SCIENCE & TECHNOLOGY

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computers and automation

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Series Editor: RICHARD BELLMAN

by YA. Z. TSYPKIN, The Institute of Automation and Telemechanics, Moscow, USSR

Translated by **Z. J. NIKOLIC**

Presents a unified treatment of the theory of learning, self-learning, and adaptation in automatic systems. Because of the complexity of many existing and developing systems, traditional methods do not guarantee the optimal operating conditions of such systems. The book presents an adaptive approach to these problems using probabilistic iterative methods as a foundation. This approach simplifies the solution of well-known problems in control theory, reliability theory, operations research, game theory, the theory of finite automata, etc., and permits the solution of many new problems. A detailed survey of the literature on adaptive and learning systems is given at the end of the book. *1971, 312 pp., $16.50.*

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INTRODUCTION TO PROBABILISTIC AUTOMATA

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This book—the first to be published in English on the subject—discusses both the practical and theoretical aspects of probabilistic automata and sequential machines. The first chapter, dealing with state theory from an engineering standpoint, covers the synthesis of stochastic machines, state minimization, equivalence, coverings and input-output relations. Chapter two is devoted to nonhomogeneous Markov chains, which provide the mathematical model on which stochastic automata are based. The final chapter presents a theory of formal stochastic languages and events, including such topics as closure properties, decision problems, and characterizations. *March 1971, 248 pp., $13.00.*

NONLINEAR PROGRAMMING

edited by J. B. ROSEN, O. L. MANGASARIAN, and K. RITTER, all at the University of Wisconsin, Madison, Wisconsin

Concerned with those algorithms and related theory which lead to efficient computational methods for solving nonlinear programming problems. One of its main purposes is to strengthen the existing relationships between theory and the computational aspects of this subject. Among the more active areas of research covered are algorithms for nonlinear constraint problems, investigation of convergence rates, and the use of nonlinear programming for approximation. This book presents the proceedings of a Symposium conducted by the Mathematics Research Center, The University of Wisconsin, Madison, May 4-6, 1970. *1970, 502 pp., $10.50.*

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computers and automation

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

Front Cover Picture

A young visitor from Curtis Jr. High School, Sudbury, Mass., "has a conversation with" a computer at Digital Equipment Corp., Maynard, Mass. It looks as if he is much interested – and it seems safe to predict that sooner or later he will be "hooked" on computers.

Departments

Key

[A] – Article
[C] – Monthly Column
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[G] – The Golden Trumpet
[R] – Reference Information

The Number of Answers to a Problem

Rudyard Kipling, well-known English poet and author (1865-1936, winner of the Nobel Prize for literature in 1907) once wrote in a poem *(In the Neolithic Age):*

> There are nine and sixty ways of constructing tribal lays
> And-every-single-one-of-them-is-right.

I doubt that Kipling could have defended the number 69. If he had been a scientist, he might have said:

> "The number of ways of writing national epic poems correctly, based on my extensive investigation of this important subject, appears to be 70, plus or minus half a dozen."

Pleasantries aside, one of the important ways of classifying problems of all kinds is according to the number of answers. Problems may have many answers, just one answer, or no answer.

The run of problems in the ordinary undergraduate textbook containing problems (in mathematics, computers, physics, or almost any of the "hard" sciences) gives a completely misleading impression of the real world, because the characteristic problem in the ordinary textbook has a single answer. This is nice for the student, because when he finds the one answer, he can stop working, and nice for the teacher, because when he examines the single answer, he can judge rather well how the student has worked.

But in the real world problems with a single answer are rare. The problems that come up in the real world, and for which you and I and other people have to gather data before we even start to solve them, usually have many answers – or no answers. For example:

> How shall I live on an income of $120 a week dividing it among my expenses?

In the United States in 1971 this is a reasonably satisfactory income for a single person, and there are literally thousands of answers to the problem, depending on the distribution of the income among food, shelter, clothing, and other expenses and payments.

For another example of a problem:

> How will 90 million people be fully employed in 80 million jobs?

The answer is, "It's impossible." And retraining, or re-education, or computer-assisted education, or computer-assisted instruction, or the Office of Economic Opportunity, etc., and all the other bright-eyed and bushy-tailed proposals from the world of training and education simply alter the identity of the persons who are holding the jobs, as in a game of musical chairs – although in many other ways the education and training is of course useful.

In the field of the application of computers, the design of computer programs, and the development of computerized systems, nobody really expects a single answer, even though a single answer has to be chosen. People expect any one of a large number of answers to be feasible, and they seek to choose that one which has the largest number of apparent advantages and the smallest number of apparent disadvantages. But it is regularly impossible to prove conclusively that a chosen answer is the best answer – usually it is only a relatively optimal answer.

This fact has many important consequences:

1. A practical answer is regularly an approximation to the solution of a problem, and therefore does not entirely solve it.
2. Better approximations are possible and should be expected.
3. As time goes on, as conditions change, as knowledge increases, as requirements alter, improved answers should be determined.
4. Any answer that is adopted should be modifiable and improvable without too much sand in the gears. In other words, it should have built-in facilities for change.
5. To obtain better and better approximate answers and to install them at appropriate times is always a requirement of good judgment and a responsibility of good management.

For many problems in the real world, not only are there many answers, but static answers may change from good to poor, as time goes on and as the real world with its kaleidoscopic multiplicity of factors continues to operate. Which is just another way of course, of expressing Murphy's Second Law:

> If left to themselves, things always go from bad to worse.

Edmund C. Berkeley

Edmund C. Berkeley
Editor

READERS' FORUM

INFORMATION TECHNOLOGY AND PUBLIC DECISION-MAKING

Alan F. Westin
From the "Sixth Annual Report", 1969-70
Harvard University Program on Technology and Society
Cambridge, Mass. 02138

This project is investigating the use of computerized information systems as decision-making aids by public agencies; it seeks to identify the changes that introduction of these systems leads to in the organization and policies of those agencies, and to explore the social implications of the changes. The study has been under way during a time in which much negative sentiment about technology arose from the belief that governmental decisions that affect people would no longer be made by traditional political processes in which the people have a voice, but by a few experts with computers, in ways that people would not understand and that would threaten their privacy and their freedom.

What has thus been seen as a threat by some, has appeared to others as a promise of increased competence and effectiveness in policy-making. Through the immense data-handling capacities of electronic computers and the speed and flexibility of telecommunication systems, it was held, man could examine his social system in all of its patterns and tremors, and could create monitoring and feedback systems to achieve cybernetic levels of competence. As computer usage transformed mathematical calculations, opened new horizons in scientific inquiry, supplied automated systems for many basic production processes in industry, and fostered vast space and missile programs, many influential voices declared that this technology could be used to improve our domestic governmental process as well. The same tools that had put men into space, it was argued, could be applied also to the painfully intractable domestic problems confronting all levels of American government during the Kennedy and Johnson years.

These proposals raised a host of questions that needed to be explored. Could information technology really deliver more timely and useful data for program evaluation and policy formulation? How would introduction of information technology into government agencies affect their internal structures, role relationships, and decision-making processes? How would such a development affect legislative and judicial oversight of executive-agency policy-making? What would be the psychological reactions of those who were the subjects, clients, and customers of government programs? Would there be changes in the relationships of government agencies to the intermediate political process (interest groups, the press, the party system) and to popular participation through the electoral system? And how would a trend toward such systems affect basic distributions of power in society between haves and have-nots?

It was to explore these questions, and to provide detailed factual knowledge about exactly what was happening in this area, that the present study was initiated in 1967.

Some of the larger issues of information technology and democratic government that are emerging from our research can be indicated here.

First, the anti-technology literature of the 1960's expressed grave fears that computers and telecommunication systems would lead to the capture of decision-making by "the machines," or at least by those technicians and their superiors who controlled the information systems. Whatever the facts in the military and intelligence areas may be, there has been no such take-over yet in the civilian agencies of American local and national government. The distant future may tell a different story, but in 1970 it requires a powerful flight of ideological or philosophical imagination to go from the current pedestrian uses being made of computers to move paper and perform basic transactions to anything resembling sophisticated, data-rich decision-making; nor is there the slightest sign of a displacement of the traditional leadership elites of top and middle management in government by the information specialists.

Second, it is possible to conclude that computers have been a factor in consolidating rather than in redistributing governmental power; computers and their associated equipment are fearfully expensive, and the poor, the black, the students, and the anti-war movements cannot harness computers to their causes. Also, to the extent that organs of government might adopt restrictive policies toward the civil liberties of dissenters or the socio-economic claims of the poor and the black, there is little doubt that information technology can make the execution of such policies more efficient. While there have been thoughtful suggestions by writers such as Robert Fano and Donald Michael that computer systems should be designed for power-sharing uses by the public and by the organs of criticism, no sign of such sharing has yet appeared in the development of computerized data banks in government.

Third, one is led to ask whether the contrast between the shimmering visions painted by computer manufacturers, software firms, and allied consultants in the early 1960's, and the bleak record of accomplishment as of 1970 suggests a case of civic fraud. Enormous sums of money from public treasuries were spent to buy computers and

(Please turn to page 60)

USING COMPUTERS TO INDIVIDUALIZE INSTRUCTION: ANOTHER APPROACH

"When a perfect match between a student's abilities and a learning packet is found, the student is told, 'This packet is just your style.' When only a very poor match can be found, the student receives the instruction, 'This packet may be hard for you. Ask for help if you have trouble.'"

Dr. John A. Connolly
American Institutes for Research
135 N. Bellefield Ave.
Pittsburgh, Pa. 15213

John Lee came up with the winning name in the name-the-computer contest – Cornelius Computer. Cornelius works with John and 250 other eighth grade students in a school located in a poverty area in Philadelphia. A typical exchange between the computer and a student like John is quite simple:

CORNELIUS:	PLEASE TYPE YOUR FIRST NAME, SPACE, AND LAST NAME
JOHN:	JOHN LEE
CORNELIUS:	LEE JOHN ID #0892 JOHN, PLEASE ENTER THE FULL NUMBER OF THE PACKET YOU HAVE JUST COMPLETED
JOHN:	1100050005
CORNELIUS:	HAS THIS PACKET BEEN SUCCESSFULLY COMPLETED? TYPE IN YES OR NO
JOHN:	YES
CORNELIUS:	YOUR RECORD NOW SHOWS THIS PACKET WAS COMPLETED. PACKET 1100060007 ASSIGNED, WHY STUDY? (TAPE) LEVEL 1 MATCH – THIS SHOULD BE EASY TO DO.

Matching Individual Aptitudes

The final statement in this dialogue is not just a word of encouragement. It represents three years of effort to build a prototype system of individualized instruction. The computer's assignment of a particular learning packet results from matching John's measured learning characteristics to a catalog of many curricular options. The matching process is a central feature of a computer-based system for managing instruction currently being developed under a Title III grant at Conwell Middle Magnet School.

Dr. John A. Connolly is a Senior Research Scientist at the American Institutes for Research with previous experience with Educational Testing Service. He received a Ph.D. from Columbia University. His previous publications are in the fields of psychological measurement and evaluative research.

Computers have frequently been used in programs of individualized instruction to track students through an instructional sequence on an individual basis, and to branch the learning sequence to adjust to individual variations in performance. This article describes a computer system which, in addition, adapts instruction to individual differences in aptitudes. The article concludes with a review of the tracking, branching, and adapting functions of the system with reference to the future of programs of individualized instruction.

The Basic System Structure

In simple terms, the system under development is designed to find out what children need, and to supply the most appropriate learning experiences to meet their individual needs. The prototype consists of three basic components: (1) a set of instruments and techniques for assessing student needs and characteristics; (2) a bank of learning packets which are cataloged in terms of those needs and characteristics; and (3) a computer program for matching the student's assessments and packet history to the curriculum options at each step of the learning sequence.

The evaluative and curricular aspects of the model are described first in order to set the background for a more detailed discussion of the matching program.

1. Student Evaluation System

An individualized program begins with an evaluation of the strengths and weaknesses of each student. These are determined by means of four different kinds of assessments. Terminal tests are used to evaluate mastery or deficiency with reference to 67 basic school objectives. Diagnostic tests indicate which of the available learning materials the student should be assigned. Progress tests are designed to measure student proficiency on the materials presented in each learning unit. Aptitude measures, the focus of the present article, attempt to determine the most effective way to teach each child.

Chart #1 shows the four aptitude variables which are measured. These aptitudes were selected for experimental use on the basis of research evidence suggesting that they may be important dimensions of learning ability.

a. **Reading.** Learning may be enhanced by adjusting the reading level of materials to the student's capabilities. Reading test scores are divided into three relatively gross categories and stored in the student data bank.
b. **Mental abilities.** Educators tend to feel that different teaching methods are required for teaching students with above average and below average mental abilities. Although there is some doubt at the present time that such generalized abilities will prove effective in the present model, a very gross index of mental ability is entered in the student file.
c. **Learning style.** Three distinct sensory pathways – the visual, auditory, and kinesthetic – convey most of the information from which the student learns. Some students appear to have strengths or weaknesses in learning by means of one or another of these pathways. Three measures were constructed and administered to all students in order to assess their relative abilities in learning comparable tasks presented through each modality. A specific learning style is entered in the evaluation file only if a student shows marked superiority in one of these tests. Otherwise the "mixed" code is used.
d. **Cognitive style.** A student's mental processes may be especially suited to learning either abstract or concrete relationships. For example, one student might find that the learning of number systems is facilitated by a considerable amount of practice with numbers, while another student might need to be taught only the principles involved. Again, a student is given a particular designation only if he shows large score differences on the measures of cognitive style.

CHART #1

MEASURES OF LEARNING APTITUDES

GENERAL DESCRIPTION	TEST	RELEVANT RESEARCH	DATA BANK INPUT
Reading Achievement	Iowa Test of Basic Skills		0 = 0-2nd grade 1 = 3-5th grade 2 = 6th and above 3 = No information
Mental Ability	Lorge-Thorndike Intelligence Tests Academic Promise Tests	Keislar & Stern	0 = Below average 1 = Average or above 2 = No information
Learning Style	Visual Learning Test Auditory Learning Test Kinesthetic Learning Test	Ingersoll	0 = Visual 1 = Auditory 2 = Kinesthetic 3 = Mixed 4 = No information
Cognitive Style	Raven Progressive Matrices Memory for Numbers Test	Jensen	0 = Concrete 1 = Abstract 2 = No difference 3 = No information

These scores and all other evaluative information on each child are maintained in a randomly-accessed disk file. The computer system will facilitate a study of the effectiveness of these variables as data accumulates on student progress. Some other kinds of learning aptitude variables (e.g., interests) are being considered for insertion in the system on an experimental basis.

2. Curriculum Cataloging System

Curriculum materials were prepared in order to provide effective learning treatments for students with specified learning aptitudes. All curriculum materials are presented in the form of learning packets, which are brief curriculum units involving independent or semi-independent learning activities. Some packets were developed by local school teachers or project staff members and others were adapted from published curriculum materials.

Each packet attempts to teach one segment of a particular learning objective. Mastery of most of the basic objectives requires the student to perform or comprehend a number of component operations or concepts, each representing one segment of the total objective. For example, the concept of place values in numbers is one component of the objective, "Arithmetic Skills."

The structure for coding the treatment characteristics of packets for entry into the curriculum data bank is shown in Chart #2. Cataloging of packets relies heavily on teacher judgment. The teachers are provided with a set of instructions for coding the treatment characteristics of curriculum packets in a way which corresponds to the measured learning aptitudes of children.

The structuring of learning experiences in this manner results in 72 possible combinations which are hypothetically different ways of teaching any single learning unit. Learning style might be varied, for example, by asking the student to read written materials (visual), listen to a taped version of the same material (auditory), or manipulate some

CHART #2

CURRICULUM CODING STRUCTURE

CODED CHARACTERISTIC	CODING CATAGORIES	DATA BANK INPUT
Reading Level	0-2nd grade 3-5th grade 6th and above	0 1 2
Difficulty Level	Simple Average or above	0 1
Teaching Mode	Visual Auditory Kinesthetic Mixed	0 1 2 3
Cognitive Method	Abstract Concrete Mixed	0 1 2

tangible object such as an abacus (kinesthetic). The other treatment characteristics can be varied in similar ways.

Thousands of possible packet variations can be conceived for teaching a complex subject involving many discrete learning steps (e.g., reading). The actual preparation of so many variations is not practical. Nor would it be desirable at this stage in the development of an untested model. Enough variations have been written for many topics, however, to serve as a basis for testing the usefulness of these variables in structuring the learning experiences of children. The computer system permits detailed analyses of curriculum availability and effectiveness.

3. Computer Matching System

The computer performs a variety of functions in the overall operation of the instructional management system. The following discussion is limited to the computer's role in prescribing a learning packet for the student corresponding to his individual needs by matching the student's assessment file to the curriculum catalog.

a. System configuration. A remote computer terminal (IBM 2740-2) is located in the Center for Individually Prescribed Learning Activities at Conwell School. Telephone lines link the terminal to a 2701 Transmission Control unit at the Philadelphia Board of Education Building. The control unit is attached to an IBM System 360, Model 30, central processing unit with core storage partitioned for multi-programming. The foreground partition, with 14K core storage locations, is dedicated to the present system. Data files are stored on a disk pack mounted on an IBM 2311 disk drive. The operating programs reside on a second, permanently mounted, systems disk pack.

The system operates mainly in the on-line processing mode, with provision for remote batch operation as well. The major on-line request is for new packet assignments. Students request their own packet assignments by interacting with the computer through the terminal and receive virtually immediate decisions. The remote batch mode is used when the full computer system is needed. This occurs when a new student is added or a new packet is entered into the curriculum file, and in other situations. These requests are transmitted during the school day, queued on the disk pack, and processed during the night.

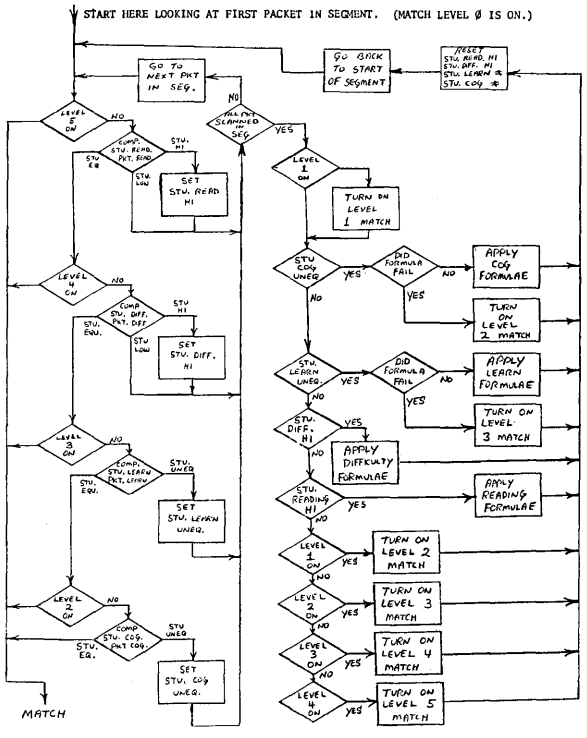
b. Matching algorithm. The rapid selection of the appropriate packet for a particular student at a given point in time is one major reason for automating the system to utilize the speed of a computer. The packet choice is based on a matching algorithm which follows the logic shown in Chart #3. The algorithm consists of six procedural steps, as follows:

(1) Search for a *perfect* (Level 0) match between the student's measured learning characteristics and the coded packet characteristics for an instructional unit. The computer first relates reading level, aptitude level, learning style, and cognitive style to the coded dimensions of the available packet variations in an effort to find an exact match. If a packet matching all of the student's measured characteristics is available, the instruction to take that packet is transmitted to the student. If not, the computer moves to the next step in the process.

(2) Search for an *imperfect* (Level 1) match. There is an implicit hierarchy in each of the four dimensions used for coding packet characteristics. Packets involving little or no reading, or reading at the 3rd to 5th grade level, for instance, are well within the capabilities of a student who reads at the 6th grade level or above. Similarly, the student with average aptitude can handle materials at a simple level; students with a strength in any of the three learning modes should prove capable of working with mixed learning modes, and the abstract learner can be taught using either a concrete or a mixed presentation. (The formulas referred to in the chart involve a detailed development of these general principles.) If a packet is available that is within

CHART #3

COMPUTER MATCHING ALGORITHM*



*- I am indebted to Frank Kisselbach and Lee O'Toole, IBM systems engineers, for designing the chart and programming the system.

the student's capabilities on all four variables, that packet assignment is given to the student. If not, the computer search continues.

(3) Search for an *imperfect* (Level 2) match disregarding the measured cognitive style of the student. At this point the computer is searching for a packet which is within the student's reach using three variables only – reading, aptitude, and learning style. Cognitive style has been eliminated first since its validity seems least firmly established. Again the student gets an assignment if one can be found.

(4) Search for an *imperfect* (Level 3) match disregarding both cognitive style and learning style. The search is continued with only two variables brought into play.

(5) Search for an *imperfect* (Level 4) match disregarding cognitive style, learning style, and aptitude level.

(6) Search for an *imperfect* (Level 5) match disregarding all four variables. In effect, assign anything that is available on the requested topic.

The result of this process is an instruction to a student to take a particular learning packet. The level of the match which was obtained is shown along with a statement to the student about the packet he was assigned. For example, when a perfect match is found, the student is told, "This packet is just your style." When only a very poor match can be found, the student receives the instruction, "This packet may be hard for you. Ask for help if you have trouble."

No student has had serious difficulty learning the operating procedures required to "talk" with the computer. Their apparent enjoyment of this process is believed to be an important motivational factor. The average student completes the entire exchange in about two minutes. The terminal's response time is about two seconds for each transmission. The interactive language and the equipment configuration are currently under study in an effort to make the exchange more effective and more efficient.

A New Role for the Computer?

In what sense does this approach offer a new role for the computer? What are the current functions of the computer in the individualization of instruction? What changes may occur in the future?

All forms of individualized instruction, no matter how diverse in other ways, involve individual as opposed to group pacing of students. Computers are sometimes used to keep track of large numbers of students who are moving at different paces through one or more learning sequences. The collection, storage, and retrieval of student progress data is one basic approach of computer systems designed to individualize instruction.

Prescribing Alternate Learning Paths

Computers are also used to prescribe alternate learning paths for students. The system typically reviews performance data on tests administered at periodic intervals through the learning sequence in order to reach a decision about the next learning assignment. The prescription is often based on table look-up procedures which involve dividing the test score distribution into several score intervals, and prescribing different learning assignments depending on where a particular score falls. Computer branching of a learning sequence to adjust to variations in individual performance is another approach to individualized instruction.

Adapting Techniques of Instruction

The approach described in this article is an effort to adapt instructional techniques to individual differences in children. It assumes that students will learn best when taught in a way which conforms to their particular learning abilities. A computerized matching algorithm is used to prescribe a learning assignment which represents the best fit between the student's learning abilities on the one hand and the available variations in ways of learning on the other. Computer adapting of ways of learning to individual abilities may be a new direction for future programs of individualized instruction.

Computers can be used to track, branch, and adapt instruction within a single system. These are complementary functions and all seem to hold promise for delivering improved instructional techniques to students. It is virtually certain that computers will also play an important role in the collection and analysis of research evidence on the effectiveness of these various techniques for the individualization of instruction.

Efficient computer programs do not by themselves produce good programs of individualized instruction. Effective tracking, branching, or adapting of instruction can be done with or without computers. The real justification for the use of computers in education lies in their ability to help educators in their efforts to solve the complex and urgent problems which they face. □

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LET US BUILD INTELLIGENT COMPUTER TUTORS

"The advances in artificial intelligence indicate that computers can perform activities at a level of sophistication that we would be quite happy to see many students (and even teachers) attain."

Laurent Siklóssy
The University of Texas
Department of Computer Sciences
Austin, Texas 78712

The numeric capabilities of computers can render many services in the educational system. Besides services such as record keeping planning that go with any sizable operation, computers can schedule classes and help instructors with the tasks of grading and evaluation. We shall be most interested here in the tutorial capabilities of computers. CAI (Computer-Assisted Instruction) has seen the development of drill-and-practice sessions handled entirely by the computer. But many workers in the field are quick to point out that computers are only a help to the teacher and should in no way be considered a threat to his position. On the contrary, their function is to relieve him of unpleasant chores.

A "Good" Teacher

Why has the computer been condemned so soon to not becoming a full-fledged tutor? The advances in artificial intelligence indicate that computers can perform activities at a level of sophistication that we would be quite happy to see many students (and even teachers) attain. Perhaps it is felt that the computer can never become a "good" teacher, because a teacher understands what he teaches, and the computer does not understand anything, but only does what it has been told.

What *is* understanding? We shall not answer the question, but instead shall quote a paradox, attributed to the English physicist J. J. Thomson: "We never understand anything; we only get used to it!" We have felt that it was more productive to try to design seemingly intelligent computer tutors than to argue about the possibilities of such a design. The extent to which our early results indicate hope of future progress is for the reader to judge.

General Schema for a Computer Tutor

There are many tasks that the computer can become *used to* performing. From among such tasks we have selected two different areas: the manipulative capabilities necessary for solving problems in set theory, and the capabilities that go with understanding and *getting used to* information structures used in computer science (such as stacks, trees, queues, list structures, etc.). Although we shall give examples from the two systems that we have programmed, that teach elementary set theory and computer information structures, we shall try to stress the generality of our approach.

Programs That Perform Tasks

At the heart of our teaching systems are programs that can perform the tasks that we wish our students to learn to perform too. When we teach set theory, we wish the

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Mr. Siklóssy's principal research interest is artificial intelligence, particularly in the areas of learning, problem solving, speech processing, and the development of intelligent computer tutors.

Later this year Prentice-Hall will publish *Representation and Meaning*, which Siklóssy coedited with H. A. Simon.

student to learn about the union of two sets. Thus, our teaching system includes programs that can calculate the union of two sets. This, of course, assumes programs that can recognize when something, whether produced by some program or by the student, is in fact a set. When we wish to teach about binary trees, we first need programs that act as if they understood binary trees. Such programs should be able to answer questions about particular trees, such, for example, as: Which node is the father of node ABC? How many sons does node ABC have? What is the length of the path from node ABC to the root of the tree?

In the areas that we have considered, elementary set theory and information structures, the type of performance programs that we have mentioned are easy to write. To the core of our tutor, we must add input/output routines that permit communication between tutor and student. Input routines preprocess the student's message, and protect the heart of the tutor. Our routine to calculate the union of two sets would fall sick if it were not given two sets as input. The output routines transmit answers, comments and suggestions to the student.

Learning by Practice and Imitation

The goal of the tutor is to transmit the knowledge, stored in his "heart", to the student. We try to achieve this by getting the student used to the subject matter. The student solves problems, that he himself has dreamed up, or that have been suggested by the tutor. The tutor will carefully compare the student's answer with an answer that it has calculated and base the future course of the tutorial dialogue on its diagnosis. The tutor can also show explicitly, by running through a problem, the methods that it uses to obtain solutions. The student therefore learns by practice and imitation. We shall give examples of diagnostic capabilities in the next section.

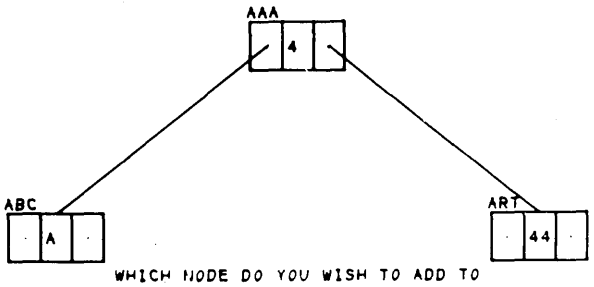

Figure 1. At the student's request, the tutor draws a tree.

Diagnostic Capabilities

A simple example demonstrates the diagnostic capabilities of our computer tutor. Suppose that we ask the student to calculate the union of the sets (A S) and (V T). An answer is the set (A S V T), but since the order of elements in a set is immaterial, so is (S T V A). For that matter, there are 4! = 24 correct forms of the answer. It is not appealing to store all these 24 answers! So suppose that we follow the multiple-choice road:

Which is the union of (A S) and (V T):

(a) (A V), (b) (A S V T), (c) ( ), (d) (A S T) ?

Now suppose that our student somehow calculates *his* answer. What happens if he finds (V T A S), or if he finds (B S T) ? The multiple-choice road does not help at all.

In our system,[1] the sets are not even stored. They can be inputs from the student, or they can be generated by an internal program, a set generator that can produce an extremely large number of different sets. Programs can calculate the union but, more importantly, they can compare "intelligently" the student's answer with the calculated union. The tutor will verify that (V T A S) is an acceptable answer, while (B S T) is not. Moreover, it will determine that (B S T) is not acceptable because part of set (A S) is missing in the union, as well as part of set (V T). (In each case, the tutor also identifies the particular missing parts.) Furthermore, the element B in the student's answer should not be there, since it belongs to neither of the two given sets. If necessary, the tutor can take these two sets and go step by step through the method it uses to calculate their union. The student is then presented with a working model that works in front of his eyes, and which he can imitate.

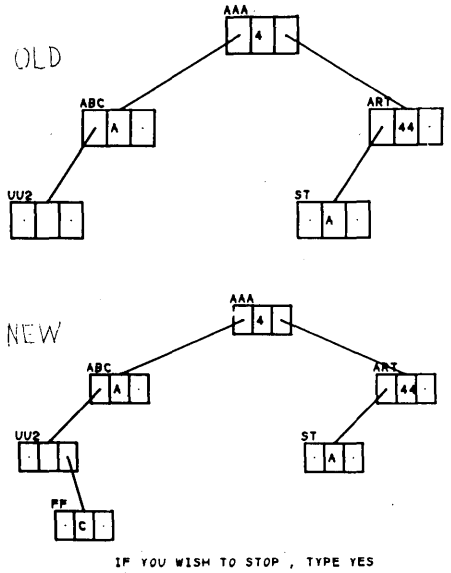

Figure 2. The tree before and after the addition of node FF.

Dynamic Capabilities

Unlike the human instructor, the computer is not limited to the use of a blackboard. In teaching information structures, it is essential to make the student familiar with the transformation in time of these structures. The blackboard does not lend itself to dynamic manipulations. On the other hand, the graphic display or CRT of a computer provides a superior medium for showing the changes in structures.

Figure 1 shows the CRT during a lesson on binary trees.[2] The student has already built a tree with nodes labelled AAA, ABC and ART. The nodes have (optional) contents and left and right links. The program is building the tree at the student's request. Figure 2 shows the state of affairs somewhat later. The tree has grown further and the student has just requested that node FF, with contents C, be added as a right node to node UU2. The tutor shows how the OLD tree looked, and how the NEW tree appears. (Since the new tree is bigger, smaller boxes were used in drawing it by the general tree drawing routine!)

It is hard to deny that our tutor knows something about

[1] The set theory teacher is programmed in LISP.

PERSPECTIVE ON FLOWCHARTING PACKAGES

"The SFL (Symbolic Flowchart Language) family is the only one that currently offers to the user any really effective degree of control over the level of detail in the flow diagram."

Dr. Ned Chapin
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The computer user today has a wide choice of packaged programs available for doing flowcharting. To see one's way through the welter, it helps to classify the offerings. This article attempts to make useful classifications, based upon a historical survey and an intensive study of a sample of currently available packages.

Families of Flowcharting Packages

The flowcharting packages available can be divided into three convenient categories based upon the input they accept. Historically the oldest and currently the most popular is the family that accepts the programer-written source code. That is, it accepts as input an ordinary source program written in a programing language. In practice the languages most commonly supported have been COBOL, FORTRAN, and symbolic languages (such as IBM-360 Assembly Language). For some languages, such as SNOBOL, LISP, and APT, the author has been unable to find any flowcharting packages at all. Some languages are supported by only a limited number of packages, such as PL/1 and RPG.

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Dr. Chapin earned his Ph.D. in Business and Economics at the Illinois Institute of Technology. He has taught many college courses, and has published several books and more than 100 articles, papers, reviews, etc. His professional activities include: ACM National Lecturer; Member, DPMA Curriculum Committee; Accreditation team member for the National Association of Trade and Technical Schools; and Program Chairman for COMPSO. He is a contributing editor for *Computers and Automation*.

SFL Input

A second family of flowcharting packages accepts SFL input. SFL (Symbolic Flowchart Language) was devised by F. David Lewis and his colleagues at IBM. This family has enjoyed considerable activity over many years. The input language is convenient and easy to use, but does require some way of converting the source language in the program to input language.

The two alternatives commonly available for this are manual translation and machine translation. The manual translation permits introducing various degrees of summarization and provides the high degree of control over the format of the resulting flowchart. Machine translation typically proceeds by a process over which the user has little control, and hence produces a relatively standardized translation and flowchart.

Other Inputs

The third family of flowcharting packages accepts other inputs. Typically these inputs are specialized languages designed for particular user needs and used only in one package, or used only in sharply modified form with other packages. Historically in terms of the volume of flowcharts produced, this has been a very important family, since it includes the AUTOCHART series of programs widely used within IBM for software documentation. The family, however, has little acceptance outside of its regular users because of the difficulty of learning the specialized languages which have no wide adaptability.

Because this subdivision into families based on input provides a comprehensive and operationally practical classification basis from the users' point of view, it is the one featured in the chart shown in Figure 1. A full historical review can be found elsewhere.[1] Detail on a selection of the most common packages available currently is given in Figure 2.

[1] Ned Chapin, *Flowcharts* (Princeton, N.J.: Brandon/Systems Press, Inc., 1970), Chapter 6.

Flowcharts Produced

Another basis of classification is in terms of the kind of flowchart the packages produce. The two main varieties are flow diagrams for the algorithm used within a program, and system charts showing the interrelationship by input and output of a series or sequence of programs. In practice the latter are all members of the SFL family and are represented by only one or two packages. As a *de facto* matter therefore, the primary emphasis is upon flow diagrams in the available packages.

Among the packages which produce flow diagrams, a classification can be made in terms of the level of detail shown in the flow diagram. Most of the packages create a flow diagram at the same level of detail as the level of detail in the source program. That is, the level of detail obtained by reading the source language is the same as the level of detail obtained by reading the flow diagram produced by the package.

Two exceptions can be observed. One is in the SFL family, since SFL permits the user to control the level of detail. The user with SFL can achieve any level of summari-

Figure 1. Classification of Flowcharting Packages

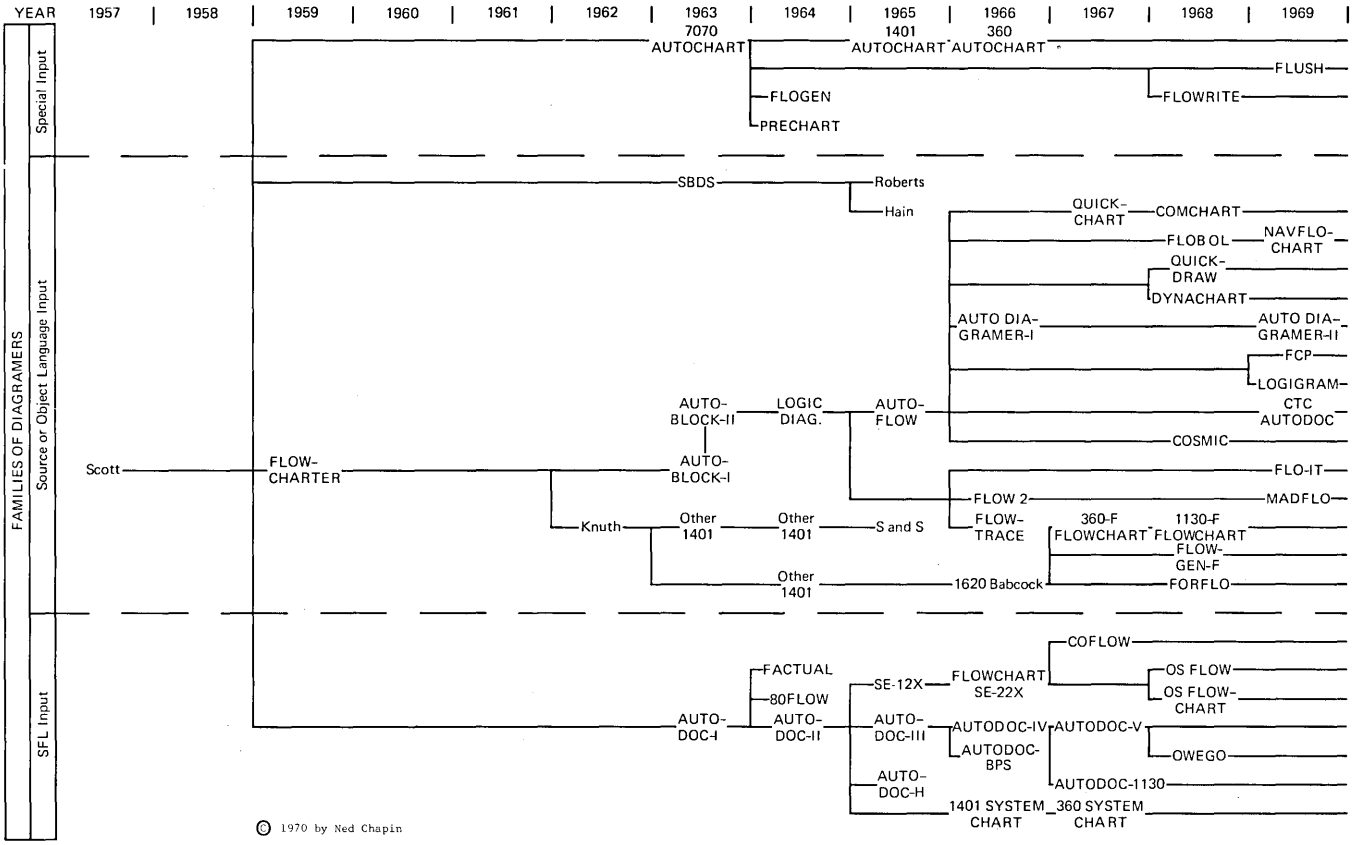

Figure 2. Some Major Flowcharting Packages

Item	PACKAGES					
Name	AUTOFLOW	DYNACHART	AUTODOC	AUTODOC-V	QUICK-DRAW	FCP
Vendor	ADR (Applied Data Research, Inc.)	APC (Applications Programing Co.)	CTC (CTC Computer Corp.)	F. David Lewis (IBM 360D-00.1.014	NCA (National Computer Analysts)	WCC (World Computer Corp.)
Input Language	COBOL FORTRAN 360-AL PL/1 Easycoder Autocoder	COBOL	COBOL FORTRAN 360-AL	SFL	COBOL FORTRAN 360-AL PL/1 Easycoder Autocoder	COBOL
Output:						
Flowchart	Yes	Yes	Yes	Yes	Yes	Yes
Cross Ref.	Yes	Yes	Yes	data	Yes	Yes
Source List	Yes	Yes	Yes	no	Yes	Yes
Diagnostics	Yes	Yes	Yes	Yes	Yes	not obs.
Other	Yes	no	Yes	no	no	no
3-year Lease	$7370	$6200	$4800	free	$5700	$2150

zation, from very broad to very detailed, that may fit his convenience. The SFL family is the only one that currently offers to the user any really effective degree of control over the level of detail in the flow diagram.

The other exception has two forms: an option, and added coding. Some packages, such as AUTOFLOW, permit the addition of special coding to the source program which will modify the flow diagram produced. This coding is like the special input used in one of the families, as noted earlier. The use of this coding enables details to be eliminated or combined or both, but does not permit a true summarization, in a conceptual sense.

The second or option form consists of a capability the user can call on to produce flow diagrams featuring branching. In these, all or all major transfers of control are shown in full, and all operations between transfers of control are shown as single operations. The result is a flow diagram showing the control sequence in the program. These flow diagrams are most helpful in debugging.

Flow Diagram Format

The flow diagrams produced by the packages can be classified on the basis of the direction of flow on the page. Most show the flow running in columns from top to bottom on the page. The only major exception is the NAVFLOCHART package. This runs the flow horizontally in rows across the page, using vertical distances for some transfers of control.

The majority of packages which organize the flow from top to bottom vertically on the page can be further classified by the number of such columns of flow. Some, such as FLOWGEN-F, use only one column. Some, such as DYNACHART, use two main columns and in addition employ an auxiliary column on the side of each main column. Some, such as QUICK-DRAW, use three columns in a fixed position on the page. Others, such as CTC-AUTODOC, use four columns in a fixed position on the page. Still others, such as the Lewis AUTODOC-V, use five columns in a fixed position on the page. A few provide for centering a variable number of columns on the page, such as AUTOFLOW, which uses from 1 to 4 columns.

Balance Between Connectors and Flowlines

Another basis for classifying flow diagrams is the balance between connectors and flowlines. Some packages such as CTC-AUTODOC rely primarily on connectors. At the other extreme are packages which rely primarily on flowlines (DYNACHART, for example, does not even have a connector outline). Others, such as AUTOFLOW, use both flowlines and connectors in about equal measure. Still others, such as the Lewis AUTODOC-V, permit the user to control the balance between flowlines and connectors to fit his own taste.

In general, flow diagrams stressing flowlines tend to appear maze-like. To offset this, the packages stressing flowlines usually try to "unscramble" the flow as they produce the diagram. Flow diagrams stressing connectors tend to appear fragmented. To offset this, the packages stressing connectors typically provide extensive cross reference aids.

Flow Patterns

Flowcharting packages can also be classified on the basis of how they present the sequence of operation. The most common practice is to take the input sequence and recreate it in the flowchart arranged into columns. These fill one page with flowchart before beginning to fill the next. The result is a graphic presentation of the sequence of operations, but it offers little improvement over the input. If that was illogically organized and heavily patched, the flowchart will probably reflect its condition faithfully.

Grouping Operations

Two alternatives used in some packages are to group the operations, and to parse the flow. In the grouping alternative, exemplified by AUTOFLOW, an attempt is made to bring together physically in the flow diagram those flows that interact with each other. That is, it attempts to reorganize the input sequence to substitute short flowlines for connectors in the flow diagram, since transfers of control provide one measure of interaction.

Still other packages, such as DYNACHART, attempt to parse the program into logical units. These units may be in the main line of flow, or they may be subsidiary. Again, transfers of control provide one measure of a logical unit: a logical unit of code has few flow entrances and few flow exits.

Highlighting the Main Flow

A third alternative, and conceptually one of the most satisfactory, is to highlight the main flow. In practice at present this can only be done with the SFL or special input packages, since none of the current packages can distinguish what is logically the main flow.

On a theoretic basis, it would look attractive to classify the packages based upon their patterns of converging (fan-in) and diverging (fan-out) flow. As a practical matter, the handling of these appears to be closely related to the cross referencing provided within the flow diagram.

Compound Conditions

The only major variation arises in some programing languages where compound conditions can be expressed within a single statement, as for example, in PL/1. Some packages, such as ADR-AUTOFLOW, break such compounds down into their component parts showing each of the separate, implied transfers of control. Most packages take the compound statement as given. In the SFL family, the packages give the user some option in the handling of compound conditions.

The Loop

In the pattern of flow, the loop has a place honored in both theory and practice. Iterative loops in particular are common. Ideally for clear comprehension of their significance, they should be shown graphically in a flow diagram in loop form, so that a glance at the flow diagram clearly reveals the loop structure of the flow. Unfortunately, the flowchart packages suffer from several impediments to this worthy goal, and can be classified by how they handle the attendant problems.

One impediment is the difficulty of putting the loop entirely on one page. The flowchart package has no way of telling that an iterative loop is present, and hence does not

set it off clearly. No package seems to have an adequate solution to this, but the DYNACHART package does about the best in the source language family.

A second impediment is the size of the loop. Some of the longer lengths may force the use of more than one page of the flow diagram. This is not a major problem since most iterative loops tend to be relatively short.

A third impediment is in the statements used in some programing languages for loop control. For example, in FORTRAN, loop control is handled by a DO statement. This signals the presence of a loop and gives its extent. But to use this information, the package must look ahead and allocate the appropriate page space. Most packages diagram the DO as if it were an ordinary arithmetic statement.

A fourth impediment relates again to the use of connectors and flowlines. To reveal the loop structure clearly, a returning flowline is helpful and more distinctive than a connector. DYNACHART uses a flowline, for example. Packages which limit flowlines to the usual directions concomitantly restrict their presentation of loops.

A fifth impediment is the common presence of nested loops. All of the packages examined failed to show the loop structure clearly for these.

Cross References

To enable cross reference between the parts of the flow diagram and between the flow diagram and the source program, several techniques are common. They too provide a basis for classifying the packages.

One common technique is to assign sequence numbers to each statement in the source code or use the programer-provided page and line numbers. The QUICK-DRAW package is an example of the former, and AUTOFLOW an example of the latter. Then by placing these numbers in the flow diagram on each outline, and by summarizing them and what they identify in cross reference tables, the user can follow the flow in relation to the source program. Obviously such a procedure lacks something in convenience, since it may require a reference to at least one other affiliated document in order to be able to trace the same flow in both the flow diagram and the source program.

Page and Sequence Number in the Flow Diagram

A second alternative, sometimes combined with the former as in DYNACHART and QUICK-DRAW, is to indicate in the flow diagram itself, the page and sequence number on the page where the flow will be found. To do this, the outlines in the sequence are normally numbered sequentially on the individual flow diagram pages. For reference just within the flow diagram, this works well. The disadvantage to this is that it clutters the flow diagram with a large number of numerals, most of which never are used. CTC-AUTODOC attempts to minimize this problem by showing the numbers only for the entrance points.

A Grid

The third alternative is to treat the pages of the flow diagram as a grid consisting of rows and columns and assign identifying letters and numbers to the respective rows and columns. The grid arrangement has been used primarily in the special input and SFL families, as for example in the Lewis AUTODOC-V. This requires the package to look ahead, but physically and conceptually, it provides a more convenient and neater means of cross references.

Classification by Use

Another major basis for classifying the packages is the use for which they are intended. Some are intended primarily for documentation, some primarily for debugging and as a substitute for a compiler. These different objectives commonly are combined in some mix for the various packages. Thus, historically the SFL and special input families have been characterized by packages whose primary objective was documentation. The source language family has been characterized by about an even balance between documentation and debugging.

Documentation

The different packages reflect the objectives differently. In order to serve as documentation, the vendor attempts to provide as complete a package as possible. It has been widely pointed out documentation is not just a flowchart. Rather it consists of probably a dozen or so things.[2] A few of the packages such as CTC-AUTODOC, AUTODIAGRAMER-II, and just recently AUTOFLOW provide some description of the operand data. This greatly enhances the value of the packages for documentation purposes.

Also to improve documentation quality, most of the packages also provide a source listing and cross referencing for data names and program data structure names. In this way, the output from the package can stand as a complete unit even though it is not complete documentation.

Diagnostics

For debugging purposes, some package suppliers incorporate diagnostics directly in the flow diagram and in the cross references. The diagnostics identify unreferenced data names, unreferenced program structure names, and out-of-flow code. Also the diagnostics may identify deadends in the flow and transfers of control to nowhere, as well as identify difficulties with the sequence of control in iterative loops, such as incorrect nesting.

For compiler substitution, the packages incorporate syntax checking and produce syntax diagnostics. Advocates for using the packages in this manner contend that for only a little additional expenditure of machine time, the programmer gets something which facilitates his work considerably; i.e., the flow diagram and the flow diagnostics. What is missing is the object language translation. Since many programers using the higher level languages do not look at the object translation anyway, its absence from the flowcharting package output (it is claimed) is not a serious lack.

Availability

Another feature of the packages is their availability. Some, such as the Lewis AUTODOC-V package are available free. Others are available for a moderate one-time fee, such as the COFLOW translator. But the common practice in the software industry is to lease the packages for a three-year period, with the lease renewable annually at a

[2] See for example, Ned Chapin, "Program Documentation: The Valuable Burden" *Software Age*, Vol. 2 No. 4 (May 1968) pp. 24-26, 28-30.

(Please turn to page 26)

COMPUTERS IN COMMUNITY SERVICE: CAN THE CULTURAL GAP BE BRIDGED? Part Two

"There is no way a member of the computer culture can ply his trade in the community without understanding the forms of both verbal and nonverbal communication used in the community."

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Part One of this article, published in the February issue, considered two requirements of the computer technician who desires to implement computers in community service: (1) He must have superior knowledge of his own discipline, together with an ability to stand on his own two professional feet; and (2) He must recognize that there are two cultures, each superimposed on the other geographically, but different from each other functionally and representationally.

Part Two, published below, considers these additional requirements: (3) The technician must realize that both perception and the language used to express what is perceived are different in each of the two cultures; (4) He must accept the span of the other culture's language which extends beyond mere words; (5) He must understand the use and meaning of humor in the other culture; and (6) He must learn to distinguish each culture's membership.

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Perception and Language

With the realization that another viable culture exists by his side, the member of the computer culture can explore the nature of the differences between them. With the knowledge that this culture has something to offer him, he can bounce back from the frustrations inherent in this exploration, and use professionally what he learns.

Each culture perceives the same situation differently, like the blind men describing an elephant of which each feels a part: the trunk, the tail, the side, the ear. Each feels the situation differently.

What it feels, it describes differently. The meaning of what each describes is different, even when the common use of English and its syntax make the words come out the same.

Let me illustrate with an example. A core-city community in the United States hoped a community health center would be established in its midst. A computer-oriented medical center traditionally serving students and established elements in town sought to establish a center in that community in response to the hope.

Both computer and community cultures perceived the same need – the elephant – and both stated this need in identical English words. Yet the community health center failed to take shape by the end of three years, despite honest attempts supported by adequate Federal and other funding. Why?

The computer-oriented professionals felt they could not operate where the needs for their services were not quantified and categorized and went about doing this by

preparing questionnaires, in the style of format familiar to them, for distribution to members of the community. The community, saturated by questionnaires in the past, refused to be plagued by another one, for any reason.

Each culture told the other what it thought. Each heard the other and thought it understood, since it understood the words, but it was as though one spoke and listened in FM and the other in AM. Each did its thing in its own way. The implementing decisions, which had to be shared by both cultures, were not forthcoming.

Logic Is Not Enough

Members of the computer culture would agree: the method of the technicians was logical. But logic did not succeed in putting the health center into operation in the community. Alone, it fell through the crack between the cultures. It brought forth no medical stations wanting computer terminals, no computerized billing requirements, no inventories to be machine reckoned, no use at all for the services of the computer culture, no services to the community culture.

There is no argument here for abandoning technical rigor in favor of expediency. To abandon his rigor and the other essentials of his culture is not the kind of help a member of the computer culture can give the community. The community culture is badly served by those from the computer culture who try to join it, leaving behind their own values. But the difficult concept of a need for technical rigor and quantification is sold, not imposed. It is sold by members of the computer culture who demonstrate a willingness to be educated by members of the community culture in *their* appreciation for human need.

A Two-Year Stand-Off

For instance, in another case in another city, computer technicians sought for two years to institute their services in a medical records section of a community health center, originally at the request of the center management. For two years the medical librarian, a member of the community, said *no.* The medical librarian had instituted a method of keeping records where G stood for grandfather and M stood for mother. She and her workers knew the people of their community and found it simple, with simple mnemonics, to retrieve records of family members, making whatever *ad hoc* associations were required in their own judgement to meet the needs of the center and the community.

The computer technicians had developed a numerical patient identification system indicating relationships of each family member to the head-of-the-family, in computer-culture terms, by subscripts to a family identification number.

A stand-off existed for two years between the computer technicians and the librarian, with discussions growing bitter on both sides, until a member of the computer culture took it upon himself to understand something of the opposition's culture and to educate the opposition in his own.

Real Communication

The technician bought the librarian a cup of coffee. He asked what *she* thought the members of the community needed from out of the system, independent of the method to be used in getting it to them.

Where a special need was shown for the distribution of training in nutrition as a backup to medical treatment for nutritional deficiencies, the means by which the computer aided the allocation of this training was shown. The subscripts ensured an ability on the part of the center to reach from the identification of one youngster with problems the doctors felt were caused by nutritional deficiencies to the responsible member of the "family" able to accept training and put its content to use on his behalf. The subscripts also make it possible for the center to reach from the youngster whose problems had been detected to others whose problems might not have been otherwise, perhaps his brothers and sisters, who could then be helped at the center's initiative.

The technician showed the librarian a computer card with the punched patterns of A through Z and 0 through 9. The quantitative difference in handling alphabetic and numeric data was explained. Technical considerations were discussed in adult terms, but without the use of technical jargon and, where possible, related to specific community needs to be met through their use.

The librarian agreed to the institution of the system, after the structuring of the patient identification system was made flexible enough to accept community conventions the computer culture generally rejects.

The community culture accepted help in meeting its needs and the computer culture profitably extended the domain of its services.

The Span of Language

Members of the computer culture make the assumption that they understand what the members of the community culture are saying, and are understood by them, because the words are in English. Two realities stand against this.

Meaning is given to words by the intent of the speaker. (This is not true in the case of computer programming languages.) Meaning is not inherent in the sound of words. Intent is a function of the cultural orientation; identical sentences from speakers with different orientations will differ in meaning.

Words Can Be Unimportant

In the community culture, words are the vehicle of least importance in conveying meaning. For example, a technician from a suburb of a major American city was training the staff of a core-city multi-service center in certain technical procedures. She did well. She spoke for an hour and held the attention of people not normally responsive to the sort of detailed work they were being asked to do. The chairman declared a break. Someone tossed brown paper bags of fried clams and onion rings onto the table and everyone dug in, except the technician who stiffened *perceptibly* and asked suspiciously where they had come from.

The staff were polite to her when the meeting resumed (a warning signal to those who know the community language; real communication sometimes comes in the form of anger or repartee, but seldom of politeness). Every eye had its shade drawn. No further word of hers was heard. Despite ten years of work in the community prior to this engagement, the technician had not learned the language of its culture.

Black people are sensitive to white skittishness in skin contact. They press physically against white outsiders in

their community and enjoy, wryly, the discomfort when it is registered. The slightest discomfort *is* registered.

There is no way a member of the computer culture can ply his trade in the community without coming to terms with these forms of communication.

Humor

While humor is part of the language, its importance demands separate treatment. It is the language element most deeply embedded in the cultural soul of the community, and not to understand its *whys* and *hows* is to ensure the failure of any attempt to institute technical operations in the community.

For members of the community, particularly the black community, humor of a wry and "put down" sort has been the lone hope given them by the Pandora's Box they opened by being born. The rationale goes something like this.

If members of the community are not part of the dominant culture, and if that culture is valid, then theirs is not. The defense is that perspective which *puts down* that world and illuminates its idiocies and inconsistencies. If they can prove to themselves it is flawed, then through its cracks they might just see substance in their own.

Which Values are Valid?

The members of the community culture are not part of the cultural system they see around them, certified as valid by established means of communication. They have difficulty themselves believing in the validity of their own system. Expressions of value associated with power tell them their values are not valid. Humor, their humor, is a practical device for counteracting this statement. The process of becoming valid to oneself is a consuming preoccupation on the part of the members of the community culture and their humor is the perspective which gives them the hope that they are valid.

The tactical result of this is what the computer culture sees as the knocking received daily by the computer technician who enters the community to do a job: collect data, teach programming, set up a computer terminal. It is a necessary knocking. It gives this hope of validity to the members of the community who are uncomfortable with the digital disciplines represented by the technician's work. They do not understand it, yet they fear it is more effective than what they do understand. The technician's reaction to the knocking also tells the members of the community what sort of person he is. If he accepts the treatment and *does not react in kind,* they may begin later to listen to what he has to say.

It is fatal to react in kind as an equal. This freedom is not given the member of any culture entering the domain of another. It is not a freedom received by the member of the community culture who takes a course in programming, gets a job in a computer installation, and answers his boss in the same way his boss addresses him. It is not a freedom he gives, in turn, to those from outside looking for business from him on home ground.

To use the humor of the computer culture within the community is bad taste and unproductive. It comes on with the arrogance of *Let them eat cake,* particularly its Ivy League variety, no matter what reason the user imagines to himself for using the humor.

Distinguish the Membership

Sometimes a computer technician will go to work on a community project with the assumption that everyone he meets who is black is a member of the community culture. This is dangerous.

There may be a black man who has worked to join what he sees as the establishment. He may have gone to accounting school for that purpose. Then to be addressed, or dealt with, in the language of the community culture is an insult.

One leader of a black community was once an executive of an electronics retail firm. In order to relate with his brothers in the community, he maintains an Afro public image: beard, hairdo, dress, and manner of speech. His private behavior is that of an educated, well-rounded, middle-class suburban professional and obviously reflects his self-image.

Despite his public appearance, he expects to be treated as the knowledgeable professional he is *by other professionals.* The influence he has in his community he throws towards those services of the computer culture which are presented to him in the technical language of that culture, which he understands. He rewards those from out of the computer culture who address him as the man they think they see, not with business, but with a put-on native behavior which confirms them in the superficial impressions they never looked beyond.

There are those, too, from out of the computer culture originally who have gone native and who need to be identified first before *they* can be communicated with.

It is important for those who function in both cultures, and whether in sales or service capacities, to know enough to distinguish the essential nature of the people they deal with.

The Transcendent Goal

Someday there will be a display console at every community health center from East Harlem to Minnesota's Red Lake Indian Reservation. The console will be tied to a computer at a central location.

To receive the patient's medical history, the physician will key in his enabling code[1] and the account number of the patient, or the patient's name and a further identification, such as the name of the street he lives on.[2]

The community worker will key in her enabling code and retrieve not only the availability of non-medical services in the community related to the patient's needs, but also the history of the patient's use of these services. The computer can give her a reading of which use of the services would be best, by whatever criteria she puts into the system.

The accountant will receive not only a history of the account, but also up-to-date information on his local Medicare rules and the regulations for third-party billing.

For any of these, or for associated services, to be consummated, members of the computer culture will have to learn enough of the nature of the culture which rules the community to build the bridge between their technology and the community's use of it. □

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[1] The computer culture should work with the community culture to interdict any system without stringent protection against divulging unauthorized data to unauthorized personnel.

[2] Community respondents often either forget their number, or simply will not give it.

THE DEEPER UNREST

"How can we realign the incentives and rewards of a technological society so that people are encouraged to contribute to each others' capacities and opportunities?"

Dr. Kingman Brewster, President
Yale University
New Haven, Conn.

Please raise your right hand and repeat after me, "I am against violence; I am against disruption; I am against coercion; I love tranquility." So, I join the chorus of those who celebrate the superficial contrasts between the campus of last spring and the campus of this fall.

I think it would be entirely wrong, however, to suppose that the present student mood is one of satisfaction. There is little to be satisfied with about the prospects of the world. There is less to be satisfied with about the prospects of the nation. And there is deep and widespread misgiving about the prospects of the self.

The Meaning of New Student Maturity

As I said last April, so I would have to say again, "The press would be misinterpreting and the public and the politicians would be misled if they believed that the violence or non-violence of the few is a measure of the morale, the state of mind, of the many." Of course I think it is a good thing students are not as easily exploited or herded by contemporary demagogues as they were last year. Of course I think it is a good thing, too, that many students have learned that Weathermen beget Minutemen and the rhetoric of Abby and Jerry begets the counter-rhetoric of John and Martha.

Naturally I am pleased to believe that the risk to which students subjected their colleges and universities last spring has made them even more appreciative now of the campus as an oasis of tolerance in a desert of mistrust. The chance to pursue the good, the true, and the beautiful seems today in ever sharper contrast to the ugliness of the outer world. The broad scope of personal freedom to probe and to experiment is still a special privilege of student youth.

This, too, is perhaps perceived to be more precious as the outside political, economic, and institutional society seems less and less patient with the non-conformist. That students seem to have learned how precious and how fragile the university privilege is, is, of course, more than welcome to anyone in my position.

The established society is kidding itself, however, if it mistakes this new wisdom and maturity for acceptance of political, economic, and social things as they are.

A Sad Scorn

Commentators have noted the gap between the high promise of political activism voiced last spring and the relatively minor performance of students in campaigns this fall. Some would confuse this with the classic apathy of the 50's. Some would see in it a "cop-out" of the psychedelic generation of the early 60's.

I don't think either is quite right. Nor does it have the vitality of revolutionary hostility. Rather I would characterize it as a sad scorn, a monumental scorn, for the way the process has been exploited by the hucksters.

As a father, as an educator, as a member of the generation which is, so to speak, "in charge," I can only feel and confess an acute sense of embarrassment about the recent political campaign.

The ad hominem attacks by the Vice President raised a stench which would make the traditional red herring smell like a rose. The show biz play upon personalities wholly obscured the real and urgent issues.

Based on an address delivered at the Ford Hall Forum in Boston on December 6, 1970.

Law and Order

Even on the chosen issue of law and order, quite apart from the patent unfairness of the effort to tag all students with dissent, and all dissent with disruption, there was nowhere any willingness to grapple with the timeless challenge of balancing the claims of justice with the claims of order. This was brought close to home for students everywhere by the Vice President's castigation of the President's Commission on Campus Unrest; and this apparently before he had time to read it through. Then there was the President's failure to respond to Governor Scranton's invitation to lift the issue of campus disorder above the level of accusation and blame. It did not take excessive cynicism to surmise that some politicians seemed to think it was more important to keep the problem of student unrest alive than to deal with it constructively.

As John Lindsay said, "Contrary to the impression which the Vice President might seek to foster, the Weathermen were *not* running in this campaign." Yet every effort was made to make willful violence the scapegoat as though it was condoned by all students, all educators, and all Democrats.

A realistic student generation might take even this in stride as "just campaign oratory." What they cannot abide, however, is the use of this one false issue as a decoy with which to divert attention from the unfinished business of the Republic.

Decoy and Diversion Not Enough

But decoy and diversion did not seem to be enough. So it was necessary for the President and Vice President to try to disparage anyone who ventured the thought that America was not the best of all possible worlds. Anyone who raised serious criticisms of things as they are ran the risk of being accused of "poor mouthing" the country.

Even out of season the only cases which the President has seen fit to take to the people for direct public television address are: the continuation of the war in Vietnam, the argument for the anti-ballistic missile, the appointment of a Southerner to the Supreme Court, the foray into Cambodia, and the veto of the health-education bill. There seems no comparable will to take the case to the people for family assistance, for the imaginative welfare program, for environmental protection, for wage, price, or profit control.

And the style always seems to be aimed at spot news impact. The calculus of immediate political appeal seems to push to one side more thoughtful exposition of strategy of goals or purposes.

Prospects for the Middle-Aged in the Year 2000

Spot news political psychology is not good enough for those of an age for whom the year 2000 will be merely middle-aged.

Temporizing with pollution in the 70's may mean extinction by poisoning or by suffocation at the turn of the century.

Ignoring the population problem in the 70's may predestine a human ant hill by the time the century ends.

Failure to do anything about the disparity between the haves and the have-nots; whether separated by race, by ghetto, or by regional underdevelopment in the 70's, may signal a world of envy and despair which by the year 2000 would be consumed by fratricidal hate.

And if in the 70's we do not fashion a world authority which transcends nations and honors a loyalty to humanity which rises higher than national chauvinism, then who can say that the weapons of frightfulness will not be unleashed during the lifetime of those now in being?

Most students do not feel they have the answers to such problems. But they do get riled up when it seems that their elders will not even admit the seriousness of the questions.

There is a haunting sense that perhaps one reason is because they do not want to have the greatness and goodness of the society to be questioned.

The young are not all that headstrong; they don't know how they would define the good society, let alone bring it about. But they do feel that the society would be better if only it could be easily admitted that all is not well.

Where Power Lies

Without knowing exactly what is wrong or how to improve things, there is a wide-spread feeling that maybe how you make out is not as closely correlated to effort as it is to private status and political favor. Inheritance may not matter as much as it used to, but who you know and what he owes you seem to make more difference than they ever did now that government is the biggest buyer, biggest banker, biggest employer and biggest contractor. And neither the market place nor the ballot box seem to have very much to do with the way the pie is divvied up by the United Auto Workers and General Motors in the confident knowledge that competitors have no other choice but to follow the wage leader and the price leader.

It is not altogether clear, either, how a representative democracy musters the self-discipline to tax itself, whether for war or peace. The alternative is resort either to the cruel hidden tax which inflation imposes upon the aged or to the cruel coercion of unemployment which drafts for poverty those already most burdened by the inheritance of oppression.

The Gap Between Promise and Performance

There is a dim perception that the goodness of a society has something to do with the degree to which its rewards go to those who add to the capacities and to the opportunities of their fellow men and the extent to which penalties are visited upon those who at best add nothing and at worst restrict their fellow men's capacities and opportunities. Perhaps no society has done very well by this standard. Maybe we have done better than most. But somehow the aura of present official self-congratulation simply serves to underscore the enormous gap between promise and performance. The speculator, the fixer, the trader on inside knowledge seem more lavishly rewarded than those who actually produce goods or perform services.

Nowhere does this gap seem greater than in the world of politics itself. Students do not blame politicians for using every trick of their trade. Whether it's the party machine or the image machine, no one can deny a master the plaudits owed to the superior craftsman.

Although there is a longing for the simple authenticity of a Truman or even an Eisenhower, students do not waste

much time grousing about the credibility gap; or, as Mr. Nixon's manager once put it with disarming candor, the "lovability gap." Even though they disparage friends, teachers, and administrators who put popularity ahead of principle, students know perfectly well that elected politics does depend upon popularity.

Credibility of the Political Process

Their concern, then, is not with the credibility of the man, but with the credibility of the process.

When the elective process seems to lose its credibility, the damage done is not only to those who are politically active. It is done to the whole society, to all of us. The credibility of the political process is important to all citizens, the passive as well as the active. It is not really different from the importance of widespread confidence in freedom of expression, freedom of thought. These rights are not just of interest to the speaker, the writer, or the thinker. All of us lose something if the pamphleteer, the orator, or the criminal defendant are deprived of their rights.

The hucksterizing of the political process is a bipartisan phenomenon. It's just that for the moment one party seems to be able to afford the high cost of hucksterism more easily than the other. The students don't really blame the ad-man. He is just the hired hand to package the product as attractively as possible, or to disparage the competing product as ferociously as the libel laws permit. What difference does it make to him whether the product is a thing, a person, a party, or an idea.

The Price of Entering Politics

The real concern lies deeper than blame. It lies in the realization that the price of serious entry into statewide, let alone national politics, is now so high that only the very wealthy can run without selling themselves. Those of little means who can or will not sell themselves to wealthy backers cannot run at all.

This concern is not limited to the season of high political activity. It is a concern as fundamental and basic as the assumptions which underlie the Bill of Rights. As long as three networks control access to a power of communication which puts all other means of persuasion in the shade; as long as access to that preferred channel costs hundreds of thousands of dollars, it will be hard to give credence to that "competition of ideas in the free market place" which was the ideal which underlay freedom of expression. Credibility of the process cannot be convincing until there is equal and inexpensive political access to network television; and, until the power of the networks is tempered by the enforcement of competition and deconcentration, and by bringing into being more numerous and more powerful non-profit television outlets.

This will be hard on the owners, but they are, after all, only licensees of a public privilege. This is one area in which it is not a rhetorical slogan but a fundamental legal fact to reaffirm again and again that "the airwaves belong to the people."

The urgent need for reform, obviously, also cries out from the experience of party primaries and political conventions. It is symbolized, too, by the grip of seniority on the work of the Congress, and the dangerously archaic arrangements for Presidential election and Presidential succession. But none of these "legitimate" reforms seem to me anywhere near as important as restoring equal access to the channels of persuasion and communication for competing parties, competing people, and competing ideas.

Crucial Issues

I think the next two years are absolutely crucial. We have an agenda before us of terribly important and terribly complicated problems.

How to reconcile the conservation of nature with the predatory effort to meet urgent material needs?

How to keep the birthrate from overrunning the planet without regulating the most intimate details of human personal freedom?

How to control bargains which legislate the destiny of the economy without impairing freedom of contract?

How to reconcile the sovereignty of the individual with the tradition of national sovereignty in a world capable of self-destruction?

Perhaps most difficult of all, how to realign the incentives and rewards of a technological society so that people are encouraged to contribute to each others' capacities and opportunities?

Finally, how to restructure the channels of persuasion and the apparatus of politics so that the discourse on these problems may in fact encourage the consideration of all worthy ideas and permit the best to compete for acceptance.

Patience

I have three worries. I worry that the young will not be patient enough to address themselves to this agenda. They have been spoiled. Spoiled not by affluence, but by the experience of two great issues which were so clear that all they seemed to require was a willingness to demonstrate moral outrage. One was civil rights. The other was the Vietnam war.

The agenda I propose is not that simple. It will yield only to sustained rigorous, rational attack. It will require more of debate than of demonstration.

Willingness to Address Problems

My second worry is the overwhelming dominance of spot news and personality. People, not problems, are the stuff of television. The personalities of presidential sweepstakes are too likely to crowd serious national issues off the screen. Somehow we must insist that men and parties be tested by their willingness to address the serious agenda.

So finally I return to my third and most basic worry. I worry that the established society, out of both timidity and smugness, will try to avoid if not suppress serious address to our agenda.

I am a congenital optimist. My job requires it. At least I do not intend to let the recent campaign or the present mood deprive me of the privilege of hope.

The Ford Hall Forum

In very large part I owe that privilege to Ford Hall Forum. The mid-30's was a great time to have your eyes opened to political, economic, and social consciousness.

And thanks to a free thinking, progressive mother, I was introduced to Ford Hall one Sunday evening when I was about fifteen. For the next three years, almost every Sunday night I was exposed to a parade of confident world-savers.

It was a time of ferment; Communism, Fascism, popular fronts abroad, and the New Deal at home were all grappling with the appalling breakdown of democratic capitalism. But after March of 1933 the mood in America was one of optimistic utopianism.

The "economy of abundance" was preached by Arthur Salter and Stuart Chase. Responsible pacificism was the gospel of Herbert Samuel and Norman Angell. Even sneering progressives like the LaFollette brothers and Norman Thomas were basically robust and cheerful. The cause of civil liberties was both civil and liberating at the hands of Felix Frankfurter and Roger Baldwin. Any ideology or ingenious idea was welcome, whether from Harold Laski, John Strachey, or the homegrown prophets of technocracy, Upton Sinclair and his EPIC Program (End Poverty in California). And there was the Townsend Plan. Huey Long and Father Coughlan on the airwaves. But this was not just a forum of nostrums and gimmicks. It was a forum of moral fervor infused with high social purpose. It offered a real sense of listening to the voice of the prophet, whether couched in the urgent social messages of John Haynes Holmes or in the stentorian periods of Rabbi Stephen S. Wise.

Through it all ran a tremendous intellectual and moral self-confidence. A feeling that man-made problems would lend themselves to man made solutions.

The Privilege of Hope

So, however deep may be the unrest, this is an appropriate place to renew and reaffirm the privilege of hope.

Our future depends upon the confidence of our sons and daughters in the capacity of the Republic to solve its problems. Their confidence will be earned only if all of us admit that we face a crisis of economic purpose, of political purpose, of personal purpose. They can be expected to rise to the crisis of this challenge only if they feel that tough questions and fresh answers are not only welcome but are encouraged. And they can be expected to work through the process, as the saying goes, only if everyone honestly and energetically is devoted to the effort to make the process credible.

Thirty-five years ago when I crowded into the balcony of the old Ford Hall, even then I took great delight in the confident gusto of Franklin D. Roosevelt. In the retrospect of history I give him and his great wife even more credit for the sense we all felt: that if you had a really good idea, it stood a chance.

The Great Depression was a crisis of capitalist economics. The current great malaise is a crisis of democratic politics. In both cases a willingness to admit the crisis is essential to positive progress.

As he said in his second inaugural, in referring to the economy, let us say with equal candor of our political, social, and international shortcomings.

"It is not in despair that I paint you that picture, I paint it for you in hope, because the nation, seeing and understanding the injustice of it, proposes to paint it out." □

Chapin - *Continued from page 19*

lower price for subsequent use. For the lease payments, the user obtains installation assistance, a copy of the program, training for his personnel, and patches for bugs, as well as in some instances the right to receive updated or improved releases of the package, although this is not uniformily applied. Lease charges range from less than $2000 to more than $8000, depending upon the selection of programming languages to be supported, the computers to be used, the selection of package features, and the number of installations to be served.

Summary

The diversity of flowcharting packages available is reflected partly in the features of the flowcharts they produce, and partly in the auxiliary outputs and the way they produce them. To clarify the diversity of offerings it is helpful to classify the packages by: the input they accept; the kind of flowchart they produce; the detail in the flowchart; the orientation of the flowchart; the pattern of flow shown on the pages of the flowchart; the balance between flowlines and connectors in the flowchart; the way of presenting the sequence of operations in the flowchart; the way of presenting loops in the flowchart; the cross referencing used; the intended use of the output from the packages; and the terms of package availability. These can be used to provide an objective, quantitative basis for package comparison. □

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GLOSSARY OF TERMS

Flowchart – a graphic means of representing a sequence of operations on data and of representing the data operated on.

Flow Diagram – a flowchart of an algorithm showing operations in a sequence on data.

System chart – a flowchart of a system composed of sequences of algorithms linked by the data they use and produce.

Flow – in a flow diagram, the graphic representation of the possible control sequence; i.e., the graphic statement of particular operations in a specified order.

Flowline – an arrow or line indicating a flow.

Connector – a graphic indication of a break or interruption in the representation of the flow.

Inconnector or flow entrance – a connector that indicates a resumption of the graphic presentation of a flow.

Outconnector or flow exit – a connector that indicates a discontinuance in the graphic presentation of a flow.

Cross reference or reference – a means of indicating corresponding locations, as of the same place in a flow diagram and in a source listing for the same program.

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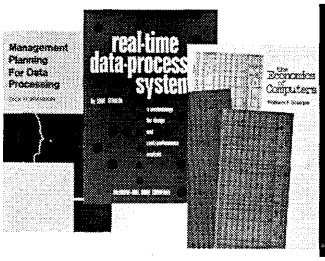

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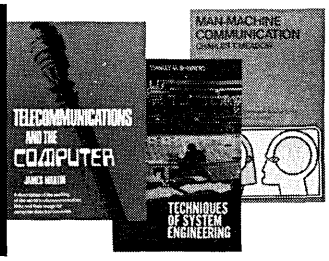

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DATA BANKS – A POSITION PAPER

Prof. Caxton C. Foster
University of Massachusetts
Amherst, Mass.

Data banks are not a new problem. Hamurabi kept an extensive clay tablet library of legal transactions several thousand years ago in Babylon. What has happened with the advent of computers is that the cost of operating such data banks has dropped by several orders of magnitude. Consider a clerk who can perhaps examine one record per second and is paid $1.80 an hour. He (or she) can then examine about 2000 records at a cost of $1.00. Now consider a computer that can scan records at a rate of 500,000 per second and rents for $250 an hour. For the same cost of $1.00 it can examine 7,200,000 records. Done by hand, a comparable search would cost $3,600 instead of $1.00. This drastic reduction in cost has made economically feasible things that could only be dreamed of yesterday. New and exciting services can be provided to individuals, organizations and researchers. We need not extoll their virtues here. Many others are doing that elsewhere.

Data banks are inevitable and essential in a complex society. Our civilization would quickly strangle in the flood of paper work if computerized files were eliminated. Although the potential for good inherent in data banks is very large, we are afraid that the potential for evil is infinite.

When every interaction of an individual with society can be collected, sifted and analyzed at low cost, he will be paralyzed by fear -- fear that today's innocent behavior, recorded indelibly on the data bank, can become tomorrow's subversive activity. As we see it the most serious problem related to the establishment and growth of data banks is the erosion of our constitutional rights. Once surrendered these rights will be most difficult to regain. "Big Brother" armed with computerized data banks is very big indeed and will be almost impossible to displace. If this is indeed the case, and we firmly believe it is, then this country should be very careful of allowing such a possible instrument of repression to be forged.

In what follows we will attempt first to show that the above described danger is very real, indeed inevitable, unless strong action is taken immediately. Second, we will try to outline some of the "strong action" we think might be helpful.

The Development in the Near Future

More and more organizations are finding it advantageous to develop data banks. Motor vehicle registries, income tax agencies, armed forces, police departments, credit bureaus, banks, insurance companies, direct mail advertisers, and many others are collecting, or are about to begin collecting, little bits and pieces of our lives in machine readable form. By themselves, these separate data files are reasonably innocent, but unfortunately, they don't stay by themselves; they tend to agglomerate -- in the name of efficiency, economy and service. Agency A and Agency B each have computerized files, and, to some extent, each could utilize some of the other agency's information. So they set up a joint operation, halve their operating costs and 1984 is one step closer.

This "gossiping" among supposedly benign agencies could presumably be prevented by appropriate laws.

The second way that data banks grow is by gathering more and more peripheral information. It seems that every time one fills out a new form it has more questions on it than the last one; more personal and more irrelevant questions. While not yet asked to list one's grandmother's maiden name on a form, it may be expected any day. To some of us this is not sensitive data. To some it might well be.

Other information is more sensitive. What may be very pertinent in one's family physician's files would be impertinent in the extreme in the hands of a direct mail advertiser.

The individual should be free to refuse to answer any question on any form that he considers personal, and it should take a court case for the interrogating agency to deny to him, on this basis alone, the services it purports to deliver.

Now let us turn to more malign groups - a would-be dictator, or perhaps organized crime.

Some computer experts say that data banks can be made secure. At best these people can be called over-enthusiastic. As many husbands discovered at least as long ago as the crusades, any lock can be opened by a skilled smith with enough time and enough incentive. Let us look at some of the ways this might happen.

Machine Failure - We have all heard of computers printing out checks for $1,000,000. What one does not hear of, unless he works in or around a machine room, is the number of times a day programs are rerun because of transient hardware errors; but the number is not insignificant.

Logical Errors - Although most logical errors are caught in the program development stage, some persist for a long time. Every large program has undiscovered flaws in it. One very famous example concerns FORTRAN - perhaps the most widely used of all computer languages. The manuals describing the system said that an attempt to take the square root

of a negative number would result in a value of zero. It was many years after FORTRAN was designed and had gained world-wide acceptance that someone discovered that the square root routine actually returned, not zero, but the square root of the absolute value of a negative number. If this supposedly glaring error could pass undetected for years, what subtle flaws could there not be in a data bank supervisory program?

Wiretapping - If a data bank is remotely accessible, then an enterprising group could soon have copies of most of its data by tapping one or more of the phone lines leading between the central computer and the remote terminals. Of course "scramblers" are available, but that just brings us back to the problem of locks again.

Unintentional Compromise - When a request arrives for data out of the bank, there must exist some kind of validation procedure that establishes the requestor's right to the data in question. Now, if there are many different people requesting information, the validation procedure cannot be too complicated if the system is going to be useful. Generally speaking, the computer industry has relied on the use of one or more "passwords" for gaining access to a system. If a person signs on the system, says he is Mr. Smith, then presents the secret code word that "only" Mr. Smith knows, we generally let him in. This, of course, can be elaborated into many levels with new and different passwords (secret codes) being required at each succeedingly more sensitive level. We can change the code words every day; every 15 minutes if necessary. But eventually, if the user presents the right keys at the right times, we open the locks. If Mr. Jones should somehow get hold of Mr. Smith's secret codes, we would have to believe he was Mr. Smith (if he said he was) and let him into the system.

Pseudo Sign-On - A couple of enterprising high school students in Amherst wrote the following program for their own "amusement." We have several teletypes in the computing center that are permanently connected to the computer. Operation over permanent leased lines is quite common and would be equivalent. These boys wrote a program which mimicked the normal sign-on procedure of the system and requested (as usual) the user to give his user number and secret code. They would leave the terminal running with this program in the machine and an unsuspecting user coming up to the terminal in question would think he was talking to the system, while actually he would be talking to their program. Once the user number and secret code were captured, the program would write them out onto a file so the students could examine them later, and then it would fake a "disaster" (system crash) so that the user would be forced to sign-on again - this time to the real system, and never know that his code was no longer secret. By the time they were caught these students had "secret" codes of over 100 users. Fortunately, we don't keep classified information on our time-sharing system.

Eavesdropping - We have a second generation machine (CDC-3600) which has write and execute protection but no "read" protection. With third generation machines this situation could be simulated by judiciously grounding out the read protection circuits. Since reading "out of bounds" is not a usual activity, this might go undetected for a long time. How many systems have incorporated in them a check of that circuit? In any event a computer science graduate student wrote a fairly simple program that would eavesdrop on the I/O buffer of any other terminal and reproduce a copy of all transactions on his own terminal. The programming consultants at our center now use this program regularly to help distant users debug their programs.

With a bit of modification this program could scan all the ports looking only for sign-on codes and list them as they appeared.

Mini Computer Code Crackers - Mini computers of high capability are now available for under $5000. For an additional $1000 one can purchase about 10 telephone adapters (data-sets or modems) and set up a lucrative business cracking codes. The mini computer calls up the time-sharing system, presents a user number, and "tries" a particular secret code. If it doesn't work the mini calls again and tries a new one.

Now on a typical system a secret code is any combination of four letters, say: ABCD. There are roughly 360,000 possible codes (26^4). If each try takes 10 seconds and we have 10 data sets working, we are making one try per second or 3600 per hour. With average luch we should hit on the proper code after trying half the possible codes, or in about 50 hours of trying. If the time-sharing system is operating 16 hours a day, that represents an average of two codes cracked per week.

Suppose the entire mini computer plus data sets costs as much as $10,000. At typical leasing costs this would rent for about $200 per month, or $50 per week. This makes the cost of cracking a code a ridiculously low $25.

Subversion of Operation Staff - Perhaps the weakest point in the security of any system is the staff that operates the machine. Peter Ustinov in the movie "Hot Millions" has explained this fully.

Bad Data - Erroneous data entered into a bank unintentionally is bad enough, but the possibilities for character assassination available by entering intentionally false and derogatory information into a data bank are staggering.

Authorized Misuse - So far, we have mentioned hardware, software and personnel problems, against which some safeguards can be provided. What will be the most difficult to control will be the overzealous administrator who can, and must, because of his job, have access to the data banks at will. I don't think we will ever appreciate how lucky we are that Hitler and Company were defeated before computerized data banks became available.

Suggested Paths of Action

In the previous section we have tried to point out that any data banks at all contain dangers that can only be partially guarded against. Yet data banks already exist and will undoubtedly proliferate. In this section, we wish to suggest some possible paths of action that might prevent some of the most serious abuses of these systems. These fall into two broad categories: Protection of the individual, and control of the agencies maintaining data banks.

Protection of the Individual - There are a number of steps which can be taken to protect individual rights. Some might require new laws, some, new interpretations of existing laws. All might possibly be contained in a new amendment to the constitution. The right to refuse to answer non-pertinent or impertinent questions. The 5th Amendment protects

the citizen in court. Military codes of ethics require prisoners-of-war to give only name, rank and serial number. The private citizen needs to be protected from being forced (however subtly) to answer questions he considers to be personal. An agency collecting data should be required by law to accept a "refuse" answer as fulfilling all its requirements for information until it can be established in court that the desired information is indeed necessary to enable it to do business properly. Obviously, loan agencies need to know how deeply one is in debt before deciding whether they will lend money or not. Other examples are legion.

Right of Access - A citizen is guaranteed the right to face his accusers in court. He should also be permitted to examine any files, anywhere, that relate to him. Semiannually copies of files should be automatically mailed to each individual. Other copies might be provided at cost.

Right of Challenge - If an individual feels that a file contains erroneous information about him, he should have the right to 1) add explanatory information, and 2) challenge the validity of the file. This second course of action should have the effect of removing that file from the data bank until the challenge is resolved in some legal fashion. The provision of local Ombudsmen will simplify these actions for the average citizen.

Right of Restriction - An individual should have the right to restrict, at his discretion, the circulation of a file concerning him. Perhaps a more positive approach to this would require his cooperation (signature, for example) before the file could be opened and/or copied.

Regulation of Data Banks -

At the other end of the scale there must be control and regulation of those maintaining data banks. The problems concerning those data banks which are necessarily secret must be examined carefully with the interests of the private citizen in the forefront.

Regulatory Commission - Congress should establish a regulatory commission with full powers over the collection, use and dissemination of personal information. This should be autonomous, but subject to Congressional control lest these very guardians be left unguarded. They should be provided with the very best of technical counsel on their own payroll. Some areas within their spheres of interest might include:

Disclosure of Distribution - All questionnaires should list the agencies that will have access to data supplied by the individual thereon.

Disclosure of Access - The individual should be notified whenever anyone examines his file. This notification should include the date, the agency examining, and the reason for the examination.

The Cost of Protection of the Individual - Let us take as a starting point the cost of a bank check. This is typically around 10¢. For this price a bank will take a piece of paper and convert it into money and provide you with a monthly record of all transactions. Particularly if the check must go from one bank to another, there are several humans involved in the processing so one cannot assign more than a penny to the computer processing involved. This would seem to be a small cost to impose on say a credit bureau which charges several dollars for a credit reference.

Flying Squads - The Commission should maintain one or more "flying squads" of programmers and engineers who, without prior notice, appear at a data bank and "take over" to test its compliance with the law. This will help to keep the computer room personnel honest.

Devil's Advocates - The Commission should retain several astute, devious, highly trained programmer-engineers whose job it is to try to find ways to "crack" the various data banks. These people should be rewarded sufficiently well as to make selling out unprofitable, or at least unnecessary.

Mergers - Data banks should not be merged without the permission of the Commission, and then only for compelling reasons. Keeping data banks sufficiently segmented is a built-in safeguard that will make it much more difficult to misuse total information on an individual. Bonafide research in Public Health or Sociology would be helped, not hindered, by strict control of data banks, because it would increase the people's confidence that data collected would be treated confidentially.

Conclusions

Perhaps the problem of data banks could be greatly alleviated if the concept of "property" were to be extended to cover information about an individual. There is probably some precedent for this in common law, where a man's "good name" is his most precious possession. If the law recognized that information about John Smith belonged to John Smith to do with as he chose, many problems could be easily handled. Maintaining a data bank would then be a privilege, not a right, and hence could be licensed and controlled. John could lend information about himself, or he could sell it if he desired, but it could not be forcefully, or covertly wrested from him. Name, address and social security number are required by law. All other information is at the owner's discretion.

EXPERIENCE AND PLANS IN THE USE OF COMPUTERS FOR UNDERGRADUATE INSTRUCTION — CONFERENCE, JUNE 23-25, 1971

Dr. Fred W. Weingarten, Director
Computer Services
Claremont College
Claremont, CA 91771

A grant of $50,000 has been awarded by the National Science Foundation to Dartmouth College for a Conference on Computers in the Undergraduate Curricula. The Conference is to be held at Dartmouth College in Hanover, New Hampshire, June 23, 24, 25, 1971.

The purpose of the conference is the dissemination of actual experience and plans in the use of computers in undergraduate instruction. Referred submitted papers will comprise the bulk of the conference, which will have parallel sessions; invited papers, panel discussions, and demonstrations will round out the meeting.

The scope of the Conference will be national. Content will be broad enough to encompass most academic fields at two and four-year colleges as well as at undergraduate schools of universities. For a similar conference held last summer at the University of Iowa, nearly 200 papers were submitted.

NEW YORK STATE IDENTIFICATION AND INTELLIGENCE SYSTEM

Burroughs Corporation, Business Machines Group, Public Relations Office
Second Ave. at Burroughs
Detroit, MI 48232

In the State of New York, fewer innocent citizens are detained for a significant length of time and more criminals are arraigned more quickly as the result of efforts by the state supported criminal justice agency located in Albany, New York.

The New York State Identification and Intelligence System (NYSIIS) is a computerized record-keeping agency which houses more than seven million criminal and non-criminal fingerprints and corresponding identification and case history data. The agency makes the data available through a communication network to over 3,600 agencies of criminal justice in New York State. NYSIIS was created by statute in 1965, as an agency within the Executive Department of the New York State Government.

Objectives

The ultimate objectives of NYSIIS are twofold: (1) improvement of criminal justice administration through systemic computerized information sharing, and (2) protection and enhancement of civil liberties. NYSIIS has made significant strides toward these objectives since its establishment over five years ago.

Here is an example of how NYSIIS can protect civil liberties.

A person is arrested and fingerprinted by the Nassau County Police Department. The Nassau County Police Department (NCPD) has one of the forty-one facsimile installations located throughout the state which can electronically transmit to NYSIIS a copy of the set of fingerprints in a total of 14 minutes.

Following receipt at NYSIIS and classification of the prints, the NYSIIS computer, a Burroughs B5500 soon to be replaced by a larger B6500, searches more than two million stored classifications in no more than 35 seconds to ascertain if there is a prior criminal history on file in the agency for the individual. If there is, a record of it will be sent in 4.5 minutes by facsimile to the Nassau County Police Department. The entire process takes no more than three hours.

Time for Fingerprint Search

Previously, the fingerprint search routine took from seven to ten days during which time many persons were unnecessarily detained without bail, or, in the alternative, released when the record would warrant their being held.

According to NYSIIS Director, Dr. Robert R. J. Gallati, "More rapid and positive identification of perpetrators of criminal acts means that the innocence of possible suspects is established sooner and with more certainty. Victims may be more readily compensated for their suffering and financial loss and they are spared undue harassment from lengthy and traumatic investigation. Offenders' rights are likewise better protected for they may, in appropriate cases, receive summonses in lieu of arrest, or if arrested, be discharged on their own recognizance. Judicial officers will have the necessary data to fix bail or sentence, or otherwise rapidly dispose of cases, thereby preserving the civil liberties of offenders and according them due process, while at the same time, knowledgeably protecting society from those offenders who are a threat to the community."

If the arrestee in the above example had a record, the Nassau County Police Department would receive a "rap sheet" defining his criminal history. This information would then be used by agencies along the criminal justice continuum to see that his case is handled appropriately.

These summary case histories contain such information as: personal description, arrest charges, dates and places of arrest, arresting agencies, court dispositions, sentences, institution data and information concerning parole and probation. It is planned to expand these case histories to include considerable additional data as the system evolves.

NYSIIS began to produce "rap sheets" directly from the computer during 1969, becoming the first agency in the world producing summary case histories by computer. The NYSIIS computer prints out "rap sheets" at the rapid rate of 1,040 lines of record information per minute from a vast computerized data base containing more than 400 million bits of criminal history information.

Fingerprints sent to NYSIIS during calendar year 1969 via the Statewide Facsimile Tramsmission Network reached a total of 57,847 compared with totals of 46,956 in calendar 1968 and 25,062 in 1967.

Facsimile Network

With the completion of new installations during 1969, the facsimile network now covers 41 locations of which 32 are in law enforcement agencies and the remaining nine are used to service the courts, probation departments and district attorney's offices in the five boroughs of New York City.

The heaviest contributor of facsimile prints during 1969 was the New York City Police Department

with a total of 34,483, followed by the Nassau County Police Department which submitted 7,517 sets of fingerprints.

Although budgetary constraints make it impossible for NYSIIS to install facsimile equipment in all of the criminal justice agencies throughout the state, wherever such equipment has been installed it is with the agreement that the equipment be constantly available for the use of all criminal justice agencies in the immediate area. Agencies that do not have facsimile equipment available on site should bring fingerprint cards to the nearest facsimile installation, with the request that such prints be transmitted to NYSIIS at the earliest possible moment.

Fingerprint Identification and Coding

Approximately 60 percent of the fingerprints received by NYSIIS (currently averaging 1,850 per day) are not "identified" as a result of the name search that is conducted in the Name Index Section. This means that every day about 1,100 sets of fingerprints — or 11,000 individual prints — must be carefully analyzed and fully classified before a technical search is conducted by the computer or, in certain cases, by manual means. The purpose of the technical search, of course, is to determine whether the individual does have a prior record under a different name, which would explain why the search in the Name Index Section had proven negative.

During the course of one year, a technical employee assigned to the Classification Section will carefully study and analyze approximately 200,000 fingerprint patterns. The task of a classifier is to study the ridges in each pattern and then make a determination, based on specific rules contained in the American System of Fingerprint Classification textbook, as to whether the pattern meets the loop, whorl or arch requirements.

There are small loops and large loops, small whorls and large whorls — and varying ridge counts are actually the basis of the formula that the computer uses in selecting one particular classification from among the hundreds of thousands of other similar classifications within its memory.

Latent Fingerprints

Another area of fingerprint record-keeping that NYSIIS makes available to the New York State criminal justice agencies is the Scene-of-the Crime (Latent) Fingerprint File. This latent file, one of the largest in the nation and continually being expanded, contains scene-of-the-crime latent prints and the fingerprints of several thousand selected individuals well known to the police — individuals who have been convicted of homicide, burglary, robbery, car theft and similar felonies. Fingerprints developed at the crime scenes (latents) are submitted to the NYSIIS Latent Fingerprint Section for searching and comparison. Latents not identified are added to the base file and are continually compared against incoming arrest prints.

In 1969, trying to develop an even more effective Latent Fingerprint Processing System, NYSIIS and the law enforcement agencies in Onondaga County participated in a pilot research study called, "The Latent Value Field Study."

A small defined area of Onondaga County, with a high burglary crime rate, was selected for the study site. All burglary crime scenes within this designated area were searched for latent prints by the investigating police officers. The Criminalistics Research Bureau of NYSIIS used experimental semi-automatic coding techniques to prepare a base file for the area against which incoming latent fingerprints were rapidly checked.

As a result of this pilot study, 69 latent fingerprint cases were submitted to the NYSIIS Latent Fingerprint Section for searching. Six perpetrator identifications were made on the basis of only scene-of-the-crime prints without other clues or any other reason to suspect the previously unknown individuals who committed the crimes.

"The latent fingerprint records are one of the most important areas in which NYSIIS is involved," Gallati said. "Because criminal mobility from city to city is quite frequent, and because our criminal and latent fingerprint files are two of the largest in the nation, we have become a valuable service to all agencies of criminal justice throughout the State of New York.

"If law enforcement agencies take the initiative to detect latent fingerprints at crime locations and send them to NYSIIS, we know that we have an excellent chance of making a 'hit' on rapists, murderers, arsonists and other criminals," Gallati stated.

Computer Capacity

NYSIIS was originally computerized in 1968 and is in the process of installing a new, larger computer to handle their rapidly growing data files. A Burroughs B6500 computer will replace the present B5500 which is operating at virtually 100 percent of capacity around the clock every day of the year. Its data storage already exceeds maximum load for a single processor.

Grants

"One of our greatest contributions to the criminal justice system has really been from a scientific technology point of view," Gallati said. "Thanks to confidence displayed in NYSIIS by the Governor and the legislature and hundreds of thousands of dollars in Federal Grants, we have been communicating with most leading research and development people throughout the country. We have also visited major research laboratories around the country and we are continuously relating new technologies to our needs in the interest of new capabilities, improved efficiencies and lower costs."

NYSIIS received $425,000 in Federal Grants for new and ongoing projects in 1969. These projects include: a personal appearance study; an auto related crime study; an evaluation of organized crime; a concept evaluation of modus operandi (methodology used in committing crimes); a nationwide computerized retrieval system for criminal history; research and development on modus operandi; a probation and parole system requirements study, and development of a name search technique.

ANTI–ABM ESSAY CONTEST ANNOUNCED

Daniel D. McCracken, Chairman
Computer Professionals Against ABM
4 Inningwood Road
Ossining, New York 10562

This is to announce an essay contest on the topic, "Would you trust the lives of your children to a highly complicated computer system that cannot be checked out?"

The contest is inspired by a letter in the January, 1970, issue of Modern Data, signed by Dr. John S. Foster, Jr., Director of the Office of Defense Research and Engineering in the Department of Defense. Dr. Foster's letter was in response to the statement of Computer Professionals Against ABM, in which we argue that a complex real-time system can only be brought to reliable operational status through an evolutionary process of testing and development under actual operating conditions. This is inherently impossible with the ABM (the Anti Ballistic Missile system). We believe it is extremely dangerous to turn over the control of hundreds of nuclear missiles to a highly complicated computer system that cannot be checked out.

Dr. Foster's reply was that all the individual parts of the Safeguard Anti Ballistic Missile system (radars, missiles, and computers) have been tested separately, and, "thus, the only real task that the Safeguard system has, is to integrate all of these functions in the computer programs and to check thoroughly and test out the programs before the system is made operational." He explained that the testing would be done with simulation tapes "so that the system is exercised just as it would be in a real battle."

If statements like these were made by a student in his first course in computing, you'd give him a C-minus and forget about it; in his second course you'd flunk him and forget about it. But when they are made by a person who controls an annual military R&D budget in excess of $10 billion, you have to think about trying to educate the man. Hence, the contest.

I think 500 to 700 words would be about right. Please send copies to me, Computers and Automation, Dr. Foster (The Pentagon, Washington, D.C. 20310), and (very important) your Senators (The United States Senate, Washington, D.C. 20510). If you can't think of better ones, here are a few points to use for Dr. Foster's edification.

— The full-scale operating system for the IBM System/360 is of the same general order of magnitude of size and complexity as the ABM software. It was thoroughly tested by IBM before release, using simulation tapes as it happens, but after it was released customers discovered literally thousands of programming errors when they used it under actual operating conditions. (Five thousand, to be precise, when my highly-placed source told me the story two years ago.) This isn't a slap at IBM; that's just how it is with big computer systems.

— American Airlines has spent, in round numbers, ten years and $100 million developing a passenger reservations system. It was a near-disaster the day it first went on line with real passengers although it had been thoroughly tested, but after a process of development under actual operating conditions it was brought to a state of high reliability and usefulness. This might qualify as an example of a system that had been tested by itself. So what happened recently when two other airlines tried to do essentially the same job? Well, one result is a $70 million suit by TWA against Burroughs, after cancellation of the contract because the system wouldn't work.

— NASA, which Dr. Foster cites to show that complex computer systems can be made to work, freezes program changes 120 days prior to a launch, then devotes 30 to 45 days to a full-time simulation based on all the lessons learned in previous Mercury, Gemini, and Apollo flights. The computers are run during the simulation by the programmers who wrote the programs in the first place, and later during the real thing the computers are also run by the same programmers. Does Dr. Foster expect the Russians (or the Chinese, or the Portugese, or whoever he's afraid of this week — it changes from time to time) to give 120 days notice of a planned attack? Landing men on the moon doesn't prove that we can make the ABM computer work — on the contrary, it demonstrates all the things that would have to be done that cannot be done.

— A RAND study shows that when a single instruction is changed in a large program, the program works less than half of the time when it is first tried after the change. Since the ABM software would be in a constant state of flux to keep up with changes in the offensive threat as well as modifications for other reasons (such as the complete change of computer now under study), how would it ever be possible to get the programs stabilized long enough to get the errors out? And you can be sure that the offensive threat would change: since the Russians have an ABM system of their own, which their scientists privately say is useless, they already know that the simplest way to incapacitate ours would be to keep forcing us to change it. (When NASA sends men to the moon, nobody jerks the moon out of orbit just as they start their descent.)

CONTEST PRIZE

Computers and Automation will award a prize of $100 to the best essay in this contest meeting the requirements mentioned above and below.

The closing date for receipt of essays (copies of letters) is May 31, 1971 in the office of Computers and Automation, 815 Washington St., Newtonville, Mass., 02160. The judges will be Daniel D. McCracken and Edmund C. Berkeley, Editor of C&A; their judgment will be conclusive. It is expected that the winning essay(s) will be published in the August issue of C&A.

The essay should be written in such a way as to be convincing to a senator or representative in Congress. The length of the essay may be less than 500 words. The essay should meet ordinary requirements for being publishable. All entries will become the property of Computers and Automation. Two copies of the essay should be submitted. The author's name and address and three or four sentences of biographical information about him should accompany the essay.

In case of ties, the prize will be divided. The prize will not be awarded if in the opinion of the judges no sufficiently good essay is received.

Let me close on a positive note, with a constructive suggestion: I urge the ABM computer system designers to provide a thorough system trace, writing the inputs and the system's responses on to tape units deep underground, so the units could survive a nuclear holocaust. Then if the Safeguard system is ever used, the designers of the ABM system for the next civilization — if any — will have the benefit of one debugging run.

The group "Computer Professionals Against the ABM" includes (organizations are listed for identification only):

Executive Committee
Daniel D. McCracken, Chairman, Consultant
Paul Armer, Stanford University
Prof. Joseph Weizenbaum, Mass. Inst. of Technology
Gregory P. Williams, Phoenix, Ariz.

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Max Palevsky, Scientific Data Systems
Prof. Anthony Ralston, State Univ. of N.Y., Buffalo
Prof. Norman R. Scott, University of Michigan
Eric A. Weiss, Springfield, Penn.

REDUCING DUES FOR UNEMPLOYED MEMBERS

Inst. of Electrical and Electronics Engineers, Inc.
345 East 47 Street
New York, NY 10017

The Board of Directors of the Institute of Electrical and Electronics Engineers has authorized the reduction, by 50%, of all dues and fees for those members of the Institute currently unemployed. This step was taken in recognition of the economic conditions currently prevailing.

IEEE members, who are currently unemployed through involuntary termination and are actively seeking re-employment, may continue their IEEE membership through December 1971, with all privileges, publications and services covered by membership dues (and by Group or Society fees, and subscription fees, if any) by payment of one-half of the established dues and fees. To take advantage of this arrangement, please inquire of IEEE Headquarters regarding details.

SOCIAL DATA PROCESSING CENTERS IN THE FORM OF TELETERMINAL TIME

Joseph Auciello, Director
Computer Job Bank
10 Upland Road
Plympton, MA 02367

Perhaps I can make a suggestion that will eliminate some of the misunderstanding between certain student groups and the data processing industry.

I suggest that "social data processing centers" be set up to make computer power available to individuals or groups who are working on problems whose solutions will benefit our society as a whole. The data centers would be manned on a volunteer basis by computer professionals. The computer time would be given thru telecommunication links by computer users; they would be free to give as much or as little CPU time as they choose to the social data center.

This proposal would allow some computer manufacturers and users a way of expressing (to varying degrees) their social concern. By computer use for people and society and their problems, the computer perhaps will cease to be known by some as a mechanical monster responsible for our social ills, but rather will be viewed more properly as an extension of man's mind and intelligence.

COMPUTERS, SCIENCE, AND ASSASSINATIONS

Computers and Automation believes that the possibility of conspiracies in the assassinations of important American leaders in our times is of the utmost interest and significance to every American — and especially to computer people, because computers can be used: to handle large amounts of information easily; to correlate the information rapidly and accurately; to prove or disprove certain theories or possibilities of conspiracy; etc. Therefore, computer people can make a unique and important contribution to society in this area.

Accordingly, Computers and Automation is publishing from time to time articles and reports on: investigations into assassinations; the major evidence; and the application of computers to the evidence. Our purpose is to present important, useful, and authoritative information objectively in order to find out the truth.

"The Assassination of President John F. Kennedy: The Application of Computers to the Photographic Evidence" -- Comment

ANOTHER VIEW

Benjamin L. Schwartz, Ph. D.
McLean, Va.

Note by Edmund C. Berkeley, Editor: In the May 1970 issue, "Computers and Automation" published a 32-page article by Richard E. Sprague, computer professional, with the foregoing title.

This article contained: (1) eleven photographs related to the assassination; (2) a two-page chart of Dealey Plaza, Dallas, Texas, where President Kennedy was shot, showing (a) geographical details, (b) the location (or probable location) of many events in regard to the assassination, and (c) the locations of many of the 75 photographers; (3) a tabulation made over many years by Sprague of some 510 photographs that were taken, and some details about each one; (4) a bibliography of 22 references; and (5) about ten pages of text. This article reported a number of aspects of a study of this assassination made by Sprague from 1963 to 1970. Part 3 of the article discussed how computers could be applied to the photographic evidence, consisting of over 25,000 frames plus 350 still pictures, a task seemingly beyond the capacity of any human being unaided by a computer.

See the notice and advertisement about this article on page 44.

The following article by Dr. Benjamin L. Schwartz, a mathematician and an operations research specialist, has been received, commenting on Sprague's article.

We are glad to publish Schwartz's article since it is a thoughtful, important, and significant polemical attack on Sprague's article, and also on "Computers and Automation" for publishing Sprague's article.

Mr. Sprague has said that he does not wish to reply to Schwartz's article. But I do wish to, and following Schwartz's article, I have put a response.

For readers who enjoy a donnybrook, the two articles are recommended.

I should like to add that in the course of an interesting (and friendly) conversation with Dr. Schwartz, he said his basic position in regard to an argument about a theorem is not whether the theorem is or is not true, but whether the theorem is proved by the evidence offered. In other words, a mathematical paper is acceptable and publishable when the author demonstrates what he says he is setting out to demonstrate, and otherwise it is not acceptable and not publishable.

Outline

Introduction

In the May 1970 issue of Computers and Automation, Richard Sprague published a remarkable article entitled: "The Assassination of President John F. Kennedy: The Application of Computers to the Photographic Evidence". That article claimed to show a number of spectacular things about the assassination. Among them were that the assassination stemmed from a conspiracy; that more than 50 persons were involved in the conspiracy; that among these people were members of the Dallas police force, the CIA, anti-Castro Cuban exiles, and others; that Lee Harvey Oswald was involved in the conspiracy, but did not do any shooting; and that knowledge of all the preceding items has systematically been denied to the American people by a (second) conspiracy of silence and/or distortions engaged in by the news media and certain public figures. Unfortunately, Mr. Sprague failed to prove his case, in my opinion and apparently that of many other readers. In subsequent issues, he has withdrawn many of the claims that he has provided conclusive proof. He still holds to his contention that his version of the assassination is true, but he has admitted implicitly that many of his arguments, as presented last May, were faulty.

The present article brings together a number of objections to the May article, including some that Mr. Sprague has acceded to, and some other, new ones. The reader should read (or reread) the original article in considering the material below.

You may feel that I am being unfair to Mr. Sprague when I attack an argument of his which he has subsequently already abandoned. However, I feel it is appropriate to include both the original claim and

the objections that forced him to withdraw it.

The reason is this: Mr. Sprague's own credibility is part of the issue. In the article, he included many assertions of additional facts about the assassination for which he gave the reader no evidence. For example, he says (p. 50-51) "A ... conclusion ... drawn from photographic evidence ... (is that) ... Oswald did not shoot Officer Tippit; ... two other men did." But Mr. Sprague does not show us the photographic evidence that supports this claim. We have to take his word for its existence. Hence, it is very much to the point to know how good he is at drawing sound conclusions from evidence. When he is shown to be vulnerable on other points, it must reflect in the credence we give to such of his claims as the foregoing.

Statement of Position I

You, the reader, are certainly entitled to know where each of us stands. For my own part, I certainly do not claim to be an expert on the events of Dallas 1963. I am an interested layman, like yourself, willing to consider new points of view as they appear in the public media, but certainly not so involved as to have made any original investigations.

On the basis of the evidence I have seen and the arguments I have heard, my current belief about Dallas 63 is the following: Oswald was the lone assassin who shot and killed John Kennedy; there was no conspiracy; there are many unexplained details, but all alternate explanations I have heard are so far-fetched as to strain credibility beyond reason and leave even more loose ends.

These opinions are not strongly held, and all are subject to change if new evidence comes to my attention. But with the increased passage of time, I think it less likely that there will be change. This expectation is reinforced by seeing Mr. Sprague's miscellaneous collection of loosely connected tidbits offered under the claim of "incontestable proof".

Statement of Position II

If I read him correctly, Mr. Sprague has for his main thesis the following: John F. Kennedy was shot to death in Dallas by several members of a large conspiracy, which Mr. Sprague calls the first conspiracy.

There was also a second conspiracy, which came into being spontaneously, after the killing. The members of the second conspiracy were public figures and officials. The objective of the second conspiracy was to suppress and conceal evidence of the first. The evidence for the first conspiracy was in large part successfully destroyed, distorted, or hidden from the public by the second conspiracy. The evidence for the second conspiracy is a number of what Mr. Sprague calls "strange events". Each of them separately, he admits, has a reasonable explanation. The combination of all of them, however, is too unlikely, in his view, to be accidental.

Commentary I

For reasons explained in more detail in the final section, the writer thinks that it is important for each reader to consider carefully the conflicting positions. Read Sprague's article: read herewith my article; read additionally as you feel necessary; and then take sides.

Before going on, I would note one point on which Mr. Sprague and I agree: the Warren Commission report is seriously defective. But I will show you that Mr. Sprague and the National Commission to Investigate Assassinations (NCTIA) are even further away from meeting any objective scientific criteria for accuracy, in either reporting or deductive reasoning.

Mr. Sprague claims to show positively that "There was a conspiracy"; " ... at least three gunmen ... fired ... at President Kennedy"; ... "Oswald ... did no shooting." (p. 30) He furthermore claims that he will show this "to be true on the basis of substantial conclusive evidence", because " ... there is conclusive evidence".

It does not suffice, for Mr. Sprague to demolish the Warren Commission: and indeed that had already been done before him. Rather he must build his own case with "undeniable evidence" (p. 30) to survive the same exacting scrutiny that was given the Warren Commission report.

Commentary II

Mr. Sprague's basic position is certainly a hard one to attack. If evidence for the first conspiracy is fragmentary, uncoordinated and unsubstantial, that merely "proves" how effective the second conspiracy has been. If you find any of the "strange" events of the second conspiracy to be not so strange in your eyes, — well, Mr. Sprague has already admitted that each separate event has a reasonable explanation.

However, it seems to me that the relative invulnerability of Mr. Sprague's position is less a proof of its validity than a tribute to his debating style. He is ingeniously turning any apparent damaging circumstance into an actual asset.

Inconsistency I

This ability to work both sides of the street is manifest many times in the article. For example, consider the question of people departing from the murder scene. On page 36, he describes how several men have been photographed shortly after the killing, running away. At least one of them leaves in a conveniently parked, nearby car. This hasty departure is taken as evidence of guilt.

But a little later on (p. 50), he considers a hypothetical conspiracy member called the umbrella man. Does he make a fast getaway? Indeed not! Mr. Sprague describes the many pictures taken later on in the day that still show the umbrella man hanging around aimlessly. This delay Sprague seems to find also suspicious.

If both early and later departures can be interpreted as signs of guilt, I wonder what the innocents did!

(We shall return later for more about the umbrella man.)

Inconsistency II

Another example of Mr. Sprague's unusual logic is seen in his attitude toward the Warren Commission and its members. He has bitter words (p. 34) for the unwillingness of Justice Warren and others to

give ear to and respond to the many criticisms of their report. Their silence is construed as evidence confirming the NCTIA theory.[1] But when one of the Commission (Sen. Richard Russell, p. 59) does speak out along the lines Mr. Sprague seems to desire, that too is taken as being in full accord with Sprague's theories. Both the open mind and the closed one work in his favor. He had devised chains of argument under which any evidence, or no evidence at all, can be construed to help his case.

Computer Relevancy

I confess to having originally plunged into the article eagerly in hope of finding both new insight into the John Kennedy assassination and new information about computer applications. Both hopes were futile. I claim that the material is not computer-related, and should not have appeared in C&A.

Some quantitative facts tell the story. The article occupies 32 pages of the issue. Of this, about one third is narrative text; another third is tables, notes, and similar material; and the remainder comprises photographs and drawings. Of these 32 pages, less than three (1-1/2 text; 1-1/3 tables) are given to computer applications. In this brief section, the material consists of vague generalities about how computers might be used. There is no description of any actual use of computers. Neither is the material sufficiently specific to permit an analyst to reduce the suggestions to practice.

In short, the conclusion this writer reaches is that the computer part of the article title, and the computer related addendum (Section 3) of the article were afterthoughts, appended to give a tenuous justification for this particular journal to publish the article.

Editorial License

Granting that this is simply this writer's inference, there is some additional evidence to support it. I suspect that the editor, Mr. Berkeley, believes Mr. Sprague's thesis of a conspiracy and desires to publicize it. I also suspect he is aware of the defects in Mr. Sprague's presentation. Mr. Berkeley, in his editorial (p. 6), refers to the article as "one of the most important .... we have ever published". Among the reasons he cites for his decision to publish are the "opportunity .... to help important truths become known". Yet even while believing that Mr. Sprague has an "important truth," Mr. Berkeley admits "It is possible that .... Sprague's article does not prove ... nor adequately support ...." the assertions.

Among Mr. Berkeley's other stated reasons for publishing are a social conscience; the use of glossy paper in C&A (permitting high quality reproduction of the photographic evidence for the readers to examine); and his relative freedom from advertiser pressure as a paid circulation magazine. None of these has anything to do with the computer business.

But his other reason does. The article, he claims "focuses on .... computer-assisted analysis of .... data .... to solve a crime". But as I have noted, that certainly is not the "focus" of the article; and the degree of justification obtainable from this one, rather contrived, argument would not, I am sure, win admission for any other subject as remote from the main stream of interest of readers of C&A.

Retreat I

Mr. Sprague has now admitted the correctness of this objection. In the July 1970 issue of C&A he says, "The conclusions stated in the article were arrived at by the author before the computer applications to photographic evidence were begun".

In correspondence with me, Mr. Berkeley also has admitted to me that the computer relevance of the article is marginal. But Mr. Berkeley has also pointed out that C&A does publish non-computer related material, e.g., Kingman Brewster's article in the February 1970 issue. However, according to the announced editorial policy concerning such articles, they are to appear in a special department ("The House is on Fire") specifically created to carry such papers. Mr. Sprague's article was not published in that department. It tried to "make it" on computer relevance, and failed.

An Impossibility

On page 32, Mr. Sprague describes an "interesting event" concerning the discovery of Jim Hicks by New Orleans District Attorney Jim Garrison.

"(Hicks) showed up voluntarily in Garrison's office. Garrison and .... Jones Harris suddenly realized that they had seen his picture before .... the photograph Harris had seen is a picture of Hicks .... (See Figure 11)". (p. 32). Figure 11, on page 33 is a somewhat blurred 7 x 9 enlargement. It shows several men SEEN FROM THE REAR. The one identified in the caption as Hicks has visible no part of his face whatever. It is simply impossible that anyone could "suddenly recognize" the subject of that picture.

Mr. Sprague has subsequently explained that the identification by Jones Harris was based upon the build, hair style, and clothing of the subject. Since these are the only visible features of the man in Figure 11, there seems to be nothing new in these comments. If a reader previously doubted that a person could be identified from a rear view, he will still doubt it. (Another input supplied by Harris is that Mrs. Hicks supposedly confirmed the identification, after the fact. Obviously, this has no bearing on Harris's original 'sudden realization'.) In fact, as far as I can see, Mr. Sprague has added nothing except that he has nothing to add. Neither do I. I am quite willing to have the reader examine Figure 11 and decide whether he believes that a person like Jones Harris, who did not know the subject, could identify him from the picture.

Retreat II — An Invisibility

In the original article, Sprague claimed that the picture showed that Hicks was carrying radio equipment in his hip pocket, and an antenna could be seen trailing behind him. This claim has now been withdrawn. It is acknowledged that no antenna can be seen. (C&A, July 1970, p.32)

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[1] My own conjecture is that Justice Warren had foisted off on him a difficult and unpleasant job for which he was not qualified by training or temperament. After doing his best in the year of the Commission's existence, he had no stomach for further acrimony over a distasteful topic.

Of course, my making such a suggestion automatically makes me suspect as a member of the second conspiracy. Indeed, I have been asked bluntly about my connections with the CIA! Needless to say, there are none.

However, Mr. Sprague still claims that the antenna is there, and he cites as proof that he has another print of the same photograph in which this object is visible. Mr. Sprague adds that he will show this to anyone who wishes to see it and comes to see him.

It is clearly impossible for more than a few of among the thousands of subscribers to C&A (many from abroad) to make such a visit. For the vast majority of the reading audience, the argument has been changed. The original theme was: "Look! Here it is! See for yourself!" It has now become, "I, Richard Sprague, have seen the evidence. Take my word for it! Believe in me!"

There can be no doubt that Mr. Sprague is honest in his conviction. He has investigated, and he is deeply convinced of the truth of his claims. His sincerity is not at issue, and never has been. His credibility is.

For that reason, I cannot accede to his plea that I should take his word for something; and I do not think that other members of the general readership should either. Mr. Sprague is well aware of the extent to which an argument is emasculated when the evidence in support of it, instead of being openly published for all to see, is limited to a small audience. This is one of his main complaints about the Second Conspiracy. He can hardly expect that we will exempt him from the same criticism when it applies to the other side of the case.

Insanity — Retreat III

Sprague adds that Hicks is now confined to a mental institution. Perhaps we are to believe that this is part of the national conspiracy to suppress the truth. For myself, I find it perfectly reasonable that Mr. Hicks may be deranged. Even casual readers of criminology literature are well aware that every sensational crime brings forth a large number of guilt-seeking mental cases to "confess". Mr. Hicks may or may not be one; but if he is not, it is up to Mr. Sprague to show this.

On the question of Mr. Hicks' mental competence, Mr. Sprague has been eloquently silent, despite several reader inquiries. He gives his source of information on Hicks confinement as a newspaper story (despite his mistrust of the news media). He leaves us no reason to doubt that Mr. Hicks is actually a valid mental case. It leads one to wonder how good the case for conspiracy can be when one of the star witnesses is apparently psychotic. The exact question was addressed in the Clay Shaw trial in New Orleans, cited by Mr. Sprague (p. 31). The decision made by the jury there is well known: No conspiracy.

An Inaccuracy

By far the clearest of the pictures in the article is Figure 10, understandably taken by a professional photographer, James Altgens. Mr. Sprague rightly draws many conclusions from a careful examination of that picture. But one of them is certainly wrong. He says "Governor Connally had been hit .... He can be seen with his face contorted." (p. 47).

Well, hardly! The person identified as Gov. Connally is turned away from the camera; and we can see only a 1/4 view of his face. His ear and cheek are clearly visible. The tip of his nose shows in profile. And a corner of the left eye. (I think the eye is open, but even with a magnifier, I cannot be sure.) His mouth is hidden by the shoulder of the passenger in front of him. His expression is masked from us. If Mr. Sprague sees the face "contorted" he is using a vivid imagination, not a scientific detachment.

This point has no apparent bearing on the assertion of conspiracy. I mention it because Mr. Sprague raised it in the first place. Perhaps he thinks it relates to his case. It certainly does have a significance in our evaluation of his competence in photointerpretation.

An Implausibility

On page 34, Mr. Sprague discusses the 6th floor window from which the shots were alleged to have come. He gives us two photographs that show this window, respectively ".... exactly 5.7 seconds before .... and exactly 3.5 seconds after" the shooting. I am impressed with the precision of the time measurement: 100 millisecond accuracy!

But I must question how such precise determination is possible. Regarding a different photograph (Figure 10) he explains carefully how precise time determination is accomplished. In the razor-sharp print of photographer Altgen's picture, the auto wheel position can be measured relative to the center stripe. A comparison with the Zapruder movies permits exact time matching.

But for Figure 6 and 7, such an argument will not do. Figure 7 is sharp, but it shows only a building wall, with no distinguishing feature, no moving elements (except people), no way to relate to other pictures. In Figure 6, the street can be seen, but the print is so fuzzy that the vehicles cannot even be identified as to make, much less exact position on the road. So the precise time determination, if done at all, must be accomplished by some other mechanism. But without being told what it is, the reader is asked to accept that these "two pictures destroy the Warren Commission's findings". (p. 35.) I don't think Mr. Sprague has proved his case.

A Contradiction

Let us remain with those two pictures of the fatal window. Mr. Sprague correctly says "the first .... shows the window with only a box appearing in it. The second .... shows the window with only the box in it." He is right.[2]

But look again. THE BOX HAS MOVED! Although we may now know exactly when the pictures were taken, or even which came first, we are sure that somebody was at the window between those two exposures. If Mr. Sprague's times are accepted as correct, then in the 15-second period covering the shooting, someone was in the room, at the window.

Yet Mr. Sprague has flatly asserted (p. 30): "At least three gunman.... (none of whom were in the sixth floor easternmost window of the Texas School Depository Building).... fired.... at President Kennedy." (My emphasis). And again (p. 35) "No one fired any shots from the window." (Emphasis in original). How Mr. Sprague converts certain evidence that somebody was present (the moved box) into the conclusion that no shot was fired is a step that evades me.

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[2]Almost. A small corner of a second box shows also in Figure 7. But that might be because of a different angle of view.

Another Contradiction

Mr. Sprague considers a hypothetical "umbrella man" (mentioned previously), (p. 50) who might have been the on-the-scene commander. The umbrella man is supposed to be seen in Figure 9 with his umbrella "open and low over his head". Figure 9 is too fuzzy to be sure of. But there is, in fact, in Figure 8, a corner of something that might well be an umbrella.

But the man himself cannot be seen; he is hidden by the shoulder in the foreground. The statement that he is holding it "close over his head" comes from the same vivid imagination that created Gov. Connally's facial contortion.

More important is the umbrella man's position. In the text (p. 50), Mr. Sprague places him "in front of the Stemmons Freeway sign", which is confirmed by the drawing on pages 48-49. Even the reason is given: "So that people on the western side can't readily see him and people in front of the sign are facing away from him." (p. 50).

But he was not in front of the sign. If there was an umbrella it was behind the sign. In Figure 8, the left hand vertical standard of the sign can clearly be seen in front of the presumed umbrella. Or perhaps Mr. Sprague wishes us to believe that the umbrella man is in front of the sign, but the umbrella is behind.

An Irrelevancy

Mr. Sprague devotes four pages of pictures and half a page of text to "the 'Tramps' and the 'Phoney Policeman'". I am at a loss to explain why. They prove nothing about the supposed conspiracy. All they show is that there are some loose ends in this case. But that was known and acknowledged long ago.

Mr. Sprague appears to find it "significant" (p. 36) that the tramps were questioned but no record exists of their being booked. He seems to feel this is unusual.

It is not. Every day, all over the country, people are detained for questioning,[3] sometimes in the station house, and then released without being booked. It is commonplace. It has happened to me. It will happen several hundred times on the day you read this. For Mr. Sprague to appear to find something suspicious in it indicates either a lack of candor or an incredible naivete about police procedures.

On Scientific Attitudes

Are Richard Sprague and the NCTIA prophets without honor, or are they cranks: It is important to decide. Martin Gardner, in his witty and scholarly book on pseudo-science, Fads and Fallacies in the Name of Science (Dover, 1957) includes a chilling reminder that in the 1930's, a renaissance of German quasi-science paralleled the rise of Hitler. He asks pointedly "If the German people had been better trained to distinguish good from bad science, would they have swallowed so easily the insane racial theories of the Nazi anthropologists?"

I share with Sprague, Berkeley, and Gardner the concern that the people should be informed. In his opening chapter, Gardner gives several clues that often help identify the quack or quack group. Here is that list.

1. They work alone, without interacting with other organizations in the field (in this case, criminal investigation).

2. They claim this isolated status is involuntary and due to the prejudice of the establishment.

3. They continually remind readers of earlier historical suppression of truth.

4. They publish outside conventional channels.

5. They believe themselves to be geniuses, and those who oppose them, idiots.

6. Everyone is out of step but them; and they proclaim their dedication to truth, and their absolute assurance that they have found it.

7. They believe that any opposition is the result of a "dastardly plot", a conspiracy, if you will, of the establishment.

8. Their attacks are aimed at the highest persons and the best-established theories.

9. And finally, they often invent their own jargon.

Gardner makes it clear that no one crank is expected to fit all these characteristics. Certainly Mr. Sprague does not. He does not claim genius status for himself, nor invent any private jargon. And his target, the Warren Commission report, is not sacrosanct.

But he does appear to believe absolutely in the "truth" he has discovered; and that there is a vast conspiracy opposing him (points 6, 7). Not only does the NCTIA not work with the FBI and other criminal investigation organizations, it classes them with the conspiracy (points 1 and 2). Sprague believes that all the news media in the country except one newspaper gave a "very distorted" report of Clay Shaw's trial in New Orleans (p. 30). All but the one were out of step (point 6).

In addition, Mr. Sprague has not succeeded in getting a hearing in the normal channels and has aired his view in a journal whose mainstream interests are entirely foreign to his subject matter (point 4). He blames this lack of access to public eye on the conspiracy of the publishers, (point 2), rather than the quality of his manuscript. (On this point, the reader must be his own judge.) He also inserts an entirely irrelevant comment (p. 30), reminding the readers that (over 60 years ago) the press was reluctant to believe and publicize the accomplishments of the Wright Brothers (point 3). The reader may find other matching characteristics.

Conclusion

Are those enough reasons to dismiss Mr. Sprague and the NCTIA as cranks (in the criminology field, at least)? I think so, especially when they are combined with inaccurate photointerpreting. But each reader must decide for himself. And I believe Mr. Sprague will agree with me on this one final point, if on nothing else. Each of you should decide for yourself.

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[3] In common, though slightly inaccurate parlance, this is called "arrest".

Response

Edmund C. Berkeley
Editor, Computers and Automation

Outline

1. Two Propositions
2. Proof of Proposition I: "Oswald was not the sole assassin and there was a conspiracy."
3. Evidence for Proposition II: Sprague's alternate hypothesis
4. The Dimensions of an Article in "Computers and Automation"
5. The Computer-Relatedness of Sprague's article
6. The Case of Jim Hicks
7. The Decision of the New Orleans Jury in the First Trial of Clay Shaw
8. The Chart of Times of Events
9. Some Other Specific Points
10. Clues for Identifying Quacks and Cranks
11. Mental Resistance to New Ideas
12. Defects in the Warren Commission Report

1. Two Propositions

There are two completely different propositions (or groups of propositions) put forward in the May 1970 article by Sprague (see page 30 of the May issue).

One is a very narrow proposition, which I shall call here Proposition I:

> The conclusion of the Warren Commission [that Oswald was the sole assassin and that there was no conspiracy] cannot be considered true by any person who carefully considers the crucial evidence -- such as the physics of the shooting, the timing of a number of events, and other important and undeniable facts. In other words, Oswald was not the sole assassin, and there was a conspiracy [page 30].

Only in regard to this Proposition I does the article assert:

> This article will develop that thesis, prove it to be true on the basis of substantial, conclusive evidence, and in particular some analysis of the photographic evidence [page 30].

The other proposition (or group of propositions) -- I shall call it here Proposition II -- relates to a number of topics: (1) the number of persons in the first conspiracy ("more than 50 persons were involved in the conspiracy at the time of the firing of the shots"); (2) the number of shots fired (Sprague maintains that 6 shots were fired, while another of the authorities, Josiah Thompson, a professor of philosophy at Haverford College, author of "Six Seconds in Dallas", maintains that four shots were fired); (3) the second conspiracy to cover up the first one; (4) arrests, with no record of persons arrested; etc.

In the May article by Sprague, evidence is offered for Proposition II. But no assertion is made that Proposition II is demonstrated. Instead, in many places there are queries and questions about what the details might be for the alternate hypothesis.

2. Proof of Proposition I

Proposition I is that:

> Oswald was not the sole assassin, and there was a conspiracy.

The proof is extremely easy, because there are many undeniable pieces of evidence, any one of which if firmly established is sufficient. (In the same way it is easy to prove the negative theorem that not all odd numbers are exactly divisible by 7, by exhibiting a single odd number (such as 11) which is not exactly divisible by 7.)

Here is what seems to me the simplest proof that I am aware of:

> 1. It was physically impossible for one man, shooting during the time the target (President Kennedy) was in line of fire from the 6th floor easternmost window of the Texas School Book Depository Building, to have fired all the shots (at least four, and probably five or six) for which there is overwhelming physical evidence.
> 2. Therefore, since two or more men were firing in precisely the same interval of approximately 6 seconds, there was a conspiracy to assassinate Kennedy, and Oswald (it is entirely conceivable that he might have done some of the shooting) was however not the sole assassin.

Of all the proof which I have seen or studied, the most spectacular and convincing to me is the explosion of President Kennedy's head, to the left and backwards at the time of the fatal shot, shown in the Zapruder film at frame 313 (see p. 35 of the May article by Sprague). I studied physics in preparatory school and again in college, and I know that when an object is hit hard from a given direction, that object has a tendency to move in the direction from which the hit comes, because of the law of momentum. It is impossible for any shot from the direction of the Texas School Book Depository Building to have driven the President's head backward and to the left as revealed by the sequence of frames Z312, Z313, Z314.

The Warren Commission saw the Zapruder film, and looked at it at least several times. For them to have accepted the conclusion that Oswald was the sole assassin and that there was no conspiracy demonstrates (from my point of view) that they cheated. It also demonstrates a second conspiracy.

For LIFE magazine to continue to refuse to show the original, clear Zapruder film year after year since 1963, to my mind, demonstrates the enormous, continuing power of the second conspiracy -- the slogan of which is "national security."

I watched a bootleg copy of the Zapruder film on May 1, 1970; I watched it played over and over, run forwards, run backwards, and stopped, at various frames for study. The copy, though not very good, showed plainly the explosion of Kennedy's head when struck by the fatal bullet. "Computers and Automation" can make arrangements to show a bootleg copy of the Zapruder film to audiences almost anywhere in the United States and Canada. If any reader is interested, he should write Computers and Automation, Dept. F, 815 Washington St., Newtonville, Mass., 02160.

3. Evidence for Proposition II: Sprague's Alternate Hypothesis

A large number of statements in the May article are included in Proposition II. But Proposition II is in the nature of an alternative hypothesis, advanced by Sprague.

It is evident that many of the details of any alternative hypothesis may and probably will differ from one investigator to another, as each one reflects on the evidence he is familiar with and as he attempts to reconstruct what he thinks probably happened.

In regard to Proposition II, the May article does not assert proof; the article expresses simply the normal position of an author of any article: "Here is my view of the situation; and here are some of the reasons which support my view." And my function as editor is essentially to make sure that the author states his view of the situation in a clear and fairly reasonable way, and offers clear and fairly reasonably supporting evidence for his view.

Among the supporting evidence are these facts: that Sprague has over six years studied the photographic evidence and other evidence; has read many of the references carefully; has put together from primary evidence a number of strands of secondary evidence; that he personally has made many trips to Dallas and elsewhere to see the scenes and to interview witnesses and photographers; that he has in his files copies of 200 of the photographs; that he has written descriptions of 200 more photographs which he did not secure copies of; that he has failed to see only some 100 of the photographs -- or 20%; that he attended many of the days of the New Orleans trial of Clay Shaw; etc.

This background makes Sprague a well-qualified author to put forward Proposition II; but that proposition in the May article is <u>not asserted</u> as "true on the basis of substantial, conclusive evidence," as a careful reading of the article will plainly show.

4. The Dimensions of an Article in "Computers and Automation"

One of the charges made by Dr. Schwartz relates to not giving evidence or supporting information for some of the statements included in Proposition II -- for example, a statement that Oswald did not shoot Officer Tippet. The charge is that the statement was made, and not supported by any details.

An article is not the same as a book or a treatise; it is much shorter. Inevitably, an article will not have room to contain for every controversial statement the data, analysis and reasoning which may constitute reasonable support of a statement. Furthermore, it is not necessary in an article to deal with all the background of each statement made.

Four significant and important references are cited on page 35 of the May article, and a commentary is given for each of these. In addition a bibliography containing references to 18 more books is given on page 60.

5. The Computer-Relatedness of Sprague's Article

The charge is made that the material is not computer-related and should not have appeared in "Computers and Automation"; and that this non computer-related article did not appear in the "House is on Fire" department of "Computers and Automation".

It is simply not true that the article is not computer-related. Part 3 of the article (see pages 56 to 58) discusses at length a number of ways in which computers should be and could be applied to the massive problems of information handling that are involved in dealing with over 25,000 pictorial frames recording various aspects of an important historical event.

The title of the article was:

> The Assassination of President Kennedy: the Application of Computers to the Photographic Evidence

With the benefit of hindsight, I now believe that it would have been better (in the sense that there would have been less misquotation of the article) if the title had actually been:

> The Assassination of President Kennedy: the Prospective Application of Computers to the Photographic Evidence

However, it is right, proper, and adequate to say "the application of" when one means "the prospective application of". For example, for many years articles on "the application of computers to the game of chess necessarily had to mean "the prospective application". For only in the last few years have computers had reasonably good computer programs for playing chess.

As editor, if I had the same decision to make again, I would again have included this article in our magazine. I would have known now some of the minor corrections which have been been published in later issues of "Computers and Automation" -- of which the most unfortunate perhaps is in the spatial chart of Dealey Plaza; the numbers in the scale of the chart, namely 10, 20, 30, 40, should be replaced by 20, 40, 60, 80 respectively.

It is certainly not necessary that a computer related article be published in the C&A department "The House is on Fire".

6. The Case of Jim Hicks

In regard to Jim Hicks, several charges are made: "The S-shaped loop of the antenna is not visible in the picture as published in 'Computers and Automation' in May." (See page 33). This is true. The picture that went to the printer showed the antenna, faintly; the picture as printed in the magazine did not show it. This point is discussed in the July 1970 issue of "Computers and Automation" on page 32.

The charge is made that "It was impossible for Jones Harris to recognize Jim Hicks from the back when Harris was in District Attorney Jim Garrison's office in New Orleans." This charge is ridiculous. The event actually happened. I have talked to Jones Harris in New York in recent weeks and he confirmed that this did happen.

The charge is made: "If Mr. Hicks is now confined to a mental institution, it may well be that Hicks is a mental case." This supposition is undeniable. However, from 1963 to early 1969 when he was in District Attorney Jim Garrison's office in New Orleans, Hicks was not so confined, and it is

quite plausible that during that time he was sane. It is even likely that he did what he said he did, establish a radio communications center in the Adelphi Hotel in Dallas so that radio communication among the firing teams could take place.

7. The Decision of the New Orleans Jury in the First Trial of Clay Shaw

In the first trial of Clay Shaw in New Orleans in February and March of 1969 the jury found Clay Shaw "not guilty" of participation in the conspiracy to assassinate President Kennedy. The May article (see page 31) says:

> The record of the trial as published in The Times Picayune contains many indications that:
>
> 1. Clay Shaw did know and meet with Lee Harvey Oswald (dead), David Ferrie (dead), and Jack Ruby (dead), and exchange money with them. Twelve witnesses saw them together in twos and threes at various times and places.
>
> 2. There were at least three gunmen in Dealey Plaza firing at President Kennedy on November 22, 1963, from at least two directions, and therefore there was a conspiracy
>
> What Garrison failed to prove to the satisfaction of the jury was that Clay Shaw was involved in the conspiracy.

The charge is made that "The decision made by the jury in New Orleans was no conspiracy." This is not the decision that was made by the jury, and the charge is false.

The jury was not asked nor empowered to give any verdict on the question of a conspiracy to shoot President Kennedy. The jury simply decided, on the basis of evidence put before them, that it was not proved that Clay Shaw participated in such a conspiracy, whether or not such a conspiracy existed.

8. The Chart of Times of Events

The May article contains on page 51 Chart 2, a schematic timing chart of photographs, movies, and events in Dealey Plaza around 12:30 pm on November 22, 1963. On page 57 appears the following text.

> The FBI and the Warren Commission staff made a careful analysis of the timing of the frames in the Zapruder film, and correlated these times with the positions of the presidential limousine and the other cars in the motorcade. (See Chart 1). Consequently, there exists an accepted time scale at 1/18 second intervals which applies to the events in the photographs: the scale consists of eighteenths of a second (named with the frame numbers of the Zapruder film) during the crucial 6.8 seconds of the fatal interval. I was able to extend this reference technique by using four other movies stretched end to end to cover the period from the moment Kennedy rounded the corner of Houston and Main Sts. up to the beginning of the Zapruder film.
>
> A preliminary correlation of the times in the various movie sequences and still photographs is shown in Chart 2 [not "Table 1" -- the correction was published in the June issue of "Computers and Automation", page 22] for the period of Kennedy's travel through Dealey Plaza. ....The period from the end of the Zapruder film (roughly ten seconds after the last shot) up to the first of Murray's photos (about 3 minutes) is covered by several movies and TV sequences.

The charge is made that "The precise method of time determination is not stated, and the reader is asked to accept 5.7 seconds before and 3.5 seconds after".

Well, how detailed can you get in a magazine article of limited length?

If one has over 25,000 frames and 350 still pictures, and persons and cars moving through a scene with 75 photographers; if one coordinates all that one can find out, with the positions of the tires of the Kennedy limousine in the motorcade, the Zapruder frames, and the time scale figured out by the Warren Commission and the FBI; etc. etc. etc. -- one should be able to go quite a way in establishing times. Actually, a detailed description of the method of computation of the 3.5 and 5.7 second times exists, and is available on request from Sprague.

I think the charge is an example of the fallacy of pettyfogging.

9. Some Other Specific Points

The charge is made that "the second photo of the 6th floor easternmost window of the TSDB shows that 'THE BOX HAS MOVED'."

Actually, the second photo is taken from a different angle and a different distance; the box has not moved, as may be shown by more photos besides.

The charge is made that "the four and a half pages of pictures of the tramps and the phoney policemen prove nothing about the supposed conspiracy."

Actually they do prove something significant: the presence at the scene of persons who have not been accounted for, and who therefore might have been involved in the conspiracy. In regard to the "phoney policeman", the May article says (page 39) "There is no record of this man being a member of the Dallas police force. He is the only Dallas policeman of those appearing in the hundreds of photographs taken Nov. 22 who is wearing an earpiece or radio communication device in his right ear (see Figure 2). Why?"

I consider it remarkable that the one man in a Dallas police uniform who cannot be identified as a Dallas policeman is the one who is equipped with a device which could be a communicating device. (How many policemen on active duty as police have to wear hearing aids?)

The charge is made that it not unreasonable to detain persons, question them, and then release them without making any record whatever -- even on an occasion when the President of the United States has been assassinated.

Well, that is not the way it seems to me. It seems to me remarkably careless not to make a record of the names and other information of such persons on such an occasion -- so careless that there might well have been some intention not to.

The charge is made that "the umbrella man is hypothetical". This is perhaps a friendly word for "imaginary," or "fictitious," or "nonexistent".

Actually, there are at least half a dozen pic-

tures showing the umbrella man (see the account on page 50 of the May article). And there is a good picture of all of him (with his umbrella folded) on page 228 of "Six Seconds in Dallas" by Josiah Thompson.

10. Clues for Identifying Quacks and Cranks

Nine clues listed by Martin Gardner in his book "Fads and Fallacies in the Name of Science" are presented by Schwartz. The charge is made that Sprague and his article, (and the act of "Computers and Automation" in publishing it) are to be classified as the behavior of quacks and cranks, by reason of satisfying (assertedly) 7 of the 9 clues.

This is an argument from a generalization (not a universal statement) and is not logically sound for every case. Over and over again a generalization, however suggestive it may be, fails because it does not conform with all the cases.

For example, one of the strongest possible generalizations (on the basis of our experience with all the days that men have lived) is that "the sun will rise tomorrow". Yet in the far distant future (some ten billion years from now) it is predicted by astronomers and physicists that the sun will explode, having exhausted its supply of hydrogen for its nuclear furnace, and when that happens the entire earth will be vaporized in the solar nuclear explosion. Then there will no longer be a solid earth to turn on its axis, and therefore there will be no more tomorrows.

11. Mental Resistance to New Ideas

Facts are stubborn things. Once a person accepts the demonstrated fact that "Oswald was not the sole assassin; there was more than one person firing; and therefore there was a conspiracy," a foundation stone is loosened, and the theory that the Warren Commission sought to establish comes tumbling down, like a collapsing building.

A great deal of human progress occurs because of stubborn facts; and often in human history persecution and death has been the reward for those who insisted on them.

To balance the quotation from Martin Gardner, I would like to quote from "The Art of Scientific Investigation" by W. I. B. Beveridge published by Mercury Books, London, 1950:

> The mental resistance to new ideas is partly due to the fact that they have to displace established ideas. New facts are not usually accepted unless they can be correlated with the existing body of knowledge; it is often not sufficient that they can be demonstrated on independent evidence. Therefore premature discoveries are usually neglected and lost. An unreasoning, instinctive mental resistance to novelty is the real basis of excessive scepticism and conservatism.

In my opinion, Dr. Schwartz displays (1) excessive skepticism, (2) extraordinary resistance to new knowledge, (3) a profound ignorance, and (4) an extraordinary cockiness since he is aware of his ignorance.

Not one word in his polemical attack on the May article by Sprague acknowledges the obviously extensive research and investigation and the accumulation of evidence which Sprague (and various other authors and researchers) have amassed.

Not one word by Dr. Schwartz admits even that the subject is important and worth investigating -- whereas any scientist must always admit that an important subject in which evidence is offered for judgment is worth investigation.

Sprague's article is like an iceberg with a little tip above water. Not once does Dr. Schwartz say "I'd like to look at more of your evidence." Actually, McLean, Va., where Dr. Schwartz lives, is within a few miles of the openly accessible, large central collection of the evidence in the case, at the headquarters of the National Committee to investigate Assassinations, 927 15 St., N.W., Washington, D.C. 20005.

12. Defects in the Warren Commission Report

Dr. Schwartz says "I agree that the Warren Commission Report is seriously defective". But Dr. Schwartz does not say how in detail.

Actually, the Warren Commission Report is so defective that it is flatly and fatally wrong:

- Oswald was not the sole assassin;
- there was more than one gunman firing;
- there was a conspiracy.

Furthermore, the Commissioners had the money, the resources, and the subpoena power to get to the bottom of the plot. They clearly did not choose to get to the bottom (at least a majority did not so choose).

The clear and obvious reason is that they did not want to get to the bottom. And the clear and obvious reason for that lack of desire is that there were indications that the Central Intelligence Agency was involved in Kennedy's assassination and probably the FBI was also involved -- and so "national security" was at stake. Furthermore, the Commissioners did not know what the people of the country would do if they were officially and soon told "the Central Intelligence Agency had a hand in killing President Kennedy" and "The FBI knew about the plot ahead of time and issued no warnings". And so the Commissioners drew back from that chasm that yawned in front of them.

I do not blame the Commissioners for not wanting to get to the bottom of the plot -- they may well have saved their own lives that way. However, their report was a betrayal of the people of the United States.

I have not tried in this response to deal with every single one of the points raised by Dr. Schwartz in his thorough and well-organized (but most one-sided attack) on the article: "The Assassination of President Kennedy: The Application of Computers to the Photographic Evidence" by Richard E. Sprague published in our May, 1970 issue. (Footnote: I believe I could deal with all of his points!)

However, I do agree with Dr. Schwartz: The best procedure is to recommend to each reader who is interested that he read Sprague's article and consider it for himself.

If you are interested and cannot find an easily accessible copy of the May, 1970, issue, please order it from us (see the notice on page 44). Then read the article, return the issue to us in 7 days in salable condition, and you will owe us nothing. In this way, you can judge for yourself.

THE MAY ARTICLE

THE ASSASSINATION OF PRESIDENT JOHN F. KENNEDY:

THE APPLICATION OF COMPUTERS TO THE PHOTOGRAPHIC EVIDENCE

Computers and Automation, published in its May issue a 32-page feature article, "The Assassination of President Kennedy: the Application of Computers to the Photographic Evidence".

In this article, Richard E. Sprague, President, Personal Data Services, Hartsdale, N.Y., states that analysis of the evidence proves:

- that the Warren Commission conclusions (that Lee Harvey Oswald was the sole assassin, and that there was no conspiracy) are false;
- that there were at least four gunmen firing from four locations, none of whom was Oswald;
- that the conspiracy to kill Kennedy involved over 50 persons (of whom several are identified in the article) including members of the Dallas police, and elements of the Central Intelligence Agency of the United States; etc.

The evidence published in this article includes eleven important photographs. One of them shows Jim Hicks, who admitted he was the radio communicator among the firing teams at Dealey Plaza, with his radio transmitter in his back left pocket. The article includes a tabulation of over 500 photographs (counting a movie sequence as one photo) taken in and around Dealey Plaza, Dallas, Texas, Nov. 22, 1963, at the time of President Kennedy's assassination and shortly thereafter. Both a spatial chart and a timing chart of the events and the photographs are included in this article.

Sprague, a computer professional for over 24 years, has as an avocation, studied the old and the new evidence for over 6 years, and has analyzed over 400 of the 500 photographs.

The work in computerized analysis of over 300 still photos and over 25,000 frames of movie sequences has been started.

To obtain your copy of this extraordinary report, please complete and mail the following order:

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Newtonville, Mass. 02160

( ) Please send me ( ) copy(ies) of the May 1970 issue containing the article on President Kennedy's assassination. I enclose $4.00 ( ) check ( ) money order for each copy. (Please do not send cash.) If not satisfactory, returnable in 7 days for full refund (if in salable condition).
My name and address are attached.

Discount: 10%, 5 to 9 copies;
20%, 10 or more copies
Special price: $1.00 for students (attach evidence);
$1.00 for non-profit organizations

An excerpt from the May article

Part 2. The Photographic Evidence

The assassination of President John F. Kennedy was the most photographed murder in history. Approximately 75 photographers took a total of approximately 510 photographs, either before or during or within an hour after the events in Dealey Plaza, and either there or nearby or related to those events. The word "photograph" in this context includes both still photos and movie sequences. The number of frames in a movie sequence ranges from about 10 to about 500; and in the count of 510 photographs given above, the 10 to 500 frames of a single movie sequence are counted just as one photograph. The total number of frames is over 25,000.

The Warren Commission examined 26 photographs, about 5 percent of the 510. The FBI examined about 50 photographs, or about 10 percent. The most famous of all the photographs is the Zapruder film, which had over 480 frames.

Many of the photographs were taken by professional photographers. About 30 of the photographers were professionals who worked for newspapers, television networks, and photographic agencies.

The Warren Commission did not interview a single one of the professional photographers, nor did the Warren Commission see any of their photographs.

Fifteen of these professionals were actually in the Kennedy motorcade, no further than 6 car lengths behind the Kennedy car. Five of these photographers were television network cameramen. The Warren Commission looked at none of their photographs.

Two of the photographers were from the White House. One of these men (Thomas Atkins) was the regular photographer for the White House. He made a special film for Lyndon B. Johnson. Atkins used his own film plus some footage obtained from the television photographers. Johnson looked at the film and then put it away. This film is now stored with the Kennedy Memorial Library materials in a warehouse in Washington, D.C.; it is stated to be "unavailable" to researchers. The Commission did not see this film, nor did they interview Atkins.

Because the professionals used movie cameras of professional quality, their films are exceedingly revealing and valuable as primary evidence. The Warren Commission looked at none of these films.

Chart 2 of this article shows the times of about 50 of the photographs taken in Dealey Plaza during Kennedy's passage through it.

Table 3 of this article lists over 510 photographs so far identified and known to exist or to have existed — with possibly a few borderline cases.

District Attorney Jim Garrison on The Assassination of President Kennedy: A Review of Heritage of Stone

Heritage of Stone / Jim Garrison / G. P. Putnam's Sons, 200 Madison Ave., New York, N.Y. 10016 / 1970, hardbound, 253 pp, $6.95

Neil Macdonald
Assistant Editor
Computers and Automation

This book is important and interesting. The words used, the narrative thread, reveals an entirely sane but deeply angry man, and a remarkably courageous one, who is appalled at the assassination of political leaders in the United States.

Whether or not you believe that District Attorney Jim Garrison of New Orleans, La., is a publicity seeking charlatan and fool as the Establishment press has portrayed him, or an honest and brave investigator as the press has NOT portrayed him, this book is very significant, well and clearly written, and filled with facts. But there is no substitute for reading the book for yourself — which this reviewer highly recommends.

Interestingly enough, there is no mention in the book per se of the defendant Clay Shaw nor mention of his trial by Garrison in New Orleans in February and March, 1969 — except that three footnotes do mention Clay Shaw. Presumably this is because the second trial of Clay Shaw (for perjury in denying that he knew certain persons) which began in January 1971 would be prejudiced by the inclusion of such material in Garrison's book. The book mainly discusses persons such as David Ferrie (dead) who knew Lee Harvey Oswald, and other persons who knew Oswald, while he lived in New Orleans.

Beginning of Garrison's Interest

On one occasion, in the autumn of 1966 Garrison was in New York talking to Senator Russell Long of Louisiana, and the talk turned to the assassination of President Kennedy. Garrison reports he was astonished to hear Long say that he felt there was a question about the Warren Commission's inquiry. Up to then Garrison had assumed that the question had been "fully and honestly" looked into by the Warren Commission.

After Long's remark, when Garrison went back to New Orleans, he began to read the 26 volumes of the Warren Commission's Hearings and Evidence, and also the Commission's conclusions.

It became clear to Garrison that the official conclusion that Kennedy had been killed by a single man with a rifle shooting at him from behind was totally impossible. It even began to seem to Garrison that Lee Oswald quite possibly had not fired any shots, and had been a mere scapegoat. So what was the meaning of these 26 volumes of evidence? Why was the government lying to the people? Who had killed President Kennedy? and why?

These questions took Garrison down a long road, and involved him in a great collision with what he called an "enormous domestic intelligence organization which would seek to discredit and destroy anyone who dared to challenge its authority."

He inventories a long list of efforts and successes by many parts of the Federal government, both official and unofficial, to impede, prevent, and discredit his investigation, deny him subpoenaed evidence, etc.

Some Evidence that the Warren Commission Conclusions are False

Referring to the end of the day of President Kennedy's assassination, November 22, 1963, Garrison writes: "The leaders of our government knew that President Kennedy was not killed by Lee Oswald." Garrison cites as evidence:

- the testimony of the overwhelming majority of the witnesses at the scene;
- what the doctors in Parkland Hospital in Dallas observed and reported;
- what the color movie film taken by Abraham Zapruder showed.

This evidence, says Garrison, makes it "perfectly clear" that the shot that killed Kennedy and blew his brains out came from the front, and not from the rear where supposedly Oswald was firing from the 6th floor of the Texas School Book Depository Building.

In another place Garrison points out that Dr. Pierre Finck (one of the doctors) testified that more lead was removed from Texas Governor John B. Connolly's wrist than was missing from the bullet that the Warren Commission asserted had gone through the President and the Governor. Garrison says that this testimony "virtually destroys the official conclusions of the Warren Commission".

This is the same John B. Connolly, Jr., who has just been appointed by President Nixon to be Secretary of the Treasury of the United States — a man who knows from personal experience and other information that the Warren Commission conclusions are false; a man who has never publicly stated "President Kennedy was assassinated by a conspiracy."

Why Was Kennedy Assassinated?

Garrison writes vigorously and well, even if not scientifically. He discusses the reasons why Kennedy was assassinated. He advances the statement: "A man who cares too much for the human race may find himself living in a hostile environment. His humanity may not be regarded as dangerous so long as his voice cannot be heard by too many people but if he is eloquent, or if he is in a position to affect the affairs of the nation, then his

humanity will be regarded by some men as a great threat".

He comments that: "All superstates engaged in efforts to gain power must maintain extensive intelligence efforts at home. They must seek to maintain control of individuals and ideas lest their international war adventures lose the support of the populace at home. ... The issue is power, immense power ...

"After the United States ascended to the position of the most powerful military nation in history, in the midst of its accumulation of the most effective death machinery of all time, there occurred the accident of the election of a President who regarded the entire human race with compassion. By the time this happened, the cold war had become our major industry, and the Central Intelligence Agency had become the clandestine arm of our military-industrial complex, and, in the process, the most effective assassination machine in the world."

Unfortunately, Garrison nowhere in his book raises the question of what the Central Intelligence Agency may be doing outside of the United States, nor the question of the vast (and wicked even if thoughtless) assent given by the American people and by the United States Congress to the assignment of the CIA to commit assassinations and carry out other violent, corrupt, hidden, etc., interference with other nations and other governments outside of the United States — all actions financed by an authorized budget of billions of dollars a year. The United States of course has no moral right whatever to engage in such practices in the rest of the world.

Diligent vs. Careless Investigation

Garrison comments: "When an assassination of a national leader is not supported by elements of the government, it is predictable that the government investigation will be effective and relentless. ... All information contributing to the discovery of the whole truth will be welcome ... When the criminals are caught, the machinery of justice will be firm and uncompromising.

" ... However it is another matter when an assassination is supported by powerful forces within the government. The ... protective guard of the President suddenly will have become curiously impotent, for its operation will be known intimately by the assassins. The assassination apparatus will be extraordinarily effective. Federal investigative agents ... will move like sleepwalkers. High officials reviewing the affair will diligently examine many irrelevant items" — such as Lee Oswald's record of a smallpox vaccination in 1951 — "but will casually overlook the most pertinent evidence relevant to the assassination."

The Cover Story

Garrison says: "In a country with advanced technology for news distribution, the removal of a nation's leader will never be attempted unless those sponsoring the murder feel assured that they will have an effective degree of control over the dissemination of the news. Government control must be at a high enough level to guarantee the subsequent distribution of official news releases encouraging the belief, that however tragic the accident, it was essentially meaningless and all is well. ...Creation of a believable cover for an assassination is routine for an intelligence agency of a major government. The cover story which is initially distributed by the press release creates a degree of acceptance virtually impossible to dislodge. This is the case especially when the official fiction is supported by the prearranged activities of a decoy pointing in the direction of a false sponsor of the assassination. The actual events of the assassination become irrelevant. All that remains relevant is the cover story issued to the press and the power to control the investigation and conceal the evidence.

Understanding of the Forces

"We must begin to recognize history as it is happening to us", says Garrison. "We can no longer toy with illusions. Our war adventures in Asia are not related to national security in any rational sense. ... " "To understand the forces involved [in the murder of Jack Kennedy] and their motivation is to understand all of the once-mysterious assassinations of the 1960's, which in each instance achieved the elimination of a public figure who opposed our massive military expedition into Asia."

The Link of Assassination to War

Garrison remarks that: "A new political instrument has been created. It provides for the permanent removal of men whose philosophies do not coincide with that of the dominant power structure of the United States. ... Justice is not so blind that it pursues the most powerful forces in the country. Nor is the press so committed to truth that it wants the burden of knowledge of what is happening. ... Sooner or later the relationship of assassination at home and war abroad must come to be understood. ... I have written this book so that the truth about the murder of John Kennedy finally may be brought out for every American to see. ... I have sought to show what has been done to our country by men who believe in solving problems by the use of force. ... I wrote [this book] in the hope that it might illuminate the peril which surrounds us. Welcome to the fight.

Nature and Quality of the Book

The contents consists of: acknowledgments; Foreword; One Friday in November; Part 1, Illusion, with five chapters, The Execution, Ornaments, Power, the Quarry, Justice; Part 2, Reality, with five chapters, The Craft of Deception, Traces of Intrigue, The Ides of November, Nightfall, The War Machine; an Appendix, John Kennedy and Nuclear Militarism; Notes; and Index.

This is a scholarly book: over 300 notes are given in pages 233 to 244; and over 1500 entries appear in the index pages 245 to 253. Thus a great deal of evidence is carefully cited for many details. But it is not a scientific book, in the sense that substantial evidence is offered for hypotheses of great generality.

Errata noticed by this reviewer: p. 95, line 6: replace "Xaxier" by Xavier"; p. 104, line 16: replace "Accessibility" by "Access".

This book is worth reading, rereading, and studying, and the knowledge in it should be applied by every American.

ACROSS THE EDITOR'S DESK

APPLICATIONS

SEARCH FOR UNDERGROUND OIL AIDED BY COMPUTER-STORED HISTORY OF OIL DRILLING ACTIVITY

Histories of 700,000 oil wells drilled in the United States since the 1890s are stored on 2,600 reels of magnetic tape in an unusual library at Petroleum Information, Inc., Denver, Colo. The firm is using an IBM computing system to keep track of almost every important well ever drilled in this country, as an aid to geologists faced with increasingly difficult drilling decisions.

Bill Goodin, executive vice president of the firm (which gathers and distributes information to the petroleum industry), said that 2.5 million oil wells have been drilled in the United States. Many wells have been drilled in each of the major petroleum basins. It is estimated that 60% of the area under this country has sedimentary deposits of rock and sand that could contain oil. Geologists seeking oil can receive reports on an area's history to aid in determining where to drill.

The oil well history file was started on an IBM System/360 Model 40 and now contains information on 700,000 wells. Each day new reports are added to the file (each year 32,000 new wells are drilled). The company soon will transfer the information to an IBM System/370 Model 155.

Information for the file, as well as for the company's other reports and publications, is gathered through the cooperation of major petroleum producers, individual smaller operators, and state and federal governmental agencies.

UNITED AIRLINES IS USING COMPUTER SYSTEM TO CURB STOLEN TICKET USE

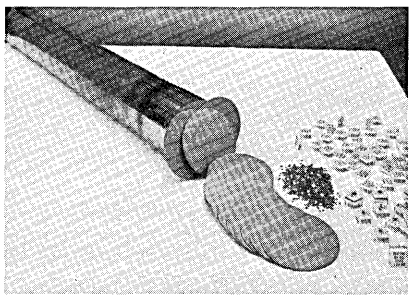
United Air Lines has installed a special purpose computer system, developed by TRW Data Systems, Torrance, Calif., to check for stolen and counterfeit airline tickets at Los Angeles International Airport. Capt. Frank Beeson of the Los Angeles Police Department, described Los Angeles as the nation's black market capitol for peddling stolen airline tickets. He said United Air Lines is the first major carrier to take a substantial positive step in helping to combat the serious and increasing use of stolen airline tickets.

The TRW system utilizes 23 keyboard terminals, 17 located at boarding gates and 6 at the ticket counters of United's two airport satellite buildings. As passengers check in, the ticket number is put into the computer through the touch-tone terminal by United counter or check in personnel. An instantaneous reply from the computer with a green light indicates the ticket is valid; a red light indicates that the ticket may be stolen. Numbers of tickets stolen anywhere in the country can be entered into the system.

It is estimated that there is more than $90 million outstanding in stolen airline tickets in the Los Angeles area. Los Angeles International Airport has the highest rate in the country in the use of stolen tickets.

COMPUTER-AIDED TECHNIQUE TECHNIQUE FOR GROWING SINGLE-CRYSTAL SILICON INGOTS

Computers have been harnessed with crystal growing furnaces to produce low dislocation-density single-crystal silicon ingots, such as the one shown at the left in the picture. Such ingots, 2¼ inches and larger in diameter, are sliced



and polished to form the silicon wafers which are then processed in a series of complex operations to produce monolithic logic and memory chips. These chips are then packaged, as shown, to form the circuitry for IBM computers.

The technique utilizes an IBM 1800 Data Acquisition and Control System to monitor and control critical process parameters such as silicon melt termperature, crystal lift and rotation speeds, and crucible lift and rotation speeds. The Teal-Little modification of the Czochralski process is used to produce the ingots. Computer-aided techniques minimize thermal disturbances during the crystal growing process, which can result from comparatively gross adjustments by human operators. Consequently, the computer enables a more consistent production of low dislocation-density single crystals.

The technique was described by Kenneth E. Domey (of the IBM Components Division East Fishkill Facility, Hopewell Junction, New York) at the Semiconductor/IC Processing and Production Conference and Exhibition which was held last month in Anaheim, Calif., in a presentation titled "Computer Controlled Growth of Single-Crystal Ingots."

MODERN MARINERS AIDED BY OCEAN-GOING MINICOMPUTERS AND ORBITING SATELLITES

A small ocean-going computer is the heart of a satellite navigation shipboard system which can pinpoint the position of a ship anywhere in the world, regardless of the weather, time of day or distance from land. The modern mariner no longer has to climb on the deck and shoot stars with his sextant to determine his position; he can now relax in a heated cabin and watch a teletype automatically print out the latitude and longitude to within 150 feet of his actual position.

The Transit Navigation System (developed originally for Navy submarine use, but since made available to non-military users) couples a Hewlett-Packard minicomputer with a specialized communication receiver. The system automatically digests information transmitted from orbiting satellites and prints out a ship's longitude and latitude on a teletype.

More than 60 shipboard navigation systems built and programmed by Magnavox are now in use; most are controlled by HP minicomputers. Because of their compactness, entire systems are frequently transferred between ships. About half the systems are aboard oceanographic research or support ships. The other half are used by navigators of oil exploration ships, commercial transports, passenger ships, cable laying ships and Navy and Coast Guard ships.

COMPUTER HELPS PRO FOOTBALL TEAMS MAKE DRAFT SELECTIONS

A direct communications link to a large-scare computer helped 8 National Football League teams pick among the top college prospects during this year's draft on Janu-

ary 28-29. The computer, an 1108 located at Univac's Midwestern Computer Center, supplied immediate ratings on players to BLESTO VIII, an organization of the Chicago Bears, Detroit Lions, Philadelphia Eagles, Pittsburgh Steelers, Minnesota Vikings, Baltimore Colts, Miami Dolphins, and Buffalo Bills. (BLESTO VIII is a wholly owned subsidiary of the eight member teams.)

The 8 teams were able to request and receive information on a UNIVAC DCT-500 Data Communication Terminal installed in the Philadelphia Eagles' office and linked to the UNIVAC 1108 in Oak Brook, Ill. Using the information, each team advised its representative at the draft in New York on which names to choose. (The computer contains files on 957 college players.)

The ratings of the top draft prospects were compiled from numerous reports of scouts. These reports cover ten general traits, 12 position traits, and the individual's size, speed, school, and injury history. Members of BLESTO VIII pay a fixed fee to support eight area scouts and five scout supervisors throughout the U.S. This is believed the first time a direct link to a computer has supplied immediate data on progress of the draft to professional football teams. Other scouting organizations also use computers extensively, but not for immediate information on the draft itself.

FLORIDA FIRM USING COMPUTER TO IDENTIFY NEW PRODUCTS, PROCESSES AVAILABLE FOR LICENSING

A Florida-based firm is using an IBM System/360 Model 20 to collect and disseminate information on new products and processes that can be licensed to other companies. On January 4, 1971, Dr. Dvorkovitz & Associates began issuing continuous reports on the newest available offerings from around the world to U.S. and foreign firms in the pharmaceutical and chemical process industries, and for patented electronic and mechanical devices.

Dvorkovitz representatives scout all parts of the world for products and processes which may be of interest to firms in other countries. Dr. Vladimir Dvorkovitz, founder and president of the firm, sends clients in many countries computer-produced reports on such unusual items as the formula for a plastic that self-destructs in sunlight and a real butter that needs no refrigeration and can be produced in either liquid or solid form. Several hundred items are reported every week.

"Our computer-based system, which was under development for more than two years, enables us to provide each client with a highly individualized report that will always be up to date", said Dr. Dvorkovitz. The computer automatically indexes each offering by its basic process or product line, and print-outs include such information as a basic description of each item; worldwide patent status on a country-by-country basis; degree of commercialization; and identification of geographic areas where licensing is possible. The name, address and responsible party as licensor are listed and direct contact may be made immediately. Every licensable offering is required to meet rigid quality standards before it is accepted for listing. There are over 1800 items currently housed in the computer's memory bank.

EDUCATION NEWS

COMPUTER TEACHES TEACHERS IN EARLY DETECTION OF HANDICAPPED CHILDREN

Elementary school teachers are learning to recognize characteristics of handicapped children with the aid of a new computer-assisted instruction program recently developed by Penn State University, University Park, Pa. The program is funded by U.S. Office of Education's Bureau of Educational Personnel Development and Bureau for the Education of the Handicapped.

An IBM 1500 system, including display terminals, image projectors and synchronized audio equipment, is housed in a van which will travel throughout Pennsylvania for on-site presentations to teachers. Some 1000 teachers per year throughout the State of Pennsylvania are expected to receive instructions on the IBM system.

Teachers, seated at computer-driven terminals, receive instructional material on spotting such telltale signs of brain damage or other handicaps as garbled speech patterns and resistance to discipline procedures. The teacher-student responds to graphically displayed material by touching a light probe to the screen or by typing answers into the system over the unit's keyboard.

Dr. Harold E. Mitzel, director of the Penn State project, said that nearly one out of every six children in the primary grades suffers from some form of handicap that requires special recognition in an educational program.

OSU STUDENTS LEARN WITH AID OF COMPUTER-CONTROLLED TAPE MACHINES

A bank of magnetic tape machines controlled by a computer is helping Ohio State University students learn everything from basic French to advanced chemistry. The system, recently implemented as a supplement to classroom instruction, consists of approximately 440 student listening devices or stations, linked to the central control unit from varied campus locations by telephone lines. Equipped with headsets and telephone dials, the learning stations are located in libraries, dormitories, schools within the univeristy and even some fraternities and sororities.

Seated at one of the stations, the student dials a three-digit figure representing the self-study or lecture which interests him. An IBM 1800 data acquisition and control system, located at OSU's Listening Center, accepts the student's call and connects him with the desired course. If the tape is currently being used by others, the student monitors the recording to completion and the computer automatically recycles it for his benefit. This is done until all students on line to any particular course of instruction disconnect. The system is currently handling approximately 4,000 student calls a day.

HIGH SCHOOL DATA PROCESSING NETWORK OFFERS SPECIALIZED COMPUTER TRAINING TO TEXAS STUDENTS

Built around two RCA Spectra 70 computers in Houston's (Texas) Region IV Education Service Center, a new educational data processing network will support 200,000 Texas high school students by 1972 in 34 of the region's 56 districts.

Using classroom teletypewrtier terminals and the simplified computer language known as BASIC, students solve mathematical problems associated with chemistry, physics, physical science, computer science and general mathematics courses. These terminals operate in a time-sharing mode with the Spectra 70/46 and Spectra 70/45. Student training in computer operation and program preparation, offered in vocation-technical and computer science courses, is handled through card reader-printer terminals, thus giving students access to the computer systems through the day. The network also will be used by teachers and school officials for classroom scheduling, grade and attendance

reporting, test scoring, tax accounting and other administrative tasks.

TWENTY-NINE SCHOOL DISTRICTS IN MINNESOTA JOIN IN 'COMPUTER CO-OP'

A "computer co-op" is providing a quarter million students and teachers in 29 independent school districts in Minnesota with complete low-cost computer services. Services range from demonstrations of a computer's problem-solving ability and classroom computer-aided instruction to unrestricted use of a time-shared computer plus the more usual administrative handling capabilities of payroll and scheduling, and computer analysis of data for research projects and experiments. The Minnesota School Districts Data Processing Joint Board, which operates as TIES (Total Information for Educational Systems) has a staff of approximately 30 professionals who administer the educational programs and operate the million dollar computer center.

TIES utilizes two computer systems. The first is a recently acquired Hewlett-Packard 2000A Time Shared Basic system with telephone links to 16 remote terminals. Seventy terminals will be used by the schools in the TIES project during the current school year. This system supplies demonstrations of a computer's abilities and computer-aided instructional programs. A professional staff, many of whom are trained both in teaching and computer technology, instruct and assist the students from kindergarten through the twelfth grade.

The other system, which primarily handles the administrative duties, is a Burroughs 3500 system with 34 data input and display terminals installed in the districts. Ten high-speed line printers, for listing of long reports, are to be installed at centrally located schools

The study of the potential use of computers in elementary and secondary education began in the St. Paul-Minneapolis area as a voluntary project in 1963. The 1969-1970 school year marked the first year of services to member school districts in seven counties. The member districts contributed approximately $3.50 per student during the past two years to cover partial expenses of the program. This took up the slack as a federal grant ran out in 1970. Costs for the coming school year (1970-1971) to cover complete operating expenses are expected to be around $5.00 per student. Previous to TIES, individual schools were purchasing time from commercial systems at $10 to $12 per hour. Costs for the same service now are approximately $1.50/hour. WWhere once there was a demand for more time than schools could afford, they now use all the time they need and costs are included in the $5.00 per student yearly charge.

RESEARCH FRONTIER

LASER BEAM SENDS DIGITAL DATA OVER LENGTHY ATMOSPHERIC PATH

Lockheed Palo Alto Research Laboratory (Calif.) has announced it is using a laser beam to send digital data at a high rate over a 1.2-mile path across the nearby hills. The new overland link — consisting of a brilliant green beam shot from a laboratory peephole to a hillside receiver — has a transmission speed of 300 million data "bits" per second.

Dr. Romayne F. Whitmer, head of the firm's Electro-Optical Systems Laboratory, said, "We believe this is the highest rate ever achieved over a long path through the atmosphere. Such a link could have large commercial and military uses." He said with advanced terminal equipment, the link could transmit the entire 23 volumes of Encyclopedia Britannica in five seconds.

Dense fog, heavy snow and other extremely poor weather conditions probably would hamper the new laser system just as they would hamper other optical links — although foul-weather tests have yet to be run, according to Dr. Whitmer. But he said the system's proven superiority in normal weather is still a major step forward. The link alleviates the problem of atmospheric distortion because it uses a "frequency modulated microwave subcarrier" to impress the information on the laser beam. The result is an FM system which, like FM radio, is far less vulnerable to distrubances than other forms of transmission.

One application may be in the field of cable television. Laser beams could carry 30 or 40 TV channels each — simultaneously — from a city or regional distribution center out to smaller centers, which then would send the signals by cable into viewers' homes. He said this could bring immense savings in cable-system construction costs.

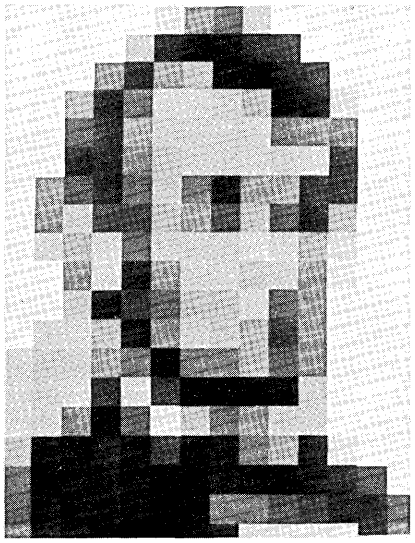
A second use would be to link computers, scattered around a city or region, so they could pass data back and forth automatically. Many large companies and government agencies require such communication between computers. This now is done primarily with more costly cable networks.

Some early use of such a laser communication system is expected between satellites in space, which is free of the disturbances found in the earth's envelope of air. But the new link across the Palo Alto foothills proves there are also many earthbound possibilities.

MISCELLANY

COMPUTER CUBISM?

No, this is a well known face that has been precisely blurred by a computer. It is part of an experiment by Leon D. Harmon at Bell Laboratories, Murray Hill, N.J., to learn the least amount of visual information a picture may contain and still be recognizable.



The picture is divided into about 200 squares, with each square rendered in an even tone from one of 16 intensities of gray. If you still don't recognize the portrait, try looking at it from 15 feet or more, or while it's in motion, or while you're squinting, or with your eyeglasses removed. Studies of the "information content" of a picture may be useful for designing future PICTUREPHONE® systems, and for devising techniques for computer storage of pictures.

(The portrait is of Abraham Lincoln)

NEW PRODUCTS AND SERVICES

NAME/MODEL NO.	DESCRIPTION	FOR MORE INFORMATION
Digital		
Cogar System 4	A stand-alone minicomputer designed for word handling as well as numerical computation / data system includes fully programmable, random-access, monolithic memory (2K expandable to 16K bytes), keyboard, two tape decks and a CRT display	Cogar Corp. Information Systems Div. Cosby Manor Rd. Schuyler, N.Y. 13502 Attn: Stephen Robbins
GRI-909 computer	Four new models fully software compatible with the original GRI-909 / Model 10 is designed for system control applications; basic memory is 1K x 16 read-write, expandable / Model 20, similar to Model 10 with operator's console for interaction with computer / Model 30 has 4K x 16 memory, expandable / Model 40, series largest	GRI Computer Corp. 230 Needham St. Newton, Mass. 02164 Attn: Irwin M. Stone
Honeywell Series 200 computers	New models, 115/2, 1015 and 2015 have elements of Model 115 / Series family spans small-to-medium price-performance range / main memory sizes range from 16,384 to 262,144 characters; cycle times from 2.75 usec per character on the 115 to 1.3 usec for two characters on the 2015	Honeywell Information Systems 60 Walnut St. Wellesley Hills, Mass. 02181
UT-1 system	Functions both as off-line computing system and as programmable remote batch data communications terminal for time sharing applications / configured around the Data General NOVA 1200 computer, system offers wide range of peripherals	UNITECH, Inc. 1005 E. St. Elmo Rd. Austin, Texas 78745 Attn: Frank Milstead
Memories		
Ampex Model RGM Core Memory	For military and other severe-environment applications / 400 nsec access time; full cycle time, 1 msec / four basic word-size configurations; capacities of 4,096 by 18 and by 36 bits, 8,192 words by 18 bits and 16,384 words by 18 bits	Ampex Corporation 9937 West Jefferson Blvd. Culver City, Calif. 90230 Attn: Chris Hoppin
Braided U-Core Read-Only Memory (ROM)	Model MP 256/36A for airborne and field service use / a 256 x 36 bit (9K) ROM / 500 nsec cycle time; access time is 250 nsec / physical size is 1.25" x 4.5" x 9.0" for a packing density of over 180 bits per cu. inch	Datapac, Inc. 3839 South Main St. Santa Ana, Calif. 92702 Attn: Tom Lee/Ben Garrett
Cogar 70	Monolithic add-on memory for 360 computers / 262K bytes expandable to a one megabyte system in plug-in increments of 262K bytes / 425 access time; cycle time of 750 nsec / a complete, self-contained system	Cogar Corp. Technology Div. All Angeles Rd. Wappingers Falls, N.Y. 12590
DD 4314-1 Disk Drive	Replaces IBM 2314 and 2319 Drives; up to 9 drives may be connected to matching control unit, DC 5314 / less than 30 msec average access times / transfer rate is 321,000 bytes per second or 624,000 digits per second with packed decimal data	Potter Instrument Co., Inc. 532 Broad Hollow Rd. Melville, N.Y. 11746 Attn: R. T. Grunenwals
ExpandaCore 620	Plug-compatible expansion memory for Varian 620/i 4K to a maximum of 32K words / a 3D, 3-wire core memory / 1.8 msec full cycle time; access time is 750 nsec	Cambridge Memories, Inc. 285 Newtonville Ave. Newton, Mass. 02160
MEGAMEMORY 1000	Flexible, 2-wire, 2½D core system for main frame memory extension or as peripheral memory / 850 nsec access time with a 1.5 usec cycle time / storage capacities — 32,768 words, 32-160 bits per word up to 524,288 words of from 8-14 bits per word	Electronic Memories 12621 Chadron Ave. Hawthorne, Calif. 90250 Attn: LeNore Plotkin
Micromemory 4000	2-wire, 2½D organization / basic module capacity is 32,768 words of 18 bits per word / 800 nsec access time, 1.5 nsec cycle time / key features are price, I-O flexibility, packaging density	
Series 720 Controllers	Provides minicomputer users with upward compatible plug-in data storage system capability / allows user to expand his storage from 0.6 million bits to over 70 million bits depending on which of 8 memory systems are used	Bryant Computer Products 850 Ladd Rd. Walled Lake, Mich. 48088
Software		
DOS ASAP (Automatic Spooling with Asynchronous Processing)	For users of IBM 360 under the Disk Operating System / alleviates dependence of CPU on relatively slow unit record devices / provides print, punch and card read operations at maximum device speed	Universal Software, Inc. 12 Horseshoe Drive Danbury, Conn. 06810 Attn: David W. Kearns

NAME/MODEL NO.	DESCRIPTION	FOR MORE INFORMATION
(Software, continued)		
EASYPLOT	A non-programmer application language for engineers and other non-programmer professions to generate plotter output / need only a keyboard terminal (such as a Teletype) and a plotter (works with most standard plotters)	Tymshare 525 University Ave., Suite 220 Palo Alto, Calif. 94301 Attn: Jim Harrison
General Ledger System	Time-sharing system for public accounting firms / reduces accountant's write-up time by 50-85% / accessed by remote terminal / no programming knowledge required / applicable to all types of business	Honeywell Information Services Operations Mail Station G1124 2701 Fourth Avenue South Minneapolis, Minn. 55408
MAGIC-Shorthand	COBOL preprocessor / provides programmer with unlimited abbreviation capability throughout all COBOL divisions by both supplied and user defined abbreviations / macro facility, syntax checking, output formatting, also supplied	Information Management, Inc. 447 Battery St. San Francisco, Calif. 94111
PROFACTS (PROduct Formulation, Accounting, and CosT System)	Provides current information for management review and production purposes / written in COBOL for an IBM System/360 Model 30 or larger, using DOS / minimum of 64K, 4 tape drives and 2 disc drives	Fortex Data Corp. 230 North Michigan Ave. Chicago, Ill. 60601
QWIK-TRIEVE*	A generalized interactive data storage and retrieval system for time-shared computers / stores data in direct access files / handles both formatted data and free data / responds to English-like query statements	Westinghouse Tele-Computer Systems Corp. 2040 Ardmore Blvd. Pittsburgh, Pa. 15221
SIRE (Symbolic Information Retrieval)	Integrated information storage, file management maintenance and retrieval system / provides capability to write applications in any language (English, French, German, Japanese, etc.) / no technical programming background required / available for UNIVAC 1106 and 1108, IBM 360/50 and larger (minimum core, 270K bytes)/ developed as in-house system by Boeing Company; Script has exclusive world-wide marketing license agreement	Script Associates, Inc. 225 108 NE Bellevue, Wash. 98004
TAXCAL	Calculates federal, state and local withholding taxes handling calculations in one pass / modularized / written in COBOL / requires 2500 to 18,000 bytes of core	Datasonics, Inc. 663 Fifth Ave. New York, N.Y. 10022 Attn: Martin Burack
Unit Inventory Techniques for System/3	For small department stores, specialty shops and other retailers / produces time-saving inventory data reports using IBM's System/3 Model 10 / written in English-like RPG II programming language	IBM Corp., Data Processing Div. 112 East Post Rd. White Plains, N.Y. 10601
Peripheral Equipment		
Automatic Calling Unit, ACU-1801	For interfacing business machines and computers with with tone or pulse dialing telephone systems / unit accepts stored telephone numbers in binary code, converts to digital code, and automatically dials those numbers over any standard telephone line / four available models	Sola Basic Industries, G-V Controls Division 101 Okner Pkwy. Livingston, N.J. 07039
Card Reader, Mod 250 Card Punch, Mod 260	Specifically for use with minicomputers / both handle 80 column cards / Reader has vacuum pick finger, handles 300 cards per minute; is 14"W, 18"D, 18"H, 47 pounds / Punch operates 120 cards per minute; is 22½"H x 19"W	UniComp, Inc. 18219 Parthenia St. Northridge, Calif. 91324
DigiNet® 160 Series	Private line data multiplex systems equipped with "internal diagnostics" / moves information over leased or private four-wire voice-grade circuits / connects directly to telephone line, no data set required / has channel speed intermix capability / modularly constructed	General Electric Co., Telecommunications Products Dept. Section P, P.O. Box 4197 Lynchburg, Va. 24502
Model 420 Portable Printer	For time-sharing and communications applications / has built-in acoustic coupler / operates at switched speeds of 10, 15, and 30 cps using non-impact thermal print head; prints 80 characters per line / teletype compatible	Data Access Systems, Inc. 503 Route 10 Dover, N.J. 07801 Attn: Robert T. Coppoletta
Model GT50/10 Graphics Tablet	High speed 10-bit device for converting hand drawn data to digital form / writing surface is 11¼" x 11¼" / may be used with graphic display terminals or as a stand-alone unit	Computek, Inc. 143 Albany St. Cambridge, Mass. 02139 Attn: Douglas Drane
Punched-tape optical reader	Operates continuously / designed specifically for batch-type, continuous tape runs / tape transported on dual-sprocket, capacitor-start/capacitor-run AC motor drive at 700 characters per second	Decitek 15 Sagamore Rd. Worcester, Mass. 01605 Attn: I. E. Spalding
Regiscan Reader	Hand-held automatic price tag reader for retailing / a 4 oz., trigger-operated device using light-emitting and photosensing diodes / automatically senses price and merchandising information from Kimball or Dennison tickets / reading time is less than one millisecond	American Regitel Corp. 870 Industrial Rd. San Carlos, Calif. 94070 Attn: Jerome Turk

*QWIK-TRIEVE is a service mark of the Westinghouse Tele-Computer Systems Corporation

NAME/MODEL NO.	DESCRIPTION	FOR MORE INFORMATION
(Peripheral Equipment, continued)		
T-66 Credit Control Terminals	A credit card reading terminal; automatically communicates with a computer, obtains credit authorizations in seconds / operates over public telephone network / can be programmed to access any on-line computer in continental United States	Audac Corp. 175 Bedford St. Burlington, Mass. 01803 Attn: Peter Bryan
230 Dataplotter®	Designed for time-share users / self-contained, desktop device, compatibly interfaced to keyboard terminals and acoustic couplers / operates at maximum speed in all directions / includes easy-to-use FORTRAN plotting subroutines	Electronic Associates, Inc. 185 Monmouth Pkwy. West Long Branch, N.J. 07764 Attn: Ed Sharpe
VertaTape, Paper Tape to Magnetic Tape Converter	Makes conversion all off line / converts coded information from 5, 6, 7 or 8 channel paper tape to 64 character magnetic tape code set and edited for computer input / plug-in patch-board programmed for each customer's particular application	Datascan, Inc. 1111 Paulison Ave. Clifton, N.J. 07013 Attn: Doug Schwartz
Data Processing Accessories		
Magnetic Tape Cartridge	Completely compatible with IBM Magnetic Tape Selectric Typewriters / 120-foot / exacting computer tape quality standards / backed by a one-year warranty	Memorex Corp. 1180 Shulman Ave. Santa Clara, Calif. 95050 Attn: Jerome M. Kelly
TM/33 Teletype Tape Handler	An automatic tape handling system / may be used to simultaneously feed and collect tape for reading or simply collect tape after perforating / mounts rigidly to the Teletype, no tools or modifications required	Data Specialties, Inc. 1548 Old Skokie Rd. Highland Park, Ill. 60035
Computer-Related Services		
Computer Assisted Diagnosis for Internal Medicine	Gives physician ready access to diagnostic information screened from medical literature / computer is called by way of teletypewriter installed in doctor's office, hospital or other central point; findings are entered into computer via numbers corresponding to those listed beside particular findings in operating manual; computer compares these with memory bank; responds with a printed listing of those diseases or syndromes found to be supported by the findings / computer also provides a literature reference and additional findings physician should look for in determining diagnosis / program encompasses diagnoses in general area of adult medicine	Mead Johnson Medical Services Evansville, Ind. 47721 Attn: Rolland M. Eckels
Computer Law Dictionary	For use by legal profession / contains over 50,000 words and terminologies used by the profession — in essence, the language of the lawyer / Omnitec 800 portable data terminal is link between the 'dictionary' and computer stored data relevant to United States Court decisions / when queried computer searches memory, finds proper response in form of legal citations, transmits response via telephone and terminal automatically types it out / service will be operational initially in and for Pennsylvania; dictionary soon will serve all of state and federal computer libraries	The Computer Searching Service Corp. 11 Erie St. Garfield, N.J. 07026
Moonlighters' Job-Matching Service	A computerized "job bank" and referral system that matches skills of moonlighters (temporary and part time employees) with specialized requirements of employers / encompasses virtually all skills required by industry and the professions / free to employers; available to moonlighters for a one-time registration fee of $10	Moonlighters, Inc. 9060 Santa Monica Blvd. Los Angeles, Calif. 90069 Attn: Robert L. Rod
New Literature		
Magnetic Disk Memories	A 72-page report on the industry covering 51 manufacturers / study encompasses four main aspects of the industry: markets, technology, products, and companies / designed to permit rapid evaluation of competitive products, annual shipments, price changes, technological developments, competitive new products and growth opportunities for major and independent manufacturers plus breakout for minicomputer disks	High Technology West 1060 Crenshaw Blvd. Los Angeles, Calif. 90019 Attn: Eugene Kurchak

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Computer Sciences Corp., Los Angeles, Calif.	RCA Corporation	A five-year contract to develop elements of software for U.S. Navy Aegis defensive missile system including radar processing, command & control & training	$11 million
Computer Technology Inc., Dallas, Texas	Barnett First National Bank of Jacksonville, Fla.	A three-year data processing facilities contract to handle design and operation of bank's computer applications; also for BankAmericard service center	$5+ million
Philco-Ford Corp., Willow Grove, Pa.	U.S. Army Electronics Command, Ft. Monmouth, N.J.	Expansion of Defense Department's Overseas Automatic Digital Network; for receiving, storing & routing messages	$2,685,000
The Medicus Corp., Dallas, Texas	Baptist Medical Centers of Birmingham, Ala.	Installation of a medical data processing center in the two-hospital system	$2.2 million
Electronic Associates, Inc., West Long Branch, N.J.	American Electric Power System	A computer-controlled simulator of a power plant control room for fossil-fueled power plant training in the electric industry	$2+ million
Greatermans Group, South Africa	The National Cash Register Co., Dayton, Ohio	Retail data-capturing equipment, initially 300 NCR 5 control registers for point of sale data collection; additional 200 registers to follow	$1.5+ million
Burroughs Corp., Detroit, Mich.	U.S. Postal Service	Design, development and installation of a Code Controlled Letter Sorting Machine	$1.3 million
Univac Division of Sperry Rand Ltd., London, England	British European Airways	Two hundred UNISCOPE 100 visual display units; will enable 22 European cities to be visually linked to BEA's BEACON seat reservation system	$1.2 million
Entrex, Inc., Lexington, Mass.	Redifon Data Systems United Kingdom	Ten System 480's, computer based data entry equipment, to be called "SEE-CHECK"	$1+ million
Computer Sciences Corp., Los Angeles, Calif.	U.S. Naval Electron Systems Command, Special Communications Project Office	Providing technical support and management assistance in communications; will provide studies and analyses in support of naval communications projects	$1 million
Peripheral Equipment Corp., Chatsworth, Calif.	Consolidated Computer	A contract including 250 PEC 6000 Series tape transports for new KEY-EDIT data preparation system	$750,000
Princeton Electronic Products, Inc., North Brunswich, N.J.	Smith, Kline & French, Inc., Smith, Kline Instruments	Electronic display equipment to be utilized in medical data processing systems	$670,000
Ampex Corp., Culver City, Calif.	Texas A & M University	Model ECM-65 core memory systems and TM-1624 magnetic tape units to be linked to an IBM 360/65 system	$475,000+
Burroughs Corp., Detroit, Mich.	U.S. Air Force	Development of an advanced aerospace multiprocessing computer to be used in future high performance aircraft and space vehicles	$469,000
Sierra Research Corp., Computer Products Group, Burlington, Mass.	Babcock and Wilcox Co., Naval Nuclear Fuel Div., Lynchburg, Va.	Installation of an SDA-770 System for factory data collection, planning and control	$300,000+
The Center for Research Libraries, Chicago, Ill.	Ford Foundation	A grant for support of a program to provide widest access to machine readable forms of 1970 Census Summary Data and public use samples on magnetic tape; also to reduce cost of using data for research purposