)	(5)	(6)
Loan No.	Borrower No.	Principal	Rate	Date Loaned	Date Due
101	777	\$1750.00	7½%	2/15/72	8/1/72
102	658	3600.00	8½%	3/1/72	7/1/72
103	721	600.00	9%	3/1/72	11/15/72
104	746	8000.00	5½%	3/1/72	12/15/72
105	777	1750.00	7½%	8/1/72	5/15/73

FORM 3: WORKSHEET FOR CALCULATING INTEREST

- (1) Half Months of Date Loaned
- (2) Half Months of Due Date
- (3) Half Months of Period
- (4) Fraction of Year
- (5) Annual Interest Rate as a Decimal Fraction
- (6) Rate to be Applied
- (7) Amount of Interest

(1)	(2)	(3)	(4)	(5)	(6)	(7)
3	14	11	.4583	.075	.03437	60.15
4	12	8	.3333	.085	.02833	101.99
4	21	17	.7083	.090	.06375	38.25
4	23	19	.7917	.055	.04354	348.32
14	33	19	.7917	.075	.05938	103.92

FORM 4: DUE PAYMENTS RECORD

(1)	(2)	(3)	(4)	(5)
Loan No.	Borrower No.	Date Due	Amount of Interest	Total Repayment
101	777	8/1/72	\$ 60.15	\$1810.15
102	658	7/1/72	101.99	3701.99
103	721	11/15/72	38.25	638.25
104	746	12/15/72	348.32	8348.32
105	777	5/15/73	103.92	1853.92

Before this information is typed on paper tape and input into the present version of GENIE, two editing changes need to be made, in order to accommodate the limitations of the present version of GENIE. One change is sequential renumbering of

items or columns in a sequence. The other change is to convert the dates and months into straight numerical data. Both of these editing changes are shown in full in Table 3. With a later version of GENIE it will not be necessary for a human being to make these editing changes, since the computer programming to accomplish them is minor. But for the present it takes time to make the changes in the program instead of by editing; and that time is diverted from direct work towards the main goal, which is understanding ordinary natural language that expresses instructions. And so for the present, this minor editing work is left on the shoulders of the human being.

The first output of GENIE is the calculating procedures expressed in Level Two Language, and that is shown in Table 4. To confirm this sequence of specifications for the calculating rule, the information from one numerical example is also shown side by side.

5. Third Illustrative Problem, Advertising Effectiveness

For a third illustrative problem, we take another simple business situation. The effectiveness of certain advertising is to be calculated.

The hypothetical situation can perhaps be made clearest by showing in a tabulation for worked examples two cases, for two ads in the August and September issues of the hypothetical magazine Scientific Canadian.

6. Future Dialog with a Businessman

Now let us consider the situation in which a businessman, whom we shall call Mr. Bernard Brown, and a salesman, whom we shall call Mr. Samuel Smith, are talking to each other, and the salesman is seeking to persuade the businessman to become interested in making an arrangement with Mr. Smith's firm for a service to provide ordinary natural language pro-

Table 3 of Article

Editing Changes for Present Version of GENIE

Editing Change No. 1	Editing Change No. 2	
	Form No.	Month in Letters
2	Column No. on Form	Column No. for GENIE
	1	1
	2	2
	3	3
	4	4
	5	5
3	6	6
	1	7
	2	8
	3	9
	constant 24	10
	4	11
	constant 100	12
4	5	13
	6	14
	7	15
	1	16
	2	17
5	3	18
	4	19
	5	20

Table 4 of Article

Calculating Amount of Interest and Total to be Repaid — Output from GENIE

(1)	(2)
Actual Output in Level Two Language	For Comparison: a Numerical Example
(1) = DAT	105
(2) = DAT	777
(3) = DAT	1750.00
(4) = DAT	7.5
(5) = DAT	80172
(6) = DAT	51573
(7) = TAB-1 (5)	14
(8) = TAB-1 (6)	33
(9) = (7) I- (8)	19
(10) = DAT	24
(11) = (9) / (10)	.7917
(12) = DAT	100
(13) = (4) / (12)	.075
(14) = (11) * (13)	.05938
(15) = (3) * (14)	103.92
(16) = (1)	105
(17) = (2)	777
(18) = (6)	51573
(19) = (15)	103.92
(20) = (3) + (15)	1853.92

Abbreviations

DAT	DATA
TAB 1	Table 1 of
I-	inverse minus, i.e., subtracted from
/	divided by
*	multiplied by
+	plus

gramming via GENIE. The time of this dialog is when GENIE has been adequately developed.

For after all, no idea is very good in the present world unless it can be marketed — unless the producer of the goods or the services incorporating the idea can persuade a logical customer to pay some money for it. The logical customer may be a business, a foundation, a university, an office of research in the government, a committee, etc.

Under these conditions we can imagine a future dialog something like the following.

Salesman: Mr. Brown, if you buy our service, here is what you get. You tell us specifically all the kinds of ordinary application problems you want to run on your computer whenever they come up, and we give you the programs. You tell us in ordinary natural language with worked examples, so that you and we both know exactly what you mean. We have a clever computer program at our head office that takes in ordinary natural English and makes computer programs. We call it GENIE, because it "hears and obeys".

Businessman: Mr. Smith, how is that possible? Everybody has told me that in order to run a computer I have to hire programmers or buy software. In fact, I am told they cost more than the computer does.

Table 5 of Article

Calculating Advertising Effectiveness — Worked Examples — Input to GENIE

FORM 1: RECORD OF ADVERTISING

(1)	(2)	(3)	(4)	(5)
Media	Month	Key of Advertisement	Space in Pages	Cost
Scientific Canadian	August	H8	½	\$1100
Scientific Canadian	Sept.	H10	1	2000

FORM 2: INCOME AND RESPONSE RECORD

(1)	(2)	(3)	(4)
Key of Advertisement	Number of Orders, End of 4 Weeks	Total Income from Orders	Number of Inquiries End of 4 Weeks
H8	26	\$3900	140
H10	50	7500	188

FORM 3: ADVERTISING MERIT

- (1) Key of Advertisement
- (2) Expected Orders from Inquiries
- (3) Expected Order Income from Inquiries
- (4) Expected total Gross Income from Advertisement
- (5) Factor of Gain or Advertising Merit

(1)	(2)	(3)	(4)	(5)
H8	35	\$5250	\$ 9150	8.31
H10	47	7050	14550	7.28

Salesman: Yes, that used to be true. But we have found a way of using ordinary natural language plus calculation layouts plus worked examples. In the old days, clever human programmers deciphered what was intended and told the computer in computer language. Now we have a computer program that decipherers better than a human being can, in many cases.

Businessman: Suppose the information I give you is incomplete? Suppose there are cases I have not told you about, or cases that I have forgotten about?

Salesman: Two things can happen. One is that the cases not provided for, not covered, are noticed by GENIE, and so it asks you questions — in the same way as an intelligent clerk could ask you a question such as, "Mr. Brown, what is the largest value of goods received that you are willing for me to sign for?" The other thing that can happen is that GENIE will not know what you have not told it, and will therefore make mistakes. But you have just the same situation with a clerk working for you: the cases where he has not been told and which he cannot think of inquiring about, he cannot handle correctly.

Businessman: Suppose that I want to make changes in a procedure. Suppose I have a computer program that will allocate our expenses one way, and then as of next fiscal year, I want to change my allocations?

Table 6 of Article

Calculating Advertising Effectiveness –
 Manager's Instructions to a Clerk –
 Input to GENIE

1. You receive a notice of advertising from the Advertising Department. From this, you copy, in this case, into Form 1, the Record of Advertising: Media, Scientific Canadian; Month of Advertising, August; the Key to the Ad, H8; the space reported in magazine pages, ½; and the cost, \$1100.

2. Four weeks later you receive for this ad from the sales manager's office: the "Number of Orders, end of four weeks," in this case, 26; and the "Number of Inquiries, end of four weeks," in this case, 140.

3. You copy this information into Form 2, the Income and Response Record: 26 into Column 2; 140 into Column 4.

4. Now compute Column 3, "Total Income from Orders: as Column 2 times \$150, the typical order amount.

5. For Form 3, Estimated Advertising Merit: Column 2, "Expected Orders from Inquiries," is equal to Column 4 of Form 2, namely 140, multiplied by 0.25, "Expected Conversion Rate," resulting in 35.

6. Now compute Column 3, "Expected Order Income from Inquiries," as Column 2 times \$150 average order, which results in \$5250.

7. Add this amount to "Total Income from Orders," Column 3 of Form 2, \$3900, and put the result \$9150, in Column 4 of Form 3.

8. Compute the "Estimated Factor of Gain" from the ad, Column 5, which equals Column 4, \$9150, divided by Column 5 of Form 1, \$1100, producing in this case 8.31.

Salesman: You tell us the modifications that you want to make in ordinary natural language, and you give us the old program in computer language. We take the modifications in ordinary natural language (with worked examples) and the old program, and we put them into GENIE and out comes the modified program.

Businessman: I don't believe it.

Salesman: Well, you don't have to believe it on my say so. Come over to our field office next week and try running your problem on our computer. By that time I can have your old expense allocation program and your new modifications run through GENIE and there will be a program sitting there tailored for you which is supposed to do your work as well as a trained clerk. And if it is not quite right, GENIE can fix it. And if you remember something next week that ought to have gone in, GENIE can take care of that, too.

Businessman: Do you make a completely new program every time somebody gives you a new set of manager's instructions and examples?

Salesman: No. A good deal of the time we have programming modules that are sitting on the shelf ready to be used. But we take what you tell us in ordinary English, put that into GENIE, and GENIE either picks up the modules or manufactures new sec-

Table 7 of Article

Calculating Advertising Effectiveness –
 Editing Changes for Present Version of GENIE

Editing Change No. 1			Editing Change No. 2	
Form No.	Column No.	Column No. for GENIE	Term	No.
1	1	1	Scientific Canadian August September H8 H10	7777 8 9 3108 3110
	2	2		
	3	3		
	4	4		
	5	5		
2	1	6		
	2	7		
	constant	8		
	3	9		
3	4	10		
	1	11		
	constant	12		
	2	13		
	3	14		
	4	15		
	5	16		

Table 8 of Article

Calculating Advertising Effectiveness –
 Output from GENIE

(1)	(2)
Actual Output in Level Two Language	For Comparison, a Numerical Example
(1) = DAT	7777
(2) = DAT	8
(3) = DAT	3108
(4) = DAT	.5
(5) = DAT	1100
(6) = (3)	3108
(7) = DAT	26
(8) = DAT	150
(9) = (7) * (8)	3900
(10) = DAT	140
(11) = (3)	3108
(12) = DAT	.25
(13) = (1) * (12)	35
(14) = (8) * (3)	5250
(15) = (9) + (14)	9150
(16) = (5) I/ (15)	8.31

tions of programs, and often does both, assembling the useful pieces.

Businessman: Friends of mine have told me that it is easy to program in FORTRAN, and that it takes only a day or so to learn FORTRAN.

Salesman: Yes, many people can learn FORTRAN in a day. But the FORTRAN programs they write on their own usually don't run. Nearly all the time at the start, two or three of half a dozen little fussy details are missing or wrong. For example, one of the rules in FORTRAN is that a variable –

Businessman: What's that?

Salesman: Excuse me, a variable is like a heading on a column in a report, like "expenses for materi-

als," or "territory of a salesman" — as I was saying, a variable which has only whole numbers for its values must have a label beginning with I, J, K, L, or M, so in FORTRAN you would have to write JEXPENSES or KTERRITORY.

Businessman: Why that silly rule?

Salesman: I don't know, but that is the way FORTRAN was designed about 15 years ago — and there is nothing at all natural about that silly detail. But GENIE takes ordinary natural English as you write it, and it knows this puzzlement in FORTRAN, and so GENIE and not you has to remember that silly detail.

Businessman: What sort of programs to make for me could I ask you for?

Salesman: Any business application that you want to do and are now doing, or that you would like to do and are not now doing — provided that what you give me in rules, and instructions, and worked examples, and calculation layouts, is definite and clear to a clerk. In other words, the information has to be all there. It has to be down on paper somehow, and in a style which can be understood by an ordinary clerk. For example, you are not supposed to use French or German, and you are not supposed to leave out some vital detail, and you are not supposed to write statements which are wrong or ambiguous — although the worked examples often resolve ambiguities.

Businessman: What about some specific areas of application?

Salesman: OK, here is a list of over 40 applications. [See Table 7 in Part 1]

Businessman: Where does that list come from?

Salesman: Out of a "Computer Directory and Buyers' Guide" that lists 2300 applications of computers.

Businessman: Can I use your GENIE program to set myself up in all those ways?

Salesman: I recommend against it. I think a business would have mental and physical indigestion if it tried. Instead, anything that you are now doing usefully under any of these headings — and anything that you figure out how to do as the months go by — can be handled by GENIE, could be translated into a computer program. But remember, garbage in, garbage out. A good system for a business depends upon a lot of fitting to the real world — not on computers at all.

Businessman: So any information handling that I am doing now, using clerks or using executives, can go into GENIE?

Salesman: Using clerks, yes; using executives, probably not. Executives use judgement that is not usually written down in rules. What you cannot get into some kind of writing plus some kind of figures plus some kind of forms probably can't go into any computer — at least at this time.

Businessman: You seem to know a lot about what can and cannot go into a computer.

Salesman: Well, it happens that I have been in the computer field for over thirty years. And I have seen lots of people make a lot of trouble for themselves with a computer. A good solid guideline

at the beginning is to stick to clerical systems you have already proved out for yourself, and translate those into a computer system. And this is why GENIE is so remarkable and so important — it cuts the costs of plain ordinary programming so greatly. On applications programming it is a breeze and a headache remover.

Businessman: Does GENIE dispense with all other computer programming?

Salesman: No. There are a number of situations in regard to which we have so far made no effort to apply GENIE. Examples are: scheduling and optimizing the operation of computers and peripherals; chess-playing; optical character reading; problems already solved by efficient computer programs; problems for which the solution is very hard to express in ordinary natural language instructions that a clerk can carry out; etc. We do not see theoretical barriers to GENIE for interpreting natural language used to express calculating rules; but at the beginning it is not sensible to bite off more than one can chew. The logical area to begin with seems to be applications in business where calculating rules are being applied by clerks.

Businessman: How did you all work it out?

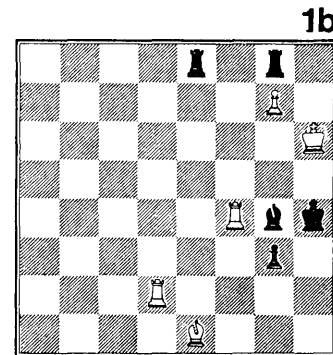
Salesman: It has been in the wind really. There had to be some important way around most of the bottleneck of programming. And we think we have found it, by taking a very broad look at the whole problem, and using all the angles together. □

CORRECTION

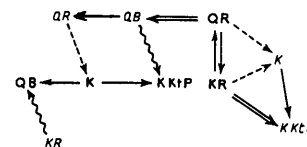
In the article "The Path to Championship Chess by Computer" by Professor Donald Michie published in the January 1973 issue of "Computers and Automation," the following corrections should be made:

Page 7, second column, third paragraph, lines 1 and 2: replace "the Rand Corporation mathematician" by "the professional philosopher".

Page 8, the chess position for Figure 1b should be:



Page 9, the graph in Figure 2 should be as follows (containing one more connecting link):



Applications of Computers in Correspondence Schools

Major Charles Ehin
Qtrs. 611-B 7th St.
Maxwell AFB, Ala. 36113

"The use of on-line computer terminals is due much greater attention by the administrators of correspondence study institutions with versatile third and fourth generation systems becoming more readily accessible."

The absence of research and literature dealing specifically with computer applications in correspondence instruction administration and the lack of general knowledge about computer systems currently being used by some home study organizations prompted the author to conduct an extensive analysis of this area.¹ Only the details of the questionnaire survey phase of the study are presented in this article.²

Method

All of the sixty-three members of the Independent Study Division of the National University Extension Association (NUEA) and the seventy-five members of the National Home Study Council (NHSC) were selected as targets for the questionnaire survey. The two groups were chosen on the assumption that members of the Associations would respond more readily to the survey and furnish the most reliable and accurate information.

Table 1
Status of Computer Applications
by Institutions Surveyed

Status	Institutions		Combined Percentage
	% of NUEA Members	% of NHSC Members	
Operational	22	44	33
Planned	12	8	10

Of the 138 schools selected for the study, 121 or 88 percent responded. Questionnaires were returned

by 94 percent of the NUEA member departments and 83 percent of the NHSC member schools. The high rate of participation was partially attained by sending out 46 follow-up notices.

Results

As indicated by Table 1, 13 (22 percent) of the NUEA departments and 27 (44 percent) of the NHSC schools are using computers to varying degrees in the administration of their respective programs. In addition, 12 percent of the NUEA members and 8 percent of the NHSC members have definite plans for incorporating EDP systems into their operations.

Active enrollments of the university affiliated departments utilizing computers range from 2000 to 12,500 and those not using computers range from 110 to 22,000. The institution with 22,000 enrollments, however, is in the final proposal stages for installing an EDP system with one of the leading computer manufacturers. The largest NUEA member which does not have immediate plans for computer applications carries 17,500 active enrollments.

Of the 62 private home study schools responding to the survey ten declined to indicate the number of active enrollments monitored by their organizations. With that exception, private schools using EDP systems have enrollments ranging from 85 to 400,000. The range of enrollments of schools not using computers is from 80 to 100,000. Interestingly, the organization with 100,000 enrollments has no immediate plans for incorporating a computer system to assist in the administration of its programs. The second largest school with 40,000 enrollments similarly has no immediate intentions of adapting an

EDP system to its operations. It should also be noted that 26 percent of the NHSC members that utilize computers employ the systems only for the maintenance of student financial records.

Specific Modes of Operation

The data in this section has been compiled from the forty questionnaires returned by the institutions that are using computers to varying degrees in the administration of the programs.

Methods of Systems Access

In order to gain access to a computer to realize its benefits an organization must own, lease or share a system or use any combination of the three methods.

Table 2 shows the manner in which correspondence study schools obtain computer time for their data processing needs. Although several independent study departments lease peripheral devices, they all share CPU time with other university departments and divisions. The procedure is logical since most campuses have a central computer facility which attempts to support all data processing requirements.

Method and Frequency	Institutions		
	% of NUEA Members (13)*	% of NHSC Members (27)	Combined Percentage
<u>Method</u>			
Own		7	5
Lease		33	23
Share	100**	56	70
Other		4	2
<u>Frequency</u>			
Daily	15	59	45
Biweekly	15	11	13
Weekly	24	30	28
Bimonthly	8		2
Monthly	15		5
Other	23		7

* The figures in parentheses represent the actual number of the population under consideration.

**In some cases departments lease card devices or terminals but they all share a central computer system. One extension division leases its own computer which it shares with the independent study department.

More than half of the private home study schools also share EDP systems. This is accomplished by the use of service bureaus, sharing a central system by branches located throughout the country, sharing a system with other affiliated resident schools, or in one instance utilizing the computer of a local university. In addition, one-third of the NHSC member organizations gain access by leasing computer systems.

The frequency with which data is processed is also depicted by Table 2. Obviously, the private institutions update their computer files more fre-

quently than the university departments. This disparity seems to be partially caused by the fact that the private home study schools are more involved with financial transactions than are the independent study departments. On the other hand, NUEA member institutions utilize EDP systems more for the generation of statistical summaries than for the support of day-to-day operations. They therefore require less frequent processing for the maintenance of their computer files. According to the survey, 69 percent of the university departments and 59 percent of the private schools employ computers to produce course-instruction-related statistical information.

Modes of Sharing EDP Systems

There are three primary ways in which to share a computer system. First, an organization can have its own keypunch equipment by leasing or purchasing it. In this manner source document conversion can be performed on the premises and data manipulation at a shared computer facility. Second, an institution may have both its keypunching (or another method of data transformation) and processing requirements accomplished at a service bureau or computer center. Such a method is more appropriate for smaller agencies with moderate information handling needs. Third, an institution could purchase or lease one or more on-line terminals tied into a shared computer system located at any distance from the physical facilities of the organization. Input/output of the terminals is either displayed in teletype form or on cathode-ray tubes (CRT's). Depending on the capabilities of the central EDP system, the third mode of sharing a computer is the most responsive and anthropocentric, giving all users the pretense that they have individual control of the entire system.

Method	% of NUEA Members (13)	% of NHSC Members (27)	Combined Percentage
In-house keypunch equipment with processing done at a shared computer center	23	20	21
Keypunching and processing done at a shared computer center	62	73	68
In-house terminal/s tied into a shared computer center for remote I/O	15		7
Other		7	4

Table 3 gives a breakdown of the methods used for sharing computer systems and the frequency with which they are employed. The NUEA and the NHSC members utilize the second mode of shared systems configuration most often. It appears that both groups should give more consideration to the introduction of on-line terminals to obtain more adequate management information. This would be especially appropriate for very small institutions that have not even considered computer applications.

Storage Media Used for Major Files

The importance of storage medium selection in the design of data files cannot be over-emphasized. The critical aspects are the speed of data transfer,

the arrangement of individual records, and the capacity of the medium. Punched card files are cumbersome, organized sequentially, and have an extremely slow computer input rate. Records on magnetic tape are arranged sequentially but data transfer is fast. Magnetic disk files can be randomly accessed and they have a very fast data transfer rate.

The types of storage media used for major files by the surveyed groups is depicted by Table 4. NUEA members use primarily punched cards or a combination of punched cards and magnetic tape for the maintenance of their active enrollment file. The high utilization of punched cards for this file by the universities could be attributed to the extensive use of card devices for statistical compilations by the departments prior to the introduction of EDP systems. The use of business machines for such purposes was well publicized in 1953 by Mary L. McPartlin⁹ of Loyola University. As a matter of fact, in some instances lesson and examination grades are posted manually onto punched cards. When a combination of punched cards and tape is used the card file is usually updated on a daily basis while the tape file is processed less frequently.

NHSC members prefer to maintain their active student file on tape or a combination of manual cards and tape. As stated previously, 26 percent of the private schools maintain only the enrollees' financial records on computer accessible files. Educational records in these organizations are primarily kept on manual cards or in folders. A large number of private organizations, however, utilize magnetic tape for all active student records.

Again referring to Table 4, it can be observed that numerous NUEA affiliates prefer a combination of manual or punched cards and microfilm for the maintenance of transcript or inactive student files. The utilization of alternative means is quite evenly distributed among the remaining departments. NHSC members on the other hand, use more manual cards for the storage of inactive student records than any other type of media.

Manual cards are utilized primarily for the maintenance of inventory control records by both groups surveyed. The choice of such a medium by the NUEA members does not seem inappropriate with enrollments not exceeding 12,500 by the departments employing computers. For several of the larger private schools, however, with up to 50,000 enrollments and available EDP systems, the procedure appears questionable.

Modes of Active Student File Input and Access

The methods of computer data input and information retrieval are directly related to the storage media employed. As indicated previously, both groups surveyed utilize punched cards and magnetic tape extensively for the maintenance of active enrollment files. The addition of records to a punched card file can only be accomplished by producing new cards and physically or mechanically placing them into the file. Conversely, the deletions of records kept in a punched card file can be performed only by manually or mechanically extracting individual cards from the file. Input or changes to sequential magnetic tape files can be initiated by the use of punched cards, paper tape, optical mark reading (OMR) equipment, or optical character recognition (OCR) units. The latter two devices have the capability of converting source data directly to tape or disk.

Table 4
Types of Storage Media Used for Major Files
by Institutions Using Computers

File and Medium	Institutions		
	% of NUEA Members (13)	% of NHSC Members (27)	Combined Per- centage
Active Student File			
Manual cards	7	11	10
Punched cards	46	7	20
Magnetic tape	8	26	20
Disk	8	7	8
Manual cards and tape		26	17
Punched cards and tape	23		8
Manual cards and disk	8	8	7
Other		15	10
Inactive Student File			
Manual cards	15	44	35
Punched cards	15	4	8
Magnetic tape	8	15	12
Disk		4	3
Microfilm	8	7	8
Manual cards and tape or disk	8	19	15
Manual or punched cards and microfilm	38		12
Other	8	7	7
Inventory Control File			
Manual cards	54	63	60
Punched cards	15	4	7
Magnetic tape		11	7
Disk		4	3
Combination of any four above	8	15	13
No records maintained	23	3	10

Table 5
Modes of Active Student File Input and Access
by Institutions Using Computers

Input and Access Modes	Institutions		
	% of NUEA Members (13)	% of NHSC Members (27)	Combined Per- centage
Input			
Punched cards	85	89	88
On-line terminal/s	15	7	10
Other		4	2
Access			
Punched cards	69	48	55
On-line terminal/s	8	11	10
Manual	23	26	25
Periodic printouts		11	8
Other		4	2

Table 5 indicates that all correspondence study institutions employ punched cards almost exclusively to update the active student file. This is logical considering the primary storage media used by the agencies and the almost total absence of OMR and OCR equipment. According to Table 5 much of the information from the enrollment file is also retrieved by means of punched cards. One fourth of the data, however, is manually accessed. Most of this may be attributed to two factors. One reason is that punched card files of the NUEA departments are usually manually searched for information. Another influence is the fact that numerous NHSC members only maintain student financial data on computer accessible files.

Student Inquiries and Reminder Notices

The institutions surveyed that use computers were asked whether replies to all student inquiries are manually prepared. Table 6 depicts the manner in which answers to student inquiries are produced. Approximately 38 percent of the NUEA members and only 15 percent of the NHSC affiliates respond manually to correspondence from students. Form letters are most frequently used by the universities, while most of the replies by the private organizations are prepared by the combined use of automatic typewriters and computers.

Table 6
Methods Used in Responding to Written Student Inquiries by Institutions Using Computers

Methods	Institutions		
	% of NUEA Members (13)	% of NHSC Members (27)	Combined Percentage
All manually typed or written	38	15	23
Some form letters	54	22	33
Some form letters and automatic typewriter replies		33	22
Some computer printed responses		15	10
Some other combination of the above methods	8	15	12

It should be noted that the use of form letters is perhaps the most impersonal way of responding to queries. On the other hand, computer printed replies and especially correspondence produced by automatic magnetic tape or card controlled typewriters can be made as unique and personal as manually composed letters. In most cases such correspondence is more informative and fluent than routinely prepared replies by clerks or counselors. The NUEA members, therefore, should investigate the possibilities of taking advantage of the above methods in the future.

Table 7
Types of Computer Generated Student Reminder Notices Utilized by Institutions Using Computers

Types of Notices	Institutions		
	% of NUEA Members (13)	% of NHSC Members (27)	Combined Percentage
Extended inactivity	23	44	38
Cancellation	23	19	20
Delinquent account	8	74	53

Table 7 shows the percentage of correspondence study institutions utilizing various forms of computer generated student reminders or notices. Apparently the NHSC members are applying information technology more fully in this area, although most of their effort is centered around delinquent accounts. There is much that can be accomplished by all correspondence instruction institutions concerning computer-based motivational subsystems development. It

must also be noted at this juncture that 63 percent of the private schools, as compared to 8 percent of the independent study departments, use computer printed address labels for sending initial course materials to students. Production of labels is a simple by-product of computer enrollment processing and is very useful both for mailing study materials and inventory control

Table 8
Extent of Computer Application in Test Scoring, Feedback, and Analysis by Institutions Using Computers

Applications	Institutions		
	% of NUEA Members (13)	% of NHSC Members (27)	Combined Percentage
Test scoring	8*	22**	18
Test feedback		22	15
Test Analysis		19	13

* One NUEA member school uses a computer for only final examination production and scoring.

** One NHSC member institution uses a computer for scoring some tests and examinations.

Computer Scoring and Posting of Grades

As is indicated by Table 8, almost no university associated departments and very few private organizations employ EDP systems in scoring lesson tests or examinations. The obvious reason for this is the fact that constructed response questions are used exclusively for lesson tests by the university departments and in most instances by the NHSC members. All of the private schools that do use computers for lesson or examination scoring also utilize the systems for the generation of test result feedback for the students. The feedback includes specific corrective comments or indicates areas to be re-studied.

No conclusive evidence has been presented indicating that essay-type tests are superior to multiple choice response examinations. A study program cannot be assumed to be personalized simply because tests are evaluated by persons instead of machines. Machines are constructed by man and can be as effective as the professionals who design and program the devices.

Table 9
Extent and Methods Used for Posting Dates of Lesson/Examination Receipts to Active Student File by Institutions Using Computers

Extent and Methods	Institutions		
	% of NUEA Members (13)	% of NHSC Members (27)	Combined Percentage
Extent	46	19	28
Methods			
Keypunching a card for each test received	67	100	82
Student submits a pre-punched card with each lesson	17		9
On-line terminal input after lesson receipt	16		9

Test analysis is facilitated by the use of computers. As lessons or examinations are evaluated by an EDP system a test analysis file can be updated at the same time and statistical summaries can be prepared periodically or by request. Such a vital educational tool could and should be continuously used to assure that lesson tests and examinations are well structured and accomplish desired objectives effectively. No university departments, and only 19 percent of the private schools, utilize EDP systems for test analysis purposes.

When lessons or examinations are received from the students for instructor grading 46 percent of the NUEA members and 19 percent of the NHSC associates that use computers post the dates the tests are received to the active enrollment file prior to distributing the tests to the instructors. According to Table 9, most of the institutions employ punched cards for posting the dates of test receipts to the student records. After the lessons or examinations have been evaluated by the instructors, punched cards are also the primary means used by all institutions to post grades to the active enrollment file. As indicated by Table 10, however, 37 percent of the grades are entered manually to the student records after instructor notification. Again, this is largely due to the high rate of manual manipulation of punched cards by the university departments and the frequent separation of educational and financial student records by the private schools.

Table 10
Modes Employed for Posting Instructor Graded Test/Examination Results to the Active Student File by Institutions Using Computers

Modes	Institutions		
	% of NUEA Members (13)	% of NHSC Members (27)	Combined Percentage
Keypunching a card as a result of instructor notification	62	50	54
Optical mark reading equipment reads instructor input		5	3
On-line terminal input after instructor notification	7		3
Generation of paper tape after instructor notification		4	3
Manual posting after instructor notification	31	41	37

Discussion

The compiled data indicates that the level of EDP systems utilization in this area, with very few exceptions, is at the mid-second generation computer development stage. For instance, only one NUEA and two NHSC member institutions are using disk storage for active student record files. A point to remember here is that third generation systems were first introduced in 1964.

The figures are not much more encouraging when the extent of EDP systems application is considered. Only 33 percent of all the schools surveyed are using computers for various purposes (some only for financial records) and 10 percent have definite

plans for incorporating a system in the near future. It appears that many schools may be still using procedures and methods in the administration of their programs similar to the ones described by Arthur J. Klein in 1919.⁴

The survey has revealed that correspondence instruction departments or schools do not have to be very large to realize benefits from EDP systems. Schools with enrollments as low as 85 are using computer systems in the management of their programs. These benefits can, of course, only be attained by sharing computer systems. Specifically, the use of on-line computer terminals is due much greater attention by the administrators of correspondence study institutions with versatile third and fourth generation systems becoming more readily accessible.

Footnotes

1. Charles Ehin, "Analyses and Alternative Proposed General Designs of Computer-Based Correspondence Instruction Systems," (Unpublished dissertation, University of Oklahoma, May, 1972).
2. See Charles Ehin, "Computer Applications in Correspondence Education," *Education Technology*, forthcoming, for a brief summary of the study and a description of one of the proposed general systems designs.
3. Mary L. McPartlin, "The Use of Business Machines in the Administration of Correspondence Courses," *Proceedings of the International Conference on Correspondence Education*, 1953.
4. Arthur J. Klein, "The Administration of Correspondence Study Departments of Universities and Colleges," *Bureau of Education Bulletin No. 56*, 1919, pp. 3-54. □

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Washington, D.C. 20036

For two and a half years now, Common Cause, with its more than 200,000 members, has been fighting pitched battles in the public interest — and often winning. We've learned a lot of lessons, but none more fundamental than this: As far as citizens are concerned, all their other rights depend on their right to know. It's no accident that the First Amendment comes first: if freedom of information is successfully stifled, all the other freedoms can be snuffed out at leisure. What citizens don't know, they can't object to.

The good investigative reporter is, therefore, an invaluable ally when citizens are fighting battles in the public interest. And reporters are virtually unanimous in asserting that aggressive investigative reporting could not survive without extensive use of confidential sources. Such sources will fall silent if it becomes apparent that courts can force reporters to reveal their identity.

Unfortunately, courts and prosecutors all over the country seem to be seeking just that result. In the last several years, journalists have repeatedly been subpoenaed to reveal confidential information, and some who refused to talk have gone to jail.

Present safeguards are inadequate to protect the public's right to know. The Attorney General's guidelines for the issuance of subpoenas to the news media apply only to the Department of Justice, contain significant loopholes, and may be changed at the whim of the Attorney General. Eighteen states possess newsmen's privilege statutes, but these laws are usually narrow and imprecisely drafted, and in many cases have been gutted by judicial interpretation.

In June, 1972, a narrowly divided Supreme Court ruled 5-4 in Branzburg v. Hayes that a newsman had no First Amendment right to refuse to reveal his confidential sources to a grand jury. The court emphasized, however, that Congress or state legislatures were free to enact newsmen's shield legislation, and it virtually invited such action.

The public's right to know should not depend on the willingness of newsmen to go to jail rather than betray confidential sources. A shield law will benefit the public as well as newsmen and is not really a "privilege". Protection for sources is a necessity as basic as a typewriter if a journalist is to search out the truth. Congress should act now to protect the free flow of information to the public.

A federal shield law should apply to reporters for newspapers, magazines, television and radio, and should protect the identity of informants and the information they give in confidence. It should apply without exception to grand juries, legislative hearings, and administrative proceedings. It should cover all civil trials with the possible exception of libel cases. This broad coverage is necessary to guard against "fishing expeditions" made possible by the lack of evidentiary rules at investigatory proceedings and the broad discovery possible in civil trials.

Criminal trials present a different problem, and here there should be a narrow and well-defined exception. The scope of inquiry here is sharply focused since a jury or prosecutor has formally preferred charges and found probable cause to believe that the defendant has committed a crime.

Furthermore, to make an effective defense, a criminal defendant may have a compelling need for confidential information possessed by a reporter. Any newsmen's privilege that Congress enacts would have to give way, in any case, before the Sixth Amendment's guarantee to a criminal defendant of compulsory process for obtaining witnesses and for confronting the witnesses against him.

The exception allowed in criminal trials must be extremely specific. It should not allow a court to engage in a general "balancing of equities" that would make it difficult for informants and reporters to predict the situations in which their agreements of confidentiality might be invaded. Three conditions should be met before disclosure is required:

1. the trial should involve a specified serious crime;
2. there should be a demonstration of probable cause to believe a newsman possesses relevant information; and
3. it should be shown that no alternative means of obtaining the information exists.

Enactment of a statutory newsmen's privilege will never prevent a reporter from testifying if he feels his obligations as a citizen compel him to do so. In cases involving immediate danger to human life, such as planned bombings, kidnappings, hijackings, and incidents of food poisoning, reporters have in the past willingly presented whatever knowledge they have to public authorities regardless of confidentiality.

No doubt a statutory privilege will sometimes operate to exclude trustworthy and relevant evidence from judicial proceedings, but this is justified by the central role played by the press in the preservation of free self-government. Thomas Jefferson said, "The basis of our government being the opinion of the people, the very first object should be to keep that right; and were it left to me to decide whether we should have a government without newspapers or newspapers without a government, I should not hesitate a moment to prefer the latter."

ADVERTISING INDEX

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

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- COMPUTER DIRECTORY AND BUYERS' GUIDE, 1973 / published by Berkeley Enterprises, Inc., 815 Washington St., Newtonville, Mass. 02160 / page 29
- COMPUTERS AND AUTOMATION / Computers and Automation, 815 Washington St., Newtonville, Mass. 02160 / page 52
- THE FLY, THE SPIDER, AND THE HORNET / taken from *Ride the East Wind: Parables of Yesterday and Today*, published by Quadrangle Books (a New York Times Company) / Computers and Automation, 815 Washington St., Newtonville, Mass. 02160 / page 39
- THE NOTEBOOK ON COMMON SENSE, ELEMENTARY AND ADVANCED / published by *Computers and Automation*, 815 Washington St., Newtonville, Mass. 02160 / pages 2, 3
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The American News Media and the Assassination of President John F. Kennedy: Accessories After the Fact¹ — Conclusion

Richard E. Sprague
Hartsdale, N.Y. 10530

"...the pattern of internal knowledge of conspiracy followed by complete suppression of such knowledge is too strong to ignore."

Part One of this article, published in the June issue of Computers and Automation, dealt with the interlocking nature of the news media and various attempts at blunting independent investigations of the assassination.

The New York Times

The record of the Times through the 1964-1971 period follows the same pattern as the CBS and Life magazine editorial policies.

The early editorials following the Warren Report supported the Commission. The Times cooperated by publishing much of the report in advance. In 1965, however, editorials began to appear questioning the Commission's findings and suggesting a new investigation. In 1964 the Times formed a research team to investigate the assassination, headed by Harrison Salisbury. The team of six included Peter Khiss and Gene Roberts. Their conclusions were never made public by the Times, but indications point to their finding evidence of conspiracy.

Khiss in particular, through the 1966-68 period in several meetings and discussions with the author, expressed doubts about the Warren Report and questioned the lone madman assassin theme. Then, when the Garrison investigation made the news, the Times began a regular campaign to undermine Garrison's case, to support the Warren Commission, and finally during the Clay Shaw trial to completely distort the news and the testimony presented. Martin Waldron was the reporter sending in the stories from the Shaw trial, but someone in New York edited them to completely change their content. The author saw the first day of the trial story as written by Waldron and the final version appearing in the Times. The two were completely different, with Waldron's original following the actual trial proceedings very closely.

The author, writing under a pen name, Samuel B. Thurston, postulated the possibility that The New York Times on selected subjects, including the JFK assassination, is controlled by the CIA through their representative among top management, Mr. Harding Bancroft.²

In the summer of 1968, the author discovered a remarkable similarity between the sketch of the as-

assin of Dr. King and one of three tramps arrested in Dealey Plaza following the assassination of President Kennedy. Peter Khiss wrote a story about this and it was published by the Times in June 1968. Apparently that was the final straw for Times management as far as Khiss was concerned. He has not been allowed to do any more research on assassinations or to even discuss the subject at the Times since then. As he told the author in 1969, he doesn't attend any press conferences about assassinations because he doesn't like it when people in Times management say, "Here comes crazy old Pete Khiss again with his conspiracy talk".

The acme of The New York Times actions and editorial positions on the JFK assassination came in November and December 1971. They published three items supporting the Warren Commission eight years after the assassination, at a time when it seemed to be a dead issue, at least on the surface.

The first was a story about Dallas eight years later by an author from Texas who wrote his entire story as though it were an established fact that Oswald was the lone madman assassin firing three shots from the sixth floor window of the Depository building and later killing policeman Tippitt.

The second was an Op Ed page guest editorial by none other than David Belin, Warren Commission lawyer. He defended the Commission and attacked the researchers. The third was a story by Fred Graham about the findings of Dr. Lattimer who was allowed to see the autopsy photographs and X-rays. Graham actually wrote most of his story which solidly backed up the Warren Commission due to Lattimer's claims that the autopsy materials proved no conspiracy, before Lattimer ever entered the Archives.

In other words, it appears that Graham knew what Lattimer was going to find and say in advance. Either that, or someone in Washington, D.C. gave someone high up at the Times orders in advance to prepare the story for page 1, upper left-hand corner, of the paper. It really didn't make any difference whether Dr. Lattimer ever saw the X-rays and photos.

The concerted campaign on the part of Times management could have been timed to prevent a discovery of new evidence of conspiracy in the autopsy materials. The reason for this possibility developing in the November 1971 period is that the five year restriction placed on the autopsy evidence by Burke Marshall, Kennedy family lawyer, expired in November 1971. Four well-known and highly reputable forensic pathologists, Dr. Cyril Wecht of Pittsburgh, Dr. John Nichols of the University of Kansas, Dr. Milton Halpern of New York City and Dr. John Chapman of De-

1. Accessories After the Fact is the title of a book by Silvia Meagher published by Bobbs Merrill in 1967, accusing the Warren Commission and the various government agencies of covering up the crime of the century. This article accuses the national news media of the same crimes.

2. Computers and Automation, July 1971.

troit, had already asked permission to examine the X-rays and photos upon the expiration of the five year period. All four are known to question the Warren Commission's findings. What better way to freeze them out of the Archives than to select a doctor who could be trusted to back up the Commission (Lattimer had published several articles doing just that), commission him to go into the Archives, and then get The New York Times to publish a Sunday page 1 story demonstrating that no one else need look at the materials because they back up the Warren Commission's findings completely.

All attempts by researchers including the author to convince Times management that the other side of the story should be told have been completely ignored. Lattimer's findings, if correct, actually prove conspiracy. The Times has been informed of this, including Fred Graham, Harrison Salisbury (Op Ed page editor), but they have shut off all discussion on the subject. The complete story of the complicity of The New York Times in the crimes to which they have become an accessory would take up an entire volume. A researcher³ is assembling the entire story and has published it in a recent magazine article.

NBC

The National Broadcasting Company became an active participant in the government's efforts to protect Clay Shaw and to ruin Jim Garrison.

Two of NBC's high level management people, Richard Townley of NBC's affiliate in New Orleans, WDSU, and Walter Sheridan, executive producer, became personally and directly involved in the Shaw trial. They were indicted by a grand jury in New Orleans for bribing witnesses, suppressing evidence and interfering with trial proceedings. The indictments are still open. NBC top-level management backed Sheridan and Townley totally.

NBC produced a highly biased, provably dishonest program personally attacking Garrison and defending Shaw, prior to the trial. Frank McGee who acted as moderator later had to publicly apologize for lies told on the program by two "witnesses" who NBC paid to give statements against Garrison. The FCC ruled that NBC had to give Garrison equal time because the program was not a news program but a vendetta by NBC against Garrison. NBC did give Garrison 30 minutes (compared to their one hour attack) to respond at a later date. Sheridan was the producer of the one hour show.

With Sheridan and Townley so deeply involved, and with such an extremely strong editorial position favoring the Justice Dept., the Warren Commission, and the lone assassin stance, it naturally raises suspicions about NBC's and RCA's independence and news reporting capabilities.⁴ At one point in 1967, the President of NBC, according to Walter Sheridan, helped in the bribery efforts by calling Mr. Gherlock, head of Equitable Life Assurance Co.'s New York office, and asking for assurance that Perry Russo, who worked for Equitable, would cooperate with NBC.

NBC is also an owner of several important pieces of photographic evidence. A TV film taken by NBC photographer David Weigman was suppressed by NBC and not made available to researchers. It shows the grassy knoll in the background just a fraction of a minute after the shots. Some of the assassination participants can be seen on the knoll.

3. Jerry Policoff. The Realist, January 1973.

4. A detailed review of NBC's performance and Walter Sheridan's and Richard Townley's involvement is given in The Kennedy Conspiracy by Paris Flammonde.

Fortunately for researchers, NBC sold the Weigman film to the other networks and to the news film agencies before realizing its importance. The author was able to purchase a copy from Hearst Metro-tone News.

NBC's affiliate in Ft. Worth, WBAP, has in their files several important film sequences. James Darnell took several sequences on the grassy knoll and in the parking lot which should contain important evidence. Dan Owens took TV movies in and around the Depository building which should show how the snipers' nest was faked on the sixth floor, and one of the assassins in front of the building.

ABC

Of the three major TV networks, ABC has remained more objective and appears to be less under the thumb of the government than the other two. For example, when NBC was busy defending the Warren Commission and Clay Shaw and attacking Jim Garrison, ABC gave Garrison a free chance to express his views without interruption on their Sunday program, "Issues and Answers". They have never taken an editorial position one way or the other on conspiracy. However, in the Robert Kennedy assassination case, an investigation into evidence of conspiracy was suppressed at ABC. The man heading the brief investigation was stopped and sent off to Vietnam. The man at ABC who called the shots in stopping the investigation, and in suppressing evidence in ABC's possession, was a lawyer named Lewis Powell.

The evidence owned by ABC is a video tape of the crowd in the Ambassador Hotel ballroom before, during and after the shots were fired in the kitchen. The ballroom microphones, including ABC's, picked up the sound of only three shots above the crowd noise. Since Sirhan fired eight shots, or certainly more than three, and since Los Angeles police tests proved that Sirhan's gun could not be heard in the position of the microphones in the ballroom, the ABC film and soundtrack is important evidence of three other shots, not Sirhan's.

The sequence was originally included in the TV film of Robert Kennedy's 1968 campaign and assassination, "The Last Journey". Following a meeting at ABC when the management learned what the film showed, the next TV broadcast of "The Last Journey" scheduled for the following week on ABC was cancelled without any logical explanation. The next time the film appeared on ABC (late 1971), the three shot ballroom sequence had been cut out.

United Press International

UPI has perhaps come closest to really pursuing the truth about the JFK assassination of all the fifteen major news organizations included herein. Yet they, too, have suppressed evidence, have not had the courage of their convictions in analyzing conspiratorial evidence, and by default have become accessories after the fact.

Two different departments at UPI became involved in the photographic evidence of the JFK assassination. The regular photo news service department, which receives wire photos and negatives from many sources all over the world, accumulated a large collection of basic evidence both from UPI photographers and by purchasing wire service photos from newspapers, Black Star, AP and other sources. This department has made all of its photographs available to anyone at reasonable prices (\$1.50 to \$3.00 per print).

UPI photographer Frank Cancellare was in the motorcade and snapped several important photos. In addition, five other photos at UPI taken by 3 un-

known photographers are significant. All of these were purchased by the author from UPI.

The other department has, however, not been as cooperative. Within the news department at UPI, Burt Reinhardt and Rees Schonfeld have varied in their attitude and performance. UPI news purchased the commercial rights to two very important films shortly after the assassination. These were color private-citizen movies taken by Orville Nix and Marie Muchmore. Both show the fatal shot striking the President, and both show evidence of conspiracy. In the Nix film, certain frames when enlarged show the man who fired the fatal shot, on the grassy knoll with a rifle. Both movies show a puff of smoke generated by another one of the men involved in the assassination.

UPI, under the direction of Burt Reinhardt, did several things with the Nix and Muchmore films. First, they produced a book, Four Days, which included several frames from the movies, reprinted in color. Second, they made a composite movie in 35 mm size from the original 8 mm movies. The composite used the technique of repeating a frame several times to give the appearance of slow motion or stop action during key sections of the films. Reinhardt, Schonfeld and Mr. Fox, a UPI writer, made the composite movie available to researchers at their projection studio in New York in 1964-65.

Fox and Schonfeld wrote an article for Esquire magazine in 1965 which portrayed the Nix film as proving the conspiracy theories about assassins on the grassy knoll to be false. This was deemed necessary by UPI management because a New York researcher and a photographic expert, after seeing the Nix film at UPI, claimed it showed an assassin with a rifle standing on the hood of a car parked behind the knoll.

The research team had used a few frames from the film in color transparencies and enlarged them in black and white to show the gunman.

In 1964 UPI gave the Warren Commission copies of both the Nix and Muchmore films for analysis. When the Commission ceased to exist, the films were turned over to the National Archives under a special agreement between UPI and the Archives. This agreement reminds one of the agreements between the Archives and the Kennedy family on the autopsy materials, and the obscure one between Life magazine, the Commission, the Secret Service and the Archives on the Zapruder film.

The UPI agreement prevents anyone from obtaining copies of the Nix and Muchmore films or slides of individual frames for any purpose, commercial or otherwise. The agreement is just as illegal as the other two, yet it has been just as effective in suppressing the basic evidence of conspiracy.

In 1967, UPI, apparently still not sure they would not be attacked by researchers on what the Nix film revealed, employed Itek Corp. to analyze the film. (At least it would appear on the surface that UPI did the hiring.) Itek Corp., a major defense contractor, did an excellent job of obscuring the truth. In an apparently highly scientific analysis using computer-based image enhancement, they "proved" that not only was there no gunman on the grassy knoll, but there was no person on the knoll at all during the shooting.

The final Itek report was made public and highly publicized by UPI. It looked to the lay public as

though the UPI earlier claim of no gunman had been scientifically substantiated. As a by-product, Itek got some great publicity for their commercially available photo-computer image enhancement system.

What the public did not know was the following:

UPI gave Itek only 35 mm enlarged black and white copies of selected frames from the Nix film. The amount of detail lost in going from 8 mm color to 35 mm black and white is very high.

UPI gave Itek frames from the Nix film carefully chosen to not show the gunman on the knoll.

UPI and Itek defined "the grassy knoll" in a very limited and carefully chosen way so as to exclude the five other people (in addition to the fatal shot gunman) on the knoll, who appear in the Nix film as well as in every other photo and movie taken of the knoll at the time the shots were fired.⁵ In addition, man #2 who had ducked down behind the stone wall during the Nix film, could not, of course, be detected by Itek since all they had was the Nix film.

Three men standing on the steps on the knoll, and two men behind the picket fence were completely ignored or overlooked.

The author began to contact Schonfeld and Reinhardt in early 1967, viewed the two films both at UPI and in the Archives, and requested copies of the original 8 mm color films or color copies of individual frames. The response to the requests were negative for more than four years. During this time, however, the author, the New York researcher, and a photographic specialist enlarged in color, the correct frames from the Nix film. The enlargements clearly show the gunman, not on top of the car, but in front of the car, with his rifle poised. He is standing on a pedestal protruding from the eight-sided Cupola behind the stone wall on the knoll. The car is parked behind the Cupola and can be seen in several other photos and movies.

Unfortunately, UPI's agreement with the researcher prevents making public the enlargements in color. UPI has consistently suppressed this evidence to this date. They offered in 1971 to make the film available for a very large sum of money, but have never agreed that it shows anyone on the knoll, and will not make copies available for research.

The UPI editorial position in articles, the book Four Days, letters, and news releases, has supported the Warren Commission through the years. The major difference between UPI and Life or CBS is that no drastic reversal of management policy took place.

AP

Associated Press became a definite accessory after the fact by taking an action unprecedented for a news wire service. They "published" a three-part report by three AP writers in 1967, completely backing up the Warren Commission. The report was transmitted by wire to all AP subscribers over a three day period and it occupied a total of nine to ten full pages of the average newspaper. It was not news, but editorial policy and position, supporting the Warren Commission and the official

5. Those interested in more detail are referred to the map in the May 1971 issue of Computers and Automation on the JFK assassination. The UPI definition of "the grassy knoll" was the area bounded by the picket fence, the stone wall, the top of the steps on the south, and the cupola.

government propaganda about the assassination of our President.

As pointed out in the first part of this article, most small newspapers rely on UP and AP for their news stories. The AP three-part report ran in hundreds of papers across the United States without opposition commentary. For many this was the gospel at the time. What more could the conspirators and their government protectors have asked?

AP photographers were on the scene in Dallas during the killing. James Altgens, one of AP's men assigned to Dallas, took seven important photos in Dealey Plaza. Henry Burrows, an AP photographer from Washington, D.C., was in the motorcade and snapped two pictures. Four other AP photographers took ten important photos. In addition AP's photo department, Wide World Photos in New York, purchased many other photographs taken in Dealey Plaza.

Meyer Goldberg, the manager of Wide World Photos, set a policy early in the 1966-1967 period, which placed AP in the position of partially suppressing basic photographic evidence. The policy contained several parts. First, Goldberg made it extremely difficult for anyone to obtain access to the photographic evidence, particularly the negatives. Second, he set a high enough price on copies of photographs (\$17.50 for one 8 x 10 black and white print) to freeze out all but commercially financed interests. Thirdly, when an original negative was discovered (by going around the organizational roadblocks set up by Goldberg), the print order, when cleared by Wide World, was always cropped. Full negative prints showing important details in the Altgens photos were nearly impossible to purchase. Fourth, whenever any suggestion was made to Wide World that their photographs contained basic evidence of conspiracy, Goldberg and AP management turned blue with anger and literally refused to discuss the subject or permit research in the files.

Various researchers, including Josiah Thompson, Raymond Marcus and the author, met this type of stiff opposition, but after many visits, discovered ways around it. The working staff at Wide World in charge of the photographic files were more cooperative, and at least one staff member was completely convinced about conspiracy.

Nevertheless, the broadly announced editorial policy and stance of Associated Press since 1964 and through 1972 has been full support of the Warren Commission and the lone assassin fable.

Newsweek

Newsweek editorial policy and reporting about the assassination and its aftermath became largely a function of the views of one man, Hugh Aynesworth. Aynesworth was the Dallas-Houston correspondent for Newsweek following the assassination. He had been a reporter on the Dallas Morning News. He was on the spot when it happened, and turned in several stories in the days and weeks immediately following November 22, 1963. His point of view was always closely allied with the Dallas police, the district attorney and the FBI. He supported wholeheartedly the Warren Report upon its appearance. Up to 1967 his performance was really not much different than a majority of other non-inquiring reporters who took what was fed to them and popularized it.

However, in May 1967, after Garrison's investigation hit the news, Aynesworth wrote and Newsweek published a violent attack on Garrison's investiga-

tion. Aynesworth accused Lynn Loisel on Garrison's staff of bribing Al Beaubolf to testify about a meeting to plot the assassination. Beaubolf later denied this accusation in a sworn affidavit and proved Aynesworth and Newsweek to be fabricators of information just like NBC.

Saturday Evening Post

As in the case of Newsweek, the position of the Saturday Evening Post solidified after the Garrison probe became public and was based largely on the antics of one man, James Phelan. Phelan wrote a blistering article for the Post published on May 6, 1967. He attacked Garrison and Russo with a special claim that Russo's original statement to Assistant D.A., Andrew Sciambra, differed from his testimony later on. In view of the earlier editorial position of the Post when Lyron Land and his wife, both editors, questioned the Warren Commission findings, the Phelan article came as somewhat of a surprise. In fact, the Post had taken a strong conspiracy stand when earlier in 1967 they published a long article excerpted from Josiah Thompson's book, Six Seconds in Dallas, and featured it on the cover.

The Garrison investigation, however, turned the Post around as it did many other news organizations. Phelan became directly involved in the case, and in a sense, was more of an accessory than Walter Sheridan or Richard Townley. He travelled to Louisiana from Texas, spent many hours with Perry Russo and other witnesses, and generally obfuscated the Shaw trial picture.

Phelan joined the efforts of Sheridan and Townley to get Russo to desert Garrison and to help destroy Garrison and his case. According to a sworn Russo statement, Phelan visited his house four times within a few weeks. Phelan told Russo he was working hand in hand with Townley and Sheridan and that they were in constant contact and were going to destroy Garrison and the probe. Phelan told Russo that he should go over to the other side because he would be the only one who would get hurt as a result of the trial because Garrison would leave him all alone standing in the cold.

Phelan offered to hire a \$200,000-a-year lawyer from New York for Russo if he would cooperate against Garrison. He asked Russo how he would feel about sending an innocent man (Clay Shaw) to the penitentiary. Phelan left New Orleans and Baton Rouge to go to New York from where he telephoned Russo several times offering to pay Russo's plane fare to New York to meet with him and discuss going over to Clay Shaw's side.

Because Phelan's article attacked Garrison, he was subpoenaed by Shaw's lawyers during a hearing in 1967. Sciambra welcomed the opportunity to cross-examine Phelan on the stand. He described the article as being incomplete and distorted and tantamount to lying. Sciambra said, "I guarantee that he (Phelan) will be exposed for having twisted the facts in order to build up a scoop for himself and the Saturday Evening Post."

Sciambra went on to say that Phelan had neglected the most important fact of all in his article. It was that Phelan had been told by Russo in Baton Rouge that Russo and Sciambra had discussed the plot (to assassinate JFK) dialogue at their initial meeting.

The statements by Sciambra were very mild in view of Phelan's actions.

Capital City Broadcasting

This organization owns several radio stations in the capital cities of various states and in Washington, D.C. Their interests in the JFK assassination increased in 1967 and 1968 when the Garrison-Shaw case was making headlines. A producer at Capital City, Erik Lindquist, decided to do a series of programs designed to get at the truth. The author furnished various evidence for scripts to be used in the programs. After several months of work, the project was cancelled, presumably by top management, and the broadcasts never did take place.

No further activities are known to the author on the part of Capital City.

North American Newspaper Alliance

This newspaper chain, with affiliated papers in smaller communities throughout the north and east, followed the same pattern of Warren Commission support as all the other major newspaper services and chains. The Alliance also became involved in the Martin Luther King case because they circulated the syndicated column of black writer and reporter Louis Lomax. He had taken an intense interest in finding out what happened in the King assassination.

Lomax located a man named Stein who had taken a trip with James Earl Ray from Los Angeles to New Orleans. The two retraced the auto trip of Ray and Stein beginning in Los Angeles and heading through Arizona, New Mexico and Texas. They were trying to find a telephone booth somewhere along the route from which Ray had called a friend named Raoul in New Orleans. Raoul, according to Ray, was the man who actually fired the shot that killed King. Stein remembered that Ray told him he was going to meet Raoul in New Orleans and phoned him at someone else's office. Stein couldn't remember exactly where the phone booth was, because he and Ray had been driving day and night without stopping.

Lomax wrote a series of articles portraying Raoul as the killer and Ray as a patsy, and sent it to the Alliance, one column each day from the places along the retraced trip where he and Stein stayed. Finally, Lomax's column said they had found the phone booth at a gas station in Texas and that he was going to obtain the phone number Ray had called in New Orleans. Presumably, he was planning to visit the local telephone company office the next morning to obtain the number.

That was the last Lomax column ever to appear in the North American Newspaper Alliance papers. He just seemed to disappear completely. The readers were left hanging not knowing whether he got the phone number or whether he discovered who it belonged to. The Committee to Investigate Assassinations located Lomax several months later and asked him what had happened.

He said he had been told by the FBI to cease and desist from his investigation and not to publish or write any more stories about it. He said he found the phone number and where it was located in New Orleans. He gave the number to the Committee. He said he was afraid he would be killed and decided to stop work on the case.

Whether North American Newspaper Alliance management knew about any of this, or whether they sanctioned the stopping of the series, remains unknown. What is known, however, is that Louis Lomax died in a very mysterious manner in 1970. He was driving alone along a highway in New Mexico, travelling

east, very near the same route he and Stein had traversed. He drove off the highway after travelling at a very high speed, and was found dead, according to the State police report. Lomax's wife says he was a very careful driver and never drove at high speeds.

Dallas Newspapers

The two newspapers in Dallas, The Times Herald and The Morning News, became accessories after the fact by suppressing evidence of conspiracy and evidence showing the involvement of members of the Dallas police in framing Lee Harvey Oswald. The management policy of both papers in supporting the official positions taken by the Dallas police and district attorney, the FBI and the Warren Commission, was not immediately established. For the first few days following the assassination, both newspapers printed anything which came along. The editions on November 22, 23, 24 and 25 make very interesting reading for the researcher because the stories were printed before anyone had any idea about what to suppress.

For example, there are stories about other people being arrested, about other rifles being found near Dealey Plaza, and about Oswald's rifle being a Mauser and a British 303 model.

However, within a couple of weeks, editorial and management policy took over, and the lone madman assassin story received all the attention from then on. Through the years, the two papers have not made any independent inquiries, have not been interested in any conspiratorial discussion, and have remained completely faithful to the official position.

There were some inquiring reporter types around (like Ronnie Dugger, for example, or Lonnie Hudkins), but they were squelched completely by management or by the FBI and Dallas police. Photographers at the two papers left town or else were completely frightened out of talking about the case or their photos. Some of these photographs showed evidence of conspiracy, including pictures of three conspirators under arrest in Dealey Plaza. Other photos proved that members of the Dallas police altered and planted evidence in the Depository building in order to frame Oswald.

Between the assassination and 1967, the management and owners of the Herald and News were not completely aware of the significance of some of the evidence in their files. Nor were they attempting to control their reporters and news staff. For example, Hudkins found out that Oswald had been a paid informer for the FBI. He even found out what his pay number had been (SI72). He took the information to Waggoner Carr, Texas Attorney General, in January 1964. Carr brought it to the attention of the Warren Commission and after Hoover denied it, the matter died in secret executive sessions of the Commission.

Several photographs taken by Dallas Morning News photographer Jack Beers proved that the police created the so-called "sniper's nest" from which Oswald allegedly fired the shots. The pictures show the positions of cartons in the sixth floor window before the police moved them. Beers' photos also indicate that the police made the large paper bag inside the Depository building which was used to help frame Oswald.

Beers was permitted to use his photos commercially in a book, jointly published with R. B. Denson, called Destiny in Dallas. If it were not for that event, researchers would probably never have

seen Beers' photos. Once the Morning News editor, Mr. Krueger, discovered that the photographs demonstrated both conspiracy and the complicity of some of the Dallas police force, he locked them up and made them unavailable to anyone. The pictures remain suppressed to this date.

The Times Herald's record is not much better. For a few years, through 1967, John Masiotta, the man in charge of the assassination photos taken by William Allen, made copies available on a very limited basis. The basis in the author's case was that a total of twelve pictures out of seventy-three taken by Allen could be purchased. The author was allowed to examine 35 mm contact prints (about 3/4" x 1/2") of the rest, and the selection decision was extremely difficult. Three of Allen's photos showed the "tramps" under arrest who were part of the conspiracy.

Once Times Herald management realized the implications of some of Allen's pictures in pointing out the real assassins, they too (in 1968) locked the files and have not permitted anyone to date to see the photos again or to purchase copies.

One photograph, taken by Dallas Times Herald photographer Bob Jackson, was apparently so obviously in opposition to the official police case, that it was suppressed by late 1966. Jackson was riding in one of the news photographer's cars in the motorcade, with Dallas Morning News photographer, Tom Dillard. As the Jackson car approached the Depository building travelling north on Houston Street between Main Street and Elm Street (see map in May 1970 C&A article), Jackson snapped a picture. At the time, the Kennedy car was undoubtedly already around the fatal turn onto Elm Street and was probably close to the position where the first shot was fired. Jackson's car was eight cars behind Kennedy's, or about twenty car lengths.

Jackson can be seen taking this picture in the Robert Hughes film and in some of the TV footage taken by other photographers. He also testified that he took the picture. When the author asked Masiotta about the Jackson photo in early 1967, he became very flustered and claimed to know nothing about it. Jackson himself was finally located and, when asked about it, became very angry and denied taking a picture. That photograph has never been seen by anyone outside of the Times Herald staff. The speculation about what it probably showed is not difficult, since the Hughes film, the Weaver photo, the Dillard photo, and the Tom Alyea first TV sequence all show the same thing. Jackson's photo, without doubt, showed "Oswald's window" in the Depository building empty when Oswald should have been in it. This was embarrassing to Jackson as well as to the newspaper because he had testified he saw someone in that window with a rifle. His own photo would have proved him a liar. Certainly if Jackson's photo (or anyone else's for that matter) showed Oswald in the sixth floor window, the whole world would have heard about it on November 22, 1963.

The Dallas Morning News, the Dallas Times Herald, Jack Krueger, Jack Beers, Bob Jackson, John Masiotta and others all became accessories after the fact. It makes no difference whether they made their own decisions, or whether they were encouraged to suppress evidence by local authorities.

Ft. Worth Star Telegram

Shining like a light in the Texas darkness, the Ft. Worth Star Telegram did not suppress the evidence in their files. They made the photographic

evidence from five of their photographers, Joe McAulay, Harry Cabluck, Jerrold Cabluck, George Smith and William Davis, available to everyone. Even though the Telegram's editorial stance was eventually pro-Warren Commission, anti-conspiracy, the photographers, editors and the lady who ran the photo files were all very cooperative.

George Smith's photos showed the three members of the assassination team under arrest. Jerrold Cabluck's aerial photos became very useful in establishing Dealey Plaza landmarks and topography. Joe McAulay's photos of a man arrested in Ft. Worth in connection with the shooting may yet become valuable.

TV Station WFAA

The second shining light in Texas was TV station WFAA, an ABC affiliate. WFAA was very cooperative (albeit expensive) in providing copies of all their photographic evidence. TV sequences by Tom Alyea, Malcolm Couch, A. J. L'Hoste and Ron Reiland, were made easily viewable and copies available. Much of this evidence, demonstrating conspiracy, was also sold to TV networks and newsreel companies.

WBAP — Ft. Worth

The NBC affiliate in Ft. Worth, WBAP, was less cooperative. Even though public statements were made that viewing of Dan Owens and Jim Darnell's footage was possible, many roadblocks were thrown into the path of researchers. As mentioned in the section on NBC, Darnell's footage of the knoll and parking lot, in particular, is very important. Yet it has remained effectively unavailable at WBAP.

KTTV — Dallas

Independent TV station KTTV in Dallas has also suppressed, or at least lost, valuable evidence of conspiracy. Don Cook's TV footage contains twelve important sequences, known to the author by interviewing Cook, and seeing him in various other photos taking his footage. One in particular is a sequence of a man being arrested in front of the Depository building at about 1:00 p.m. From other evidence it is possible to determine that the man may be William Sharp, an important participant in the assassination. Cook can be seen in a picture taken by Phil Willis pointing his 16 mm TV film camera directly at the man from about ten feet away.

Willis' photo does not show the man's face, only the policemen arresting him, and his arms and shoulders. Cook's close-up footage, then, is very important. In 1967, the author interviewed Cook in Dallas and determined that his film had been turned over to the editor at KTTV. A phone call to the station resulted in a statement being made to the author that Cook's footage had been lost, "on the cutting room floor," and was not available for viewing. No further efforts have even been made to open up KTTV's evidence in the assassination.

New Orleans Newspapers

As unbelievable as it may sound to the reader not living in New Orleans, the only two publications in the United States printing the truth about the trial of Clay Shaw were the New Orleans Times Picayune and the New Orleans Times Herald. All other newspapers and magazines printed completely distorted and untrue versions of the trial.⁶

6. For a comparison of New Orleans newspapers and all other media coverage of the Shaw trial, see the author's unpublished book The Trial of Clay Shaw — The Truth and the Fiction.

Between 1963 and 1967, both New Orleans newspapers used AP and UP stories on most of their coverage of the Kennedy assassination. Suddenly, because of the nosiness of two Times Herald reporters, the papers found themselves deeply involved in the middle of the sensational Garrison investigation, and finally in 1969, they reported on the Shaw trial.

The papers took no editorial position on Jim Garrison, the trial, the investigation, the assassination, or the guilt or innocence of Shaw until after the final verdict was delivered by the jury. Then, both papers savagely attacked Garrison on the editorial page, joining all other publications in doing so. Off the record, the reporters and others at both papers supported Garrison. This was reflected in a book published by the two Herald reporters, Rosemary James and Jack Wardlaw, Plot or Politics.

The management and editors of the newspapers evidently paid more attention to national forces from Washington and New York than they did to New Orleans citizens or the testimony at the trial. Today, 1973, interviews with 9 people out of 10 in New Orleans will produce the opinion that Garrison was right, was not and is not crazy and crooked, and that there was a conspiracy.

The reason for this seeming anomaly is that most New Orleans citizens read either the Herald or the Picayune. The verbatim proceedings at the Shaw trial, as well as all of the detailed events for the two years that the Federal Government successfully delayed the trial, were faithfully printed in both papers. You and I, dear reader, were treated to a highly biased account of the three years of events in New Orleans by Time magazine, Newsweek, U.S. News, The New York Times, NBC, CBS, ABC, UP, AP and all the rest.

For example, the average New Orleans citizen was well aware that the Justice Department, under both Ramsey Clark and John Mitchell, was responsible for continually delaying the trial. You and I were fed the impression that Garrison delayed the trial.

Mr. New Orleans citizen, lets call him Joe, knew that Shaw's lawyers were paid by the CIA. You and I were told that Shaw paid a lot of money for his lawyers and suffered financially because of it.

Joe knew that the FBI was looking for Shaw under his alias, Clay Bertrand, before lawyer Dean Andrews ever mentioned the name as being associated with Lee Harvey Oswald just before he died. You and I were told that Andrews made up the name Clay Bertrand out of whole cloth, and no mention was made to us of the FBI's search.

Joe knew that twelve people saw Clay Shaw together with Oswald and David Ferrie on many occasions and exchanging money on two occasions. You and I were led to believe by Time and The New York Times that only three people saw them together and that the three were not credible witnesses.

Joe knows today how Garrison is being hounded and framed by the Justice Department in a fake pin ball rap. More importantly, the government does not want Regis Kennedy, FBI agent, and Pierre Finck, Army doctor at the JFK autopsy, to have to testify again at a trial. They both took executive privilege and long distance telephone advice from Mitchell in Washington during the Shaw trial.

Finck's testimony was printed in the Times Picayune but not in Time magazine. He said that an Army

general gave orders during the autopsy at Bethesda Naval Hospital. The general, unidentified, told Finck and the other doctors not to probe the neck wound in the President. We did not read about this or hear about it. We also are not up with Joe in New Orleans in realizing the importance of probing (or not probing) the neck wound. If that wound did not go through the President's neck, then conspiracy would be proved.

The Times Picayune record of the Shaw trial is especially accurate, appearing in the morning paper as an almost verbatim report of what happened. The Herald's record was reasonably accurate, but because the paper was printed by 3:00 p.m., the paper missed some of the longer sessions.

WDSU-TV -- New Orleans

As mentioned in the section on NBC, WDSU became directly involved in the JFK assassination aftermath because of Rick Townley and Walter Sheridan. Both are still under indictment by Garrison for bribing witnesses and tampering with evidence. Townley, on the staff of WDSU, was close to the action with Garrison, Shaw, Andrews, Ferrie, Perry Russo, Layton Martens, Gordon Novel, Sergio Arcacha Smith, David Lewis, David Llewelyn, Guy Bannister, and many other participants in the drama known to him.

According to accounts in the New Orleans papers and repeated in Paris Flammonde's book, The Kennedy Conspiracy, Townley tried to get Perry Russo, Garrison's prime witness at the Shaw trial, to change his testimony at the upcoming trial to make it seem that Garrison had hypnotized him and then asked leading questions to get Russo to testify against Shaw.

Townley went to Russo's house twice, threatened him with being discredited, perhaps fired from his job, and offered him a chance to work closely with NBC in their efforts to "destroy Garrison and his case". Townley told Russo he could get Shaw's lawyer, F. Irving Dymond, to go easy on him if he would alter his testimony. He assured Russo that his employer, Equitable Life, had promised the president of NBC that no retaliation would be taken against Russo if he cooperated with WDSU and NBC.

Walter Sheridan told Russo that NBC and WDSU could set him up in California where Russo always wanted to live, if he did help bust up the Garrison probe. NBC would pay his expenses there, protect his job, get Russo a lawyer and guarantee that Garrison would never extradite him back to Louisiana. Sheridan told Russo that NBC had flown Gordon Novel out of Louisiana to McLean, Virginia (home of the CIA) and had given Novel (an important witness for Garrison's case) a lie detector test. Sheridan said NBC would make sure Novel would never be extradited to Louisiana to testify. (Novel never was.)

Townley also tried to influence Marlene Mancuso, former wife of Gordon Novel, and an important Shaw trial witness. He told her that she should cooperate with WDSU and NBC because Garrison was going to be destroyed and that NBC was not merely going to discredit the probe. He said Garrison would go to jail.

On July 10, 1967, Richard Townley was arrested and charged with attempted bribery and intimidation of one witness, and of attempted intimidation of another. Also he was accused of serving as an intermediary to influence cross-examining trial attor-

neys not to damage the character and reputation of Perry Russo.

Sheridan was arrested on July 7 on the same first two counts. Both posted bond, and the trials have never taken place. However, Townley's statements did come true. The Federal Government, aided and abetted by WDSU and NBC, did crucify Garrison. That case isn't over yet, though, with F. Lee Bailey representing him and the government's key witness, Pershing Gervais, turning "traitor" against the government case.

The author's belief is that this kind of behavior in the face of all the evidence gathered by the staffs of their own organizations, on the part of 15 to 24 major news media management groups, is highly unlikely.

One other rather minor possibility has been suggested. It is comparable to the kind of influence obviously wielded recently in the IT&T-Republican National Convention case. It might be called business or financial or lobbying influence in reverse. This theory holds that each major news organization shut up about the Kennedy assassination because they were afraid of losing face or influence or FCC licenses or business or advertisers or Government favors of one kind or another.

This theory is perhaps best exemplified by a story told by Dorothy Kilgallen, before she died, to a close friend. Dorothy had been writing several articles about the JFK assassination for the newspapers who published her column. She believed strongly that there had been a conspiracy and that Jack Ruby was involved. She interviewed Ruby alone in his jail cell in Dallas, the only person outside of the police who had this opportunity. She told her friend shortly afterward that she was planning to "blow the case wide open" in her column. She said the owner of the New York newspaper where her column appeared was refusing to let her print stories in opposition to the Warren Commission. When the friend asked her why, Dorothy said, "He's afraid he won't be invited to White House parties any more".

Of the three possible motives for suppression in the news media, the influence from the top and from high government places seems the most probable. When will we, as Americans, learn the truth about this influence in the case of the Kennedy assassination?

Conclusions

What conclusions can be reached from the information presented herein? Certainly, the pattern of internal knowledge of conspiracy followed by complete suppression of such knowledge is too strong to ignore. Two major alternative conclusions suggest themselves as one reviews the evidence of suppression and secrecy. The first is that our national news media were controlled on the subject of the assassination by some very high level group in Washington. The control was exercised from the top down. The top may not have been the very top (chairman of the board), but was near the top. For example, someone in Washington could have told Mr. Salant at CBS and Mr. Bancroft at The New York Times what to do, without contacting Mr. Paley or Mr. Ochs.

The orders to cease, desist, and suppress came from the top down in each case. To influence the very top level of all fifteen major news media organizations in this manner would have taken a great deal more than money or power or threats. In fact,

the only kind of appeal which seems likely to have had a chance of shutting everyone up is a "highly patriotic, American flag, national security, danger from exposing the truth" kind of appeal. It is probably just such an argument that worked with the Warren Commission. Judging by the fact that Lyndon B. Johnson said there was a conspiracy to Walter Cronkite and then successfully persuaded CBS to edit out his remarks "on ground of national security," this kind of an appeal does work. In that case, enough time had passed that someone at CBS felt guilty enough about it to leak the information.

The other major possibility seems rather remote from a probability standpoint, but nevertheless should be considered. It is that all fifteen (or really 24) news organizations reached a point of exasperation, disbelief and tuning-out type psychological effect in 1968-1969. In this theory, surprisingly believed by a number of people who were involved, the top managers of these 24 organizations reached this exasperation point independently of one another. Within a two to three-year period culminating in the Shaw trial and a fadeout of belief in Jim Garrison personally, every one of these managers finally said, "Stop, cease, desist, lock the files, you're fired, shut up, I don't want to hear another word about it". □

Unsettling, Disturbing, Critical . . .

Computers and Automation, established 1951 and therefore the oldest magazine in the field of computers and data processing, believes that the profession of information engineer includes not only competence in handling information using computers and other means, but also a broad responsibility, in a professional and engineering sense, for:

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

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

THE FLY, THE SPIDER, AND THE HORNET

by Edmund C. Berkeley

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

Finally, they decided to hold a conference on the problem of getting through the screen.

The Fly spoke first and said, "My Colleagues, I have surveyed this screen for many hours without finding any hole. But I cannot believe that there is no hole in this screen. All my experience of the world up to the present time has shown me that there are holes in thickets of twigs, holes in screens of leaves, holes in tangles of grass, holes everywhere. In fact, I have been able to fly over, under, or around every barrier I have ever encountered. Nature does not make thickets, screens, and tangles without holes.

"Therefore, the principle to be used is perseverance in spite of obstacles. I will fly again and again and again at the screen in hopes of getting through. As the old saying goes, 'If at first you don't succeed, try and try again.' I'll never give up; my honor as a Fly is at stake."

The Spider spoke second and said: "My colleagues, I too have surveyed this screen for many hours without finding any hole. I am sorry I have to contradict my honorable Colleague the Fly, but I have come to the conclusion that this screen has no hole.

"Therefore, the principle to be used is adjustment to changed conditions. So I will plan to spend the rest of my life inside this screen. I shall build my web inside the screen, catch my food, and live out my life in this new way."

The Hornet spoke third, and said, "My Colleagues, I too have persistently surveyed this screen for many hours with-

out finding any hole. But I remember that I flew into this general region without going through that screen. Accordingly, there must be some other way of returning to the woods and the fields.

"Therefore, the principle to be used is exploration of other alternatives. I shall stop my fruitless search for a hole in this screen, and instead search in other directions and avenues to find other means of escape."

The Fly and the Spider said at once, "Honorable Colleague, please pardon us for saying so, but that is plain silly. Just think how close you are to escaping through the screen — only a few little thin wires between you and freedom."

The Hornet replied, "My friends, those wires may be few, and little, and thin, but nevertheless they are too substantial for me to pass through."

The Fly then said, "Besides, honorable Colleague, this conference of ours was called on the subject of getting through the screen — and, honorable Colleague, you are off the subject and out of order." The Spider said, "I must agree with the Fly."

Thereupon, the Hornet made a motion that the subject of the conference be amended from getting through the screen to escaping to the woods and fields. But he was outvoted 2 to 1.

None of the three would change his views, and the conference soon adjourned.

A day later, the Fly died of exhaustion.

A week later, the Spider, having caught only one moth in his web, died of starvation.

But an hour later, the Hornet exploring under the eaves of the roof between the inclined beams of the attic, found an opening to the outdoors, and flew out, returning to a happy life in the woods and fields.

Taken from:

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COMPUTERS and AUTOMATION for July, 1973

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ACROSS THE EDITOR'S DESK

Computing and Data Processing Newsletter

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APPLICATIONS

FROM SHOES TO BUMPERS — COMPUTERS HELP ENSURE QUALITY

*George Snyder
Mobay Chemical Company
Div. of Baychem Corp.
Pittsburgh, Pa. 15205*

Two new computers have been installed at Mobay's headquarters here to provide management with the most advanced tools for solving both business and scientific problems. The IBM computers are used for such diverse challenges as providing an extra step from the soles of your shoes and a tougher, more protective bumper on your car. Mobay sells thousands of tons of basic chemicals and plastic resins each year to a variety of customers, including companies in the automotive, clothing, construction, furniture, electronics, aircraft and appliance industries.

A small computer, the IBM System/7, is attached to a testing machine which presses, pushes and pulls flexible and rigid foam and plastics samples into various shapes to test resilience and strength. The computer records and prints out periodic readings as the material is put through its contortions. This pretesting enables Mobay to assure its industrial customers that the chemicals they purchase, when properly formulated, will make strong, quality shoe soles, automobile bumper components, or numerous other consumer products.

The second larger computer, an IBM System/370 Model 135, is used for a variety of control operations, from keeping an eye on construction costs to the precise color matching of plastics. Contained in the larger computer's information storage units is color spectrum data which directs the mixture of pigments to achieve uniform colors in the pelletized plastics produced by Mobay.

Mobay customers mold this material into such products as football helmets, casings for pens, and

even household items such as chairs and tables. Called Merlon polycarbonate, it also is made into clear plastic sheeting which can be used as window material in areas where vandalism and breakage are serious problems. In laboratory tests, the material resisted .38 cal. slugs, shotgun blasts and thrown bricks.

Mobay's plants in West Virginia and Texas are tied into the main System/370 in Pittsburgh via telephone lines and their own small, general purpose computing systems, the IBM 1130. This teleprocessing system is used for inventory reporting, payroll processing and for maintaining all plant records stored in the larger computer in Pittsburgh. The System/370 also is used to monitor both minor repair and construction costs and as an aid in plant design calculations. It performs major business tasks in marketing and financial areas, and is programmed to handle Mobay's accounting activities.

BINDERY + IBM COMPUTER: COVERING A MILE OF MAGAZINES

*John Pilkington
The Heckman Bindery, Inc.
North Manchester, Ind. 46962*

If Heckman Bindery could stack all the magazines it handles each year into a single pile, the pile would rise well over a mile into the air. Heckman puts hard covers on these periodicals for libraries.

The northeastern Indiana firm also rebinds old library books, for a potential savings of \$50 over the cost of new books; prebinds new volumes to add months to their usability; repairs and restores Bibles and other valuable books; and binds inexpensive paperbacks so they can be circulated in hard cover form for as long as two years.

Just keeping track of the libraries' binding instructions for their periodicals was a monumental task; 250,000 different work order forms were on file. Librarians complained because it took so long to dig through their files for specifications and to fill out the detailed forms Heckman needed.

Both problems were solved with a computer, an IBM System/3, and a new order-handling procedure called H.E.L.P. (Heckman Electronic Library Program). The firm claims its program can save librarians up to 50 percent of the time it normally takes to maintain and prepare their periodical binding specifications.

As an example of how H.E.L.P. works, all of Purdue University's constant binding instructions for TIME magazine are stored in the computer. Heckman has supplied the University with a computer-printed, multiple-page form, called a "pattern", and an index card containing this information. If a Purdue librarian wants to submit the school's January through September, 1972 issues of the magazine for binding, he simply pulls out the TIME pattern, enters the variable information (dates and volume number), and sends the completed pattern to the bindery with his magazines. Heckman uses the pattern to direct its work and update its computer records, if necessary.

The index card is retained in Purdue's file to alert librarians that the January-September issues of TIME are at the bindery. The back of the card, which contains information on each binding order, serves as a chronological history for the University's permanent files. When the bound volume is delivered to Purdue by a Heckman representative (the company provides 28-day pick-up and delivery service in 33 states), it is accompanied by a new pattern. This enables the University to repeat the ordering process in the following quarter.

Another feature of the H.E.L.P. system is the assistance it provides both Heckman and the libraries in purging their files.

MINICOMPUTER HELPS BAY AREA TV STATION BOOST RATINGS DURING ELECTION COVERAGE

*Edgar E. Geithner
Data General Corp.
Southboro, Mass. 01772*

A Nova-based election reporting system gave a San Francisco, Calif. television station the greatest election viewer ratings in its history during the 1972 elections. The Nova 1200, made by Data General Corporation, is part of a system that receives, tabulates, stores, and displays voting information on command, giving viewers the latest tallies and percentages on their screens. A Telemation Event Display system designed by Telemation, Inc. of Salt Lake City, was installed just before the primaries.

During the primary elections, California had an unusually large line-up of names and issues. Mr. Briggs said the old method of typing lists on paper took three times more people and ten times longer to prepare for a newscast. The Nova-based system updated the entire vote tallies in just three minutes.

Election information information was prepared in advance on a character generator keyboard in "pages". A page lists district, contest, candidates and party affiliation. It is numbered for recall and updating. Shortly before KRON-TV's election reporting began, a program tape was generated from the pages in disc storage and loaded into the Nova. The pages were displayed on a terminal and televised.

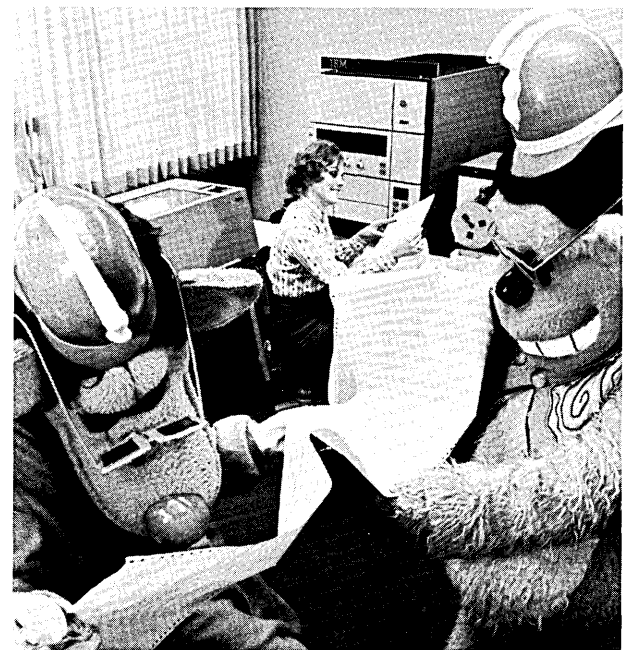
After the polls closed, reporters called vote totals into the news desk. Six teletypewriters were used to input vote tallies to the Nova. The viewer ratings justified the expense of the Nova-based system according to Clark Briggs, KRON-TV's election producer.

YOGI BEAR AND COMPUTER HARD AT WORK AT FUN CENTER

*Thomas J. Olds
Kings Island
P.O. Box 400
Kings Mills, Ohio 45034*

Though these furry cartoon characters seem a bit fuzzy about the goings on of a computer room, there's no misunderstanding over their common goal of helping people have more fun at Kings Island. A 1,600-acre family entertainment complex north of Cincinnati, Ohio, Kings Island reopened April 28 for its second season. With a 33-story replica of the Eiffel Tower as its landmark and symbol, the fun center features more than 100 attractions in addition to a motor inn, two golf courses and 300 campsites. More than two million people from all 50 states visited the facility during 1972.

Drooper and Bingo of the Banana Splits (who seem to be having trouble with the computer printout), along with Yogi Bear, Fred Flintstone and other cartoon characters, perform in the Happy Land of Hanna-Barbera, one of five themed areas.



The computer, an IBM System/3, operated here by Lois Anson, helps monitor by state and county a sampling of auto license plates to determine which areas should be stressed in Kings Island's promotional efforts. The IBM computer also is used for gift shop inventory and retail sales analysis reports, which help managers stock their shelves according to the popularity of the various items in their shops.

SATURN COMPUTERS WRESTLE WITH EXPLORATION, POLLUTION AND FLOODING

*RCA Corp.
30 Rockefeller Plaza
New York, N.Y. 10020*

The launching of the first Skylab manned space station and the study of flood control on Alabama rivers have one thing in common: they're both relying on a family of computers known as the RCA 110A's. Originally developed for NASA, the computers were installed at Cape Kennedy to check out the Saturn

1B and Saturn V rocket boosters up to the instant of launch, and at the Marshall Space Flight Center, Huntsville, Ala., for use in developing and testing the launch vehicles prior to delivery to the Kennedy Space Center.

One of the RCA 110A computers recently was loaned by the Marshall Space Flight Center to the University of Alabama's electrical engineering department in Tuscaloosa, where it is concerning itself with such problems as flood control on Alabama rivers, sewerage disposal problems in Mobile, and working out complex problems for graduate and undergraduate students.

While the academic 110A began playing the quiet role of electronics professor, two of its sister computers at Cape Kennedy were acting more like robot physicians as they put the Saturn V and Saturn 1B rockets through a thorough physical examination prior to launch. The goal of Skylab is to conduct scientific missions that could lead to better utilization of the earth's resources and to test man's ability to live in space for long periods.

In Tuscaloosa, things may be less exciting for the academic 110A, but they certainly are no less important. Environmental research is a high priority item and this Space Age computer may help man keep his feet on the ground.

IRAN'S COMPUTERIZED MONITORING AND CONTROL SYSTEM REGULATES CRUDE OIL PIPELINE FLOW

*J. N. Dravillas
Westinghouse Electric Corp.
Gateway Center
Pittsburgh, Pa. 15222*

Iran's largest completely computerized pipeline supervisory control system will be installed on the new Ahwaz-Rey Second Crude Oil pipeline in August, 1973. The monitoring and control system, perhaps the most modern in the industry worldwide, will provide centralized control of 466 miles (750 kilometers) of crude oil pipeline from Ahwaz, in the south of Iran, over the Zagros Mountain Range, to the Rey Refinery, just south of Tehran. The pipe diameter is 30 inches and 26 inches, and the line will have a future capacity of 410,000 barrels a day.

The control system includes twin Westinghouse-2500 computers (one serves as a backup) at the central control facility at Rey and control and monitoring equipment at seven remote stations along the line (with two more planned for the future). Because of the range of desert and mountain temperatures to which the system will be subjected, equipment at the remote stations is designed to operate satisfactorily from -22 to +167 degrees F (-30 to +75 C). At the central station at Rey a graphic representation clearly illustrates the up-to-the-minute situation along the entire length of the line — the central computer scans all remote instrumentation every two seconds!

Since this is a supervisory control system, the computer takes no direct action to rectify any problems or vary the flow rates. Instead, it feeds pertinent information to the operator on hand, who then takes corrective action.

The Ahwaz-Rey pipeline is owned by the National Iranian Oil Company; general contractor for the job is Neill-Price International.

COMPUTER TO HELP DESIGN "EYES" FOR SPACE PROBES

*Itek Corporation
Lexington, Mass. 02173*

A "virtual storage" computer has gone into operation at the Optical Systems Division of Itek Corp. An IBM System/370 Model 158 will perform the millions of calculations needed to design and produce lenses for cameras on space ships, astronomical telescopes and other special devices. The computer will serve Itek's divisions, processing business as well as scientific and engineering applications and will also become the base of a corporate management information system.

Virtual storage, as incorporated in the Model 158, is a technique for storing data that makes the computer appear to the user as if it had a capacity of 16-million bytes of storage — many times its actual capacity. The technique can greatly speed and simplify the development of many computer applications, including remote computing networks and systems for inquiring into the computer from distant locations.

Itek, which has run computer programs on a Model 158 at speeds up to five times those possible with their installed System/370 Model 145, relies heavily on computers for lens design and production. This is an extremely complex and demanding art, according to Dr. Robert Hills, Director of Optics. "Today, some lens design projects would take years without a computer. The computer can also accurately predict the performance of lens systems before manufacturing begins. It would be prohibitively costly, if not impossible, to carry out dependable predictions by any other means."

One Itek-developed fabrication process requiring a powerful computer is CAOS — Computer Assisted Optical Surfacing. A large optical surface can be ground and polished by a special machine which is controlled by computer-generated instructions. These instructions are produced by the computer from optical test data. Other technical applications will include design and simulation of circuits and thermal, electrical and structural devices.

AIR FRANCE USES MINICOMPUTER TO ASSIGN SEATS IN AIRPLANES; SAVES \$35,000

*June Fanazick
Public Relations
Data General Corp.
Southboro, Mass. 01172*

A minicomputer is saving Air France approximately \$35,000 annually according to a spokesman for the airline. The computer, a Data General Corporation Nova, reduced the time needed for passenger check-in at John F. Kennedy Airport, New York, the Air France representative said. The Nova 800 minicomputer is part of the Multiflight Boarding Pass System developed by General Computing Equipment Corp. of Garland, Texas, which was specifically designed to meet passenger check-in time demands caused by wide-bodied jet transports.

With the help of the Nova, passenger check-in times are significantly reduced, and over-boarding and redundant seat assignments are virtually eliminated. Each agent has a display console with an array of lights that show specific seat status, al-

lowing him to assign seats and issue boarding passes automatically. Both passenger's and stewardesses' portions of the pass contain flight number, class, seat number, destination, date and boarding gate. The entire check-in process takes as little as 15 seconds.

When an agent's display shows that a desired seat is available, he reserves that position by pressing the appropriate seat button. After the boarding pass is printed, the system transmits the transaction to the Nova's memory, removing the seat from the pool of unoccupied seats and updating all other agents' displays. It assigns group seating in a similar manner.

The system adapts to a variety of seating configurations, such as four, five or six across, for different flights and different flight segments within a flight. Red and blue lights indicate cabin class, exits and nonsmoking zones. The Nova stores these and any other special programmed cabin designations.

A single central control station operates up to 15 consoles; system expands in additional increments of 15 consoles. A key lock controls access to the system for security measures. In the event of power failure, the system retains all registered seat assignments until power is restored.

Air France at JFK also services Avianca and Transportes Aereos Portugueses. A similar system was installed at Philadelphia International Airport in March that services Air France, Alitalia and Lufthansa Airlines. Air France also has systems at Los Angeles and Montreal.

EDUCATION NEWS

UNITED NATIONS INTERNATIONAL SCHOOL GETS FREE COMPUTER SYSTEM

*Mrs. Murray Fuhrman
Special Representative of the Secretary-General
United Nations
New York, N.Y. 10017*

The United Nations International School has announced the gift of an educational computer system from Digital Equipment Corporation's Educational Products Group in Maynard, Mass. The \$33,500, "Edu-System-25", a powerful, multi-functional minicomputer system, has been donated with free teacher instruction, a comprehensive kit of textbooks, teacher guides, visual aides, and sample programs. The system will be shared by students from more than 90 countries at the new United Nations International School building on East River Drive at 25th Street.

The Digital system is designed primarily for instruction in mathematics problem solving, beginning at grade seven. It also runs simulations in physics, chemistry, biology, earth sciences, and social studies. Additionally, the equipment can be used for remedial and tutorial drill and practice in mathematics and in a variety of other subject areas.

Upon receipt of the computer system, the Secretary-General of the United Nations, Kurt Waldheim, said "It is quite possible that the students from throughout the world who face each other across the Digital computer may, in a few years time, face each other across international conference tables. The lesson of using teamwork to achieve common goals

will provide the foundation upon which a significant contribution to international cooperation may be made tomorrow."

AMERICAN COLLEGE ABROAD ADDS COMPUTER SCIENCES

*Public Relations Department
National Cash Register Co.
Dayton, Ohio 45409*

Computer science instruction has come to the American College of Switzerland. Students at this unique American institution in Europe now can study data processing just as their counterparts in the United States. As a part of this training the American College is offering introductory courses in computing, courses in COBOL and FORTRAN, and two advanced data processing seminars in its International Business Studies and Natural Sciences departments.

To accomplish this the college has installed an NCR Century 100 system with a 32K memory, 450-line-per minute alphanumeric printer; 300-card-per-minute reader, and a dual-spindle disk unit which can store 9.4 million bytes.

The expansion of American business activities overseas, the development of the Common Market and the rapid multiplication of U.S. missions throughout the world have combined to create a new class of Americans and a new problem. Aside from the difficulties and expense involved in sending young men and women back to the United States for their college education, many U.S. families living overseas prefer to have them study in a European setting, both for the cultural advantages and because of family proximity.

While designed for the U.S. student abroad, the American College is not restricted to this group. Stateside students from colleges which do not offer a junior-year-abroad program are also enrolling in the American College of Switzerland in ever-growing numbers. The College also accepts qualified non-American students who wish to obtain an American undergraduate education or to prepare for graduate studies in their chosen field in America.

COMPUTER-RELATED SERVICES

WORLDWIDE CANCER INFORMATION SERVICE CENTER

*James Fordham
National Cancer Institute
Bethesda, Md. 20014*

The U.S. Department of Health, Education, and Welfare/National Institute of Health has announced the launching of the first worldwide service to speed vital cancer information to physicians and scientists. Dr. Frank J. Rauscher, Jr., Director of the National Cancer Institute, said NCI has awarded a \$780,000 contract to Informatics Inc. of Canoga Park, California, to develop the first phase of the Cancer Information Service (CIS).

The 15-month contract will include the most extensive study in history of worldwide cancer data services, the information needs of cancer scientists, and how information about cancer can be made more available throughout the scientific community.
(please turn to page 49)

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
GTE Information Systems Inc., White Plains, N.Y.	Social Security Administration, Dept. of HEW, Washington, D.C.	Development and installation of nationwide data communications network to speed supplemental security income payments to needy aged and handicapped persons	\$21 million (approximate)
Computer Sciences Corp. (CSC), Los Angeles, Calif.	National Aeronautics and Space Administration (NASA), Washington, D.C.	Providing comprehensive scientific analysis and programming services to Goddard Space Flight Center, Greenbelt, Md.	\$16.5 million
Univac Div., Sperry Rand Corp., Blue Bell, Pa.	Space and Missile Systems Office, USAF, Washington, D.C.	Production of Minuteman Weapons Systems Controllers (WSC)	\$11.9 million
Centronics Data Computer Corp., Hudson, N.H.	Computer Related Equipment (CORE) Ltd., Frankfurt, Germany and Surrey, England	Printer order to be delivered over the next 12 months	\$5.2 million
Goodyear Aerospace Corp., Akron, Ohio	McDonnell Douglas Corp.	Developing and building first prototype flight simulator for Air Force F-15 Eagle; McDonnell Douglas is prime contractor for new air superiority aircraft	\$4.5 million
Univac Div., Sperry Rand Corp., Blue Bell, Pa.	Australian Mutual Provident Society (AMP), Sydney, Australia	UNIVAC 1110 system to be center of data communications network for AMP covering Australia and New Zealand	\$4 million (approximate)
Librascope Div., Singer Co., Glendale, Calif.	Pasadena Laboratory, Naval Undersea Center, San Diego, Calif.	Four weapon control and setting subsystems for Underwater Fire Control System Mk 116 Mod 1 to be installed aboard DLGN 38, 39 and 40 class vessels	\$2.6 million (approximate)
Instrumentation Engineering, Inc., Franklin Lakes, N.J.	Siemens AG, Munich, West Germany	A System 390 computer-controlled test station; will be used for testing telephone switching logic in West Germany	\$855,000
Space & Defense Systems Div., Fairchild Camera & Instrument Corp., Syosset, N.Y.	Naval Electronics Systems Command, Washington, D.C.	Second phase of charge-coupled device (CCD) development program which emphasizes development of larger arrays to be used in a variety of low-light-level imaging applications with further effort on anti-blooming and new on-chip amplifier techniques	\$800,000+
College of Engineering, University of Missouri-Columbia, Columbia, Mo.	Naval Electronics Systems Command, Washington, D.C.	Development of control system that will make Sanguine's transmitting sites almost immune either to enemy attack or equipment failure; Sanguine Communications System provides worldwide communications with submarines operating at any depth, anywhere	\$402,220
University of Rochester Medical Center, Rochester, N.Y.	National Cancer Institute	Developing automated prescreening system for detection of cancer cells; currently no such system exists	\$347,583
Logicon, Inc., Torrance, Calif.	National Aviation Facilities Experimental Center (NAFEC), FAA, Atlantic City, N.J.	A digital air traffic control pilot display system to be used to increase the flexibility and throughput of NAFEC's Digital Simulation Facility	\$330,734
Stanford Research Institute Menlo Park, Calif.	National Science Foundation	One year research in industrial application of advanced automation; exploratory project designed to develop techniques and systems for automating materials handling, inspection and assembly line production	\$277,100
Logicon, Inc., Torrance, Calif.	Army Electronics Command, Fort Monmouth, N.J.	Systems engineering services in support of Joint Ground and Amphibious Military Operations (BAMO) program	\$192,000
Informatics Inc., Western Div., Canoga Park, Calif.	Ames Research Center, NASA, Mountain View, Calif.	Computer programs for a central computer and its subsystems, including mini-computers, to control data acquisition and recording at the wind tunnel test facilities	\$133,000
Advanced Memory Systems, Inc., (AMS), Sunnyvale, Calif.	Telefunken Computer GmbH, Konstanz, West Germany	Design and manufacture of complete memory systems (average size 128K words X 59 bits) to be supplied over a two year period	---
Collins Radio Co., Dallas, Texas	Pan American World Airways	Airline communications system capable of handling 52,000 "conversations" an hour with reservations computer and can transmit 11,500 teletype messages an hour; Collins system will be communications arm of PANAMAC II worldwide reservations system	---
Computer Corporation of America, Cambridge, Mass.	Dept. of Defense, Washington, D.C.	Model 204 On-Line Database Management Software System; system performs database management functions from multiple remote terminals	---
Inforex, Inc., Burlington, Mass.	Social Security Administration, Federal Business Office, Washington, D.C.	Seventy 1302 data entry systems, totaling 851 individual keystations; contract also provides government with option to increase total order for Inforex data entry systems by approximately 50%	---
Communication Systems Div., Philco-Ford Corp., Willow Grove, Pa.	U.S. Postal Service	Modifying OCR I electronic mail sorting devices currently installed in 12 Post Offices throughout U.S.; bar-code reading capabilities are being added	---
Missile Systems Div. (MSD), Rockwell International Corp., Anaheim, Calif.	Northrop Corp., Columbus, Ohio	Two air-to-air ranging radars for Northrop's lightweight fighter	---

NEW INSTALLATIONS

OF	AT	FBR
Burroughs B 6700 system	Central Systems Data Center; Lansing, Mich. (2 systems)	Producing and processing 10.5 million expenditure warrants (checks), and to process over 4 million income, sales and other tax returns each year; replaces current Data Center equipment (systems combined value, \$4.6 million)
Control Data Cyber 70, Model 72 system	Computer Data (H.K.) Limited (CDL), Hong Kong	Computing and communications services to Crown Colony customers; special applications include off-line and on-line banking; stock shares registration; structural engineering and off-track betting
	Northeastern University, Boston, Mass.	Providing faculty members and students more opportunity to use computing techniques; anticipate all colleges within the University will use the system in a wide variety of applications
	University of Nevada System, Reno, Nevada	Supporting computing requirements of students, faculty and administration at campuses in Reno and Las Vegas, the Desert Research Institute, and the three community colleges
Control Data Cyber 70, Model 73 system	Union Bank of Switzerland, Zurich, Switzerland	Forming the central computer complex of a new commercial banking system; includes dual CD CYBER 1000 data communications systems; another dual CYBER 1000 system is scheduled to be added in late 1973 in Geneva, Switzerland; shipments include variety of entry/display terminals and peripheral equipment (system valued at \$12.3 million)
Control Data Cyber 70, Model 73 system Cyber 70, Model 76 system	Lower Saxony Ministry for Culture, Hanover, West Germany	Development of regional data center at the university to serve a variety of scientific research and educational institutions in northern West Germany
Control Data SC-1700 system	Procesa, Zaragoza City, Spain	Supplying customers with expanded data services
Honeywell dual 6050 system	U.S. Army Operations Center, Washington, D.C.	Use in part of the World Wide Military Command and Control System (WWMCCS); 14 systems were delivered in 1972, remaining 20 systems to be installed in 1973 (system valued at \$3.2 million)
NCR Century 200 system	Korea Exchange Bank, Seoul, Republic of Korea	First phase of nationwide on-line computer network; also have an NCR Century 100 system at data center for off-line batch processing; a second Century 200 system will be added later for further expansion of bank's data processing services
	St. Petersburg Bank and Trust Co., St. Petersburg, Fla.	Nucleus of Central Information File systems for their member institutions
NCR Century 251 system	La-Z-Boy Chair Co., Monroe, Mich.	Nationwide data processing network linking all manufacturing facilities to company headquarters (system valued at \$797,000)
NCR Century 300 system	City of Pittsburgh, Pittsburgh, Pa.	Replacement of smaller system; uses include tax collection, water billing, general accounting, police information operations and police traffic tickets (system valued at \$1,461,000)
	Tabulating Consultants, Inc., Burbank, Calif. (2 systems)	Additional processing power and data storage capacity; will replace two small computers now in service
Univac 1106 system	Conzinc Riotinto of Australia, Ltd., Melbourne, Australia	Large volumes of work now handled by service bureaus (system valued at more than \$1 million)
	Maryland State Colleges, Towson State College, Towson, Md.	Maryland State Colleges Information Center (MSCIC) to serve 7 colleges in the state for full range of business/administrative applications; student use via terminals for instruction in computer language and operation, testing various programs, and mathematical and scientific calculations (system valued at approximately \$1.5 million)
Univac 1108 system	Personnel Research Div., Human Resources Lab., Lackland AFB, Texas	Research and development activities of the Human Resources program
Univac 1110 system	City Public Service Board, San Antonio, Texas	Total management information system; applications include customer revenue accounting, electric and gas systems load information, forecasting consumption, resource and facilities management, decision making model, and construction management system (system valued at \$3.4 million)
Univac 9400 system	Nova Scotia Power Corp., Halifax, Nova Scotia	Processing approximately 250,000 customer accounts across Nova Scotia; future plans include acquisition of visual display terminals for dealing with customer inquiries in an on-line mode
Univac 9700 system	Alfred Herbert, Coventry, England	Centralizing overall administration and production functions; company plans to expand present production scheduling, direct order entry, inventory control and sales, and marketing systems into most of its locations; replaces an IBM System/360-40 (system valued at \$1 million)
Univac 494 system	Beamtenheimstaettenwerk GmbH (BHW), Hameln, West Germany	Primary use in administration of various construction projects under Association's authority; data communication lines will link over 100 BHW consulting agencies to data stored in Hameln center

CALENDAR OF COMING EVENTS

- July 17-19, 1973:** Summer Computer Simulation Conference, Queen Elizabeth Hotel, Montreal, Canada / contact: Stuart Trask, Sun Life Assurance Co. of Canada, P.O. Box 6075, Montreal 101, P.Q., Canada
- July 20-22, 1973:** 1973 International Conference of Computers in the Humanities, University of Minnesota, Minneapolis, Minn. / contact: Prof. Jay Leavitt, 114 Main Engineering Bldg., University of Minnesota, Minneapolis, MN 55455
- July 22-27, 1973:** 32nd Research Conference on Instrumentation Science, Hobart & William Smith Colleges, Geneva, N.Y. / contact: ISA, Meetings Administrator, 400 Stanwix St., Pittsburgh, PA 15222
- July 23-27, 1973:** 3rd Annual International Computer Exposition for Latin America, Maria Isabel-Sheraton Hotel, Mexico City, Mexico / contact: Seymour A. Robbins and Associates, 273 Merrison St., Box 566, Teaneck, NJ 07666
- Aug. 5-8, 1973:** 7th Annual Mathematical Programming Seminar and Meeting, Breakers Hotel, Palm Beach, Fla. / contact: George M. Lowell, Haverly Systems Inc., 4 Second Ave., Denville, NJ 07834
- Aug. 6-8, 1973:** 5th Annual Meeting of the National Association for State Information Systems, Hotel Ambassador, Chicago, Ill. / contact: Carl Vorlander, NASIS, Exec. Dir., P.O. Box 5377, Lexington, KY 40505
- Aug. 7-9, 1973:** Association for the Development of Computer-based Instructional Systems, University of Michigan, Ann Arbor, Mich. / contact: G. Ronald Christopher, The Ohio State University, 1080 Carmack Rd., Columbus, OH 43210
- Aug. 13-17, 1973:** SHARE Meeting, Miami Beach, Fla. / contact: D. M. Smith, SHARE, Inc., Suite 750, 25 Broadway, New York, NY 10004
- Aug. 20-24, 1973:** 3rd International Joint Conference on Artificial Intelligence, Stanford University, Stanford, Calif. / contact: Dr. Max B. Clowes, Laboratory of Experimental Psychology, University of Sussex, Brighton, Sussex BN1 9QY, England
- Aug. 27-29, 1973:** ACM '73, Atlanta, Ga. / contact: Dr. Irwin E. Perlin, Georgia Institute of Technology, 225 North Ave., N.W., Atlanta, GA 30332
- Aug. 27-Sept. 1, 1973:** Computer Arts Society, 1973 Edinburgh International Festival, Edinburgh, Scotland / contact: R. John Lansdown, Secretary, Computer Arts Society, 50-51 Russell Square, London WC1B 4JX, England
- Aug. 30-Sept. 1, 1973:** International Conference on Systems and Control, PSG College of Technology, Coimbatore, India / contact: Dr. R. Subbayan, PSG College of Technology, Coimbatore 641004, Tamil Nadu, India
- Sept. 4-7, 1973:** International Computing Symposium 1973, Davos, Switzerland / contact: Dr. H. Lipps, International Computing Symposium 1973, c/o CERN, CH-1211 Geneva 23, Switzerland
- Sept. 10-12, 1973:** 5th Congress on Instrumentation in Aerospace Simulation Facilities, California Institute of Technology, Pasadena, Calif. / contact: H. F. Swift, Materials Physics Research, University of Dayton Research Institute, Dayton, OH 45469
- Sept. 17-19, 1973:** 7th Annual Intergovernmental Council for ADP Conference, Ottawa, Canada / contact: ICA Secretariat, 18 Kerena Hayessod St., Jerusalem, Israel
- Sept. 25-27, 1973:** Conference on 'Hybrid Microelectronics,' University of Kent at Canterbury, England / contact: Registrar, Institution of Electronic and Radio Engineers, 8-9 Bedford Sq., London WC1B 3RG, England
- Sept. 25-28, 1973:** Engineering in the Ocean Environment Conference, Washington Plaza Hotel, Seattle, Wash. / contact: Ted Hueter, Honeywell Inc., Marine Sys. Ctr., 5303 Shilshole Ave., N.W., Seattle, WA 98107
- Sept. 25-28, 1973:** IFAC Symposium, Purdue Univ., W. Lafayette, Ind. / contact: Carl Jenks, Div. of Confs., Rm. 116, Stewart Ctr., Purdue Univ., W. Lafayette, IN 47907
- Oct. 2-3, 1973:** Elettronica 2 - 2nd International Conference of Industrial Applications of Electronics, Turin, Italy / contact: Secretariat, 2nd Covegno Internazionale di Elettronica Industriale, Corso Massimo d'Azeglio 15, 10126 Torino, Italy
- Oct. 2-4, 1973:** 2nd International Computer-Aided Design and Computer-Aided Manufacturing Conf., Detroit Hilton Hotel, Detroit, Mich. / contact: Public Relations Dept., Society of Manufacturing Engineers, 20501 Ford Rd., Dearborn, MI 48128
- Oct. 3-4, 1973:** 7th Annual Instrumentation & Computer Fair, Sheraton Inn/Washington-Northeast, Washington, D.C. / contact: Richard Bullock, Instrumentation Fair, 10774 Tucker St., Beltsville, MD 20201
- Oct. 8-12, 1973:** Business Equipment Show, Coliseum, New York, N.Y. / contact: Rudy Lang, Prestige Expositions, Inc., 60 E. 42nd St., New York, NY 10017
- Oct. 12-14, 1973:** 12th Annual UAIDE Conference, Chase-Park Plaza Hotel, St. Louis, Mo. / contact: Bobby R. Peoples, HEW, Rm. 1070 North Bldg., 330 Independence Ave., S.W., Washington, DC 20201
- Oct. 15-17, 1973:** 14th Annual Switching and Automata Theory Symposium, University of Iowa, Iowa City, Ia. / contact: Prof. Gerard Weeg, Computer Science Dept., University of Iowa, Iowa City, IA 52240
- Oct. 15-18, 1973:** 28th Instrument Society of America International Conference and Exhibit, Astrohall, Houston, Tex. / contact: Philip N. Meade, Exhibit Director, ISA, 400 Stanwix St., Pittsburgh, PA 15222
- Oct. 16-18, 1973:** Canadian Computer Show and Conference, East Annex, Coliseum, Exhibition Park, Toronto, Canada / contact: Industrial Trade Shows of Canada, 481 University Ave., Toronto, Ontario M5W 1A7, Canada
- Oct. 16-18, 1973:** Input/Output Systems Seminar '73, O'Hare International Tower, O'Hare Airport, Chicago, Ill. / contact: DPSA, 1116 Summer St., Stamford, CT 06904
- Oct. 18-19, 1973:** Computer Science and Statistics: 7th Annual Symposium on the Interface, Memorial Union, Iowa State Univ., Ames, Iowa / contact: William J. Kennedy, Statistical Lab., Iowa State Univ., Ames, IA 50010
- Oct. 21-25, 1973:** 36th Annual Meeting, American Society for Information Science, Los Angeles Hilton Hotel, Los Angeles, Calif. / contact: H. W. Jones, Northrop Corp., Aircraft Div., Hawthorne, CA 90250
- Nov. 5-7, 1973:** Systems, Man & Cybernetics Conf., Sheraton Boston Hotel, Boston, Mass. / contact: S. A. Meer, Signatron Inc., 27 Hartwell Ave., Lexington, MA 02173
- Nov. 8-10, 1973:** 3rd National Conference of the Society for Computer Medicine, Denver, Colo. / contact: Dr. Joseph M. Edelman, Society for Computer Medicine, 200 Professional Ctr., 244 Peachtree Blvd., Baton Rouge, LA 70806
- Nov. 13-15, 1973:** Data Networks, Analysis and Design, Tampa, Fla. / contact: Raymond Pickholtz, Sch. of Engrg., George Washington University, Washington, DC 20006

MONTHLY COMPUTER CENSUS

Neil Macdonald
Survey Editor
COMPUTERS AND AUTOMATION

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

Part 1 of the Monthly Computer Census contains reports for United States manufacturers, A to H, and is published in January, April, July, and October. Part 2 contains reports for United States manufacturers, I to Z, and is published in February, May, August, and November. Part 3 contains reports for manufacturers outside of the United States and is published in March, June, September, and December.

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

The following abbreviations apply:

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

SUMMARY AS OF JUNE 15, 1973

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL \$ (000)		NUMBER OF INSTALLATIONS			NUMBER OF UNFILED ORDERS
					In U.S.A.	Outside U.S.A.	In World	
Part 1. United States Manufacturers								
Adage, Inc. Brighton, Mass. (A) (May 1973)	AGT 10 Series	4/68	X		32	3	35	X
	AGT 100 Series	1/72	100-300	(S)	12	7	19	1
Autonetics Anaheim, Calif. (R) (Jan. 1969)	RECOMP II	11/58	X		30	0	30	X
	RECOMP III	6/61	X		6	0	6	X
Bailey Meter Co. Wickliffe, Ohio (A) (Aug. 1972)	Metrotype	10/57	40-200	(S)	8	0	8	0
	Bailey 750	6/60	40-250	(S)	37	15	52	0
	Bailey 755	11/61	200-600	(S)	7	0	7	0
	Bailey 756	2/65	60-400	(S)	15	12	27	2
	Bailey 855/15	12/72	50-400	(S)	0	0	0	3
	Bailey 855/25	4/68	100-1000	(S)	16	0	16	0
	Bailey 855/50	3/72	100-1000		1	0	0	X
Bunker-Ramo Corp. Westlake Village, Calif. (A) (June 1973)	BR-130	10/61	X		160	-	-	X
	BR-133	5/64	X		79	-	-	X
	BR-230	8/63	X		15	-	-	X
	BR-300	3/59	X		18	-	-	X
	BR-330	12/60	X		19	-	-	X
	BR-340	12/63	X		19	-	-	X
	BR-1018	6/71	23.0	(S)	-	-	-	-
	BR-1018C	9/72	-	-	-	-	-	-
Burroughs Detroit, Mich. (N) (R) (June 1973)	B100/500	7/65	2.8-10.0		1141	677	1818	25
	B200	11/61	5.0		-	-	500	-
	B205	1/54	X		19	2	21	X
	B220	10/58	X		23	2	25	X
	B300	7/65	7.0		-	-	600	-
	B1700	8/72	-		2	-	-	-
	B2500	2/67	4.0		277	123	400	30
	B2700	8/72	-		-	-	-	-
	B3500	5/67	12-14		572	285	857	110
	B3700	11/72	-		-	-	-	-
	B4700	10/71	-		4	-	-	-
	B5500	3/63	23.5		154	47	201	-
	B5700	12/70	32.0		27	8	35	22
	B6500	2/68	33.0		-	-	60	2
	B6700	8/72	30.0		7	4	11	60
	B7500	4/69	44.0		-	-	-	13
	B7700	2/72	85.0		-	-	2	4
	B8500	8/67	200.0		1	-	-	-
Computer Automation, Inc. Newport, Calif. (A) (April 1971)	108/208/808	6/68	5.0	(S)	165	10	175	110
	116/216/816	3/69	8.0	(S)	215	20	235	225
Consultronics, Inc. Dallas, Texas (A) (April 1973)	DCT-132	5/69	0.7		75	65	135	-
Control Data Corp. Minneapolis, Minn. (R) (April 1973)	GL5	7/55	X		-	-	295	X
	G20	4/61	X		-	-	20	X
	LGP-21	12/62	X		-	-	165	X
	LGP-30	9/56	X		-	-	322	X
	M1000	-	-		1	-	-	-
	RPC4000	1/61	X		-	-	75	X
	636/136/046 Series	-	-		-	-	29	-
	160/8090 Series	5/60	X		-	-	610	X
	921/924-A	8/61	X		-	-	29	X
	1604/A/B	1/60	X		-	-	59	X
	1700/SC	5/66	3.8		-	-	428-478	0
	3100/3150/3170	5/64	10-16		-	-	93-120	C
	3200	5/64	13.0		-	-	55-60	C
	3300	9/65	20-38		-	-	205	C
	3400	11/64	18.0		-	-	17	C
	3500	8/68	25.0		-	-	15	C
	3600	6/63	52.0		-	-	40	C
	3800	2/66	53.0		-	-	20	C
	6200/6400/6500	8/64	58.0		-	-	117	C
	6600	8/64	115.0		-	-	88	C

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL (\$1000)	NUMBER OF INSTALLATIONS			NUMBER OF UNFILED ORDERS
				In U.S.A.	Outside U.S.A.	In World	
Control Data (cont'd)	6700	6/67	130.8	-	-	5	C
	7600	12/68	235.0	-	-	12	C
	Cyber 70/72	12/68	235.0	2	8	10	-
	Cyber 70/73	-	-	1	3	4	-
Data General Corp. Southboro, Mass. (A) (Mar. 1973)	Nova	2/69	9.2	(S)	-	925	-
	Supernova	5/70	9.6	(S)	-	413	-
	Nova 1200	12/71	5.4	(S)	-	2700	-
	Nova 800	3/71	6.9	(S)	-	485	-
	Nova 820	4/72	6.4	(S)	-	170	-
Datacraft Corp. Ft. Lauderdale, Fla. (A) (April 1973)	Nova 1210/1220	2/72	4.2-5.2	(S)	-	1540	-
	6024/1	5/69	52-300	(S)	18	18	4
	6024/3	2/70	33-200	(S)	100	25	4
	6024/5	12/71	11-80	(S)	50	0	33
	6024/5R	2/73	30-60	(S)	1	0	2
Datapoint Corp. San Antonio, Texas (A) (June 1973)	Datapoint 2200	2/71	151-292	-	-	2000	-
			151-292				
Digiac Corp. Plainview, N.Y. (A) (Feb. 1973)	Digiac 3060	1/70	9.0	(S)	78	0	8
	Digiac CT-10	-	9.0	-	20	0	1
Digital Computer Controls, Inc. Fairfield, N.J. (A) (June 1973)	D-112	8/70	10.0	(S)	755	140	-
	D-116	1/72	10.0	(S)	793	84	-
Digital Equipment Corp. Maynard, Mass. (A) (May 1972)	PDP-1	11/60	X	-	48	2	X
	PDP-4	8/62	X	-	40	5	X
	PDP-5	9/63	X	-	90	10	X
	PDP-6	10/64	X	-	-	-	X
	PDP-7	11/64	X	-	-	-	X
	PDP-8	4/65	X	-	-	-	X
	PDP-8/I	3/68	X	-	-	-	X
	PDP-8/S	-	X	-	-	-	X
	PDP-8/L	9/66	X	-	-	-	X
	PDP-8/E	11/68	X	-	-	-	X
	PDP-8/M	-	4.9	(S)	-	-	-
	PDP-8/H	-	3.9	(S)	-	-	-
	PDP-8/F	5/72	3.9	(S)	-	-	-
	PDP-9	12/66	X	-	-	-	X
	PDP-9L	11/68	X	-	-	-	X
	DECSystem-10	12/67	700-3000	(S)	-	-	-
	PDP-11/20	-	10.8	(S)	-	-	-
PDP-11R20	-	13.8	(S)	-	-	-	
PDP-11/05	-	10.8	(S)	0	0	-	
PDP-11/45	-	-	(S)	0	0	-	
PDP-12	9/69	-	-	-	-	-	
PDP-15	2/61	17.0	(S)	-	-	-	
LINC-8	9/66	X	-	-	-	-	
Electronic Associates Inc. West Long Branch, N.J. (A) (June 1973)	640	4/67	1.2	-	109	61	1
	8400	7/67	12.0	-	21	8	0
	PACER 100	7/72	1.0	-	40	35	25
General Automation, Inc. Anaheim, Calif. (A) (June 1973)	SPC-12	1/68	-	-	-	-	-
	SPC-16	5/70	-	-	-	-	-
	System 18/30	7/69	-	-	-	-	-
General Electric West Lynn, Mass. (Process Control Computers) (A) (June 1973)	GE-PAC 3010	5/70	X	-	25	1	X
	GE-PAC 4010	10/70	6.0	-	30	4	32
	GE-PAC 4020	2/67	X	-	200	60	X
	GE-PAC 4040	8/64	X	-	45	20	X
	GE-PAC 4050	12/66	X	-	23	2	X
GE-PAC 4060	6/65	X	-	18	2	X	
Hewlett Packard Cupertino, Calif. (A) (Oct. 1972)	2114A, 2114B	10/68	0.25	-	-	-	-
	2115A	11/67	0.41	-	-	-	-
	2116A, 2116B, 2116C	11/66	0.6	-	-	-	-
Honeywell Information Systems Wellesley Hills, Mass. (R) (June 1973)	G58	5/70	1.0	-	-	-	-
	G103A	6/69	1.3	-	-	-	-
	G105B	6/69	1.4	-	-	-	-
	G105RTS	7/69	1.2	-	-	-	-
	G113	4/66	2.2	-	200-400	420-680	620-1080
	G120	3/69	2.9	-	-	-	-
	G130	12/68	4.5	-	-	-	-
	G205	6/64	X	-	11	0	X
	G210	7/60	X	-	35	0	X
	G215	9/63	X	-	15	1	X
	G225	4/61	X	-	145	15	X
	G235	4/64	X	-	40-60	17	X
	G245	11/68	X	-	3	-	X
	G255 T/S	10/67	X	-	15-20	-	X
	G265 T/S	10/65	X	-	43-60	15-30	X
	G275 T/S	11/68	X	-	-	-	X
	G405	2/68	6.8	-	10-40	5	X
	G410 T/S	11/69	1.0	-	-	-	X
	G415	5/64	7.3	-	70-100	240-400	X
	G420 T/S	6/67	23.0	-	-	-	X
	G425	6/64	9.6	-	50-100	20-30	X
	G430 T/S	6/69	17.0	-	-	-	X
	G435	9/65	14.0	-	20	6	X
	G440 T/S	7/69	25.0	-	-	-	X
	G615	3/68	32.0	-	-	-	X
	G625	4/65	X	-	23	3	X
	G635	5/65	47.0	-	20-40	3	X
H-110	8/68	2.7	-	180	7	0	
H-115	6/70	3.5	-	30	-	-	
H-120	1/66	4.8	-	800	160	-	
H-125	12/67	7.0	-	150	220	-	
H-200	3/64	7.5	-	800	275	-	
H-400	12/61	10.5	-	46	40	-	
H-800	12/60	30.0	-	57	15	-	
H-1200	2/66	9.8	-	230	90	-	

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL (\$000)	NUMBER OF INSTALLATIONS			NUMBER OF UNFILLED ORDERS
				In U.S.A.	Outside U.S.A.	In World	
Honeywell (corp'd)	H-1250	7/68	12.0	130	55	185	
	H-1400	1/64	14.0	4	6	10	X
	H-1800	1/64	50.0	15	5	20	X
	H-2015	"	"	2	"	"	"
	H-2040	"	"	3	"	"	"
	H-2050	"	"	4	"	"	"
	H-2200	"	"	"	"	"	"
	H-2300	1/66	18.0	125	60	185	"
	H-3200	2/70	24.0	20	2	22	"
	H-4200	8/68	32.5	18	2	20	"
	H-6030	"	"	"	2	"	"
	H-6040	"	"	"	3	"	"
	H-6060	"	"	"	4	"	"
	H-8200	12/68	50.0	10	3	13	"
	DDP-24	5/63	2.65	"	"	90	X
	DDP-116	4/65	X	"	"	250	X
	DDP-124	3/66	X	"	"	250	X
	DDP-224	3/65	X	"	"	60	X
	DDP-316	6/69	0.6	"	"	452	"
	DDP-416	"	X	"	"	350	X
	DDP-516	9/66	1.2	"	"	900	"
	H112	10/69	"	"	"	75	"
	H632	12/68	3.2	"	"	12	"
	H1602	"	"	"	"	"	"
	H1642	"	"	"	"	"	"
	H1644	"	"	"	"	"	"
	H1646	"	"	"	"	"	"
	H1648	11/68	12.0	"	"	20	"
	H1648A	"	"	"	"	"	"

PROBLEM CORNER

Walter Penney, GDP
Problem Editor
Computers and Automation

PROBLEM 737: CUBE DIVISION

When the boss entered the Computer Center, he saw several people drawing geometrical figures on scrap pads. "What's all this?" he asked.

"It's a problem Pete is writing a program for," said Joe. "We're trying to beat him to it with pencil and paper."

"What problem is that?"

"To put it simply, it's to find the maximum number of cubes a cube can't be divided into."

"Can't be divided into? What kind of double talk is that?"

"Let me begin with squares since that's how Pete got started on this. He found that a square could not be divided into five smaller squares, but could be cut up into six, seven or any greater number of squares."

"How can a square be cut up into six or seven smaller squares?"

"Well, for six you can cut a square into nine smaller squares and imagine the four in one corner to coalesce into one larger square." Joe drew a figure on his scrap pad. "For seven you could cut a square into quarters, then cut one of these pieces into quarters." He drew another figure to illustrate this.

"And Pete is trying to do the same thing for cubes, you say?"

"Yes, he's got a lot of instructions for cutting up cubes, coalescing them and doing other operations. He thinks he can put all this together and come up with the answer. But I'm pretty sure we'll scoop him on this."

What is the maximum number of cubes into which a cube can not be divided?

Solution to Problem 736: Sweeping Numbers

If there are two sweeps and the first number is 2, the 1 can be in any of the nine remaining places; with the

numbers 3 to 10 appearing in order. If the first number is 3, the 1 and 2 may occur in any of $\binom{9}{2} = 36$ places, the

1 occurring in order. Thus there are more arrangements producing two sweeps with initial 3 than with initial 2. Similarly the number increases to initial 5, remaining constant for initial 6, then decreasing.

Across the Editor's Desk — Continued from page 43

The work will be performed by Informatics Inc. Systems and Services Company, Rockville, Md.

Under phase one of the contract, Informatics will begin developing: (1) an International Cancer Research Data Bank, which will collect, store and disseminate results of cancer research to scientists throughout the world; (2) cancer literature and data services such as indexing, abstracting and translating; and (3) information support services, which will produce information such as directories, surveys, progress reports, catalogs and special reports.

Special projects to be undertaken in the first phase of the contract include a catalog of all information systems and services currently being offered by NCI, and a directory of organizations and individuals throughout the world offering cancer research and treatment. The CIS is already working with the Institut Gustav-Roussy in Paris, which each month reviews cancer literature from 2000 journals and distributes the information in three languages to five countries. Cooperation with other organizations, such as the Association of American Cancer Institutes, the National Library of Medicine, the Regional Medical Libraries, and services such as Biological Abstracts, Chemical Abstracts, Current Contents and Excerpta Medica, will be explored.

Under the National Cancer Act of 1971, specific responsibilities were assigned to the Director of NCI for the collection, analysis, storage and dissemination of cancer research information, nationally and internationally. The International Cancer Research Data Bank has been authorized by the Congress to make available to any cancer researcher in any country the results of cancer research efforts. A unified and coordinated undertaking of this kind is new not only to cancer research, but to the field of biosciences itself.

COMPUTER-ASSISTED ANALYSIS AND DOCUMENTATION OF COMPUTER PROGRAMS

● ARE YOU INTERESTED IN THIS KIND OF PROBLEM?

Problem: You have a piece of software, a working binary program (WBP) in machine language — with operating instructions, and it is useful in your installation -- but you have no idea how it works in detail and you have no idea how to modify it to suit new conditions or requirements. (The programmers who wrote it went away two years ago to their next job -- or they never worked for you at all -- or ...)

But YOU have the problem of understanding and modifying that program, salvaging what you can of it; YOU have the problem of making its subroutines useful in other programs by calling them when you want them; etc.

Theory: Use a computer to assist you in your detective work analyzing that program (the WBP) and producing documentation for it. Desired Goal: Complete understanding.

Idea 1: Use a computer program (SIMULATOR ANALYZER) which will simulate your computer, and operate the given program (WBP) on examples, step by step, from one point to another point, showing you intermediate results, telling you where control goes.

Idea 2: Use a computer program (RELOCATOR) which will shift the WBP into another area of core, and thereby reveal which machine words can be moved unchanged, and which machine words have to have the shift difference added or subtracted from them.

Idea 3: Use a computer program (SUBROUTINE EXAMINER) which will show how each subroutine in the WBP operates on each kind of information that comes into it.

Idea 4: Apply techniques of CRYPTANALYSIS to discovering what systems of character representation are being used in the computer program.

Etc., Etc., Etc.

● IF THIS KIND OF PROBLEM IS INTERESTING TO YOU, WHY NOT TAKE A LOOK AT THE FOLLOWING BOOKS?

Research in Computer-Assisted Documentation of Computer Programs

by Edmund C. Berkeley
principal investigator, author

- Vol. 1, published by Information International, Boston, Mass., softbound, April, 1969, 128 pp, \$3.00
- Vol. 2, published by Berkeley Enterprises Inc., Newtonville, Mass. 02160, softbound, Nov. 1971, 112 pp, \$3.00

Technical (but understandable) reports produced — and research done — under contracts with the Office of Naval Research (N00014-68-C-0268, N00014-C-70-C-0225)

Volume 1, CONTENTS:

- The Subject and Purpose of this Research
- The Documentation of Computer Programs
- Some Estimates of Loss Due to Inaccessibility of Computer Programs
- The Concept of the Simulator Analyzer
- Model 1 and Model 10 of the Simulator Analyzer
- Cryptanalysis of a Portion of a Computer Program with Unknown Documentation

Volume 2, CONTENTS:

- Simulator Analyzer Model 13
- "Comments" in Computer Programs: Principles for Abbreviating, and Suggested Abbreviations
- Successful Relocation of the Working Binary Program for "Old 16K DDT" (Dynamic Debugging Program) Without Knowing the Symbolic Program from Which it was Assembled

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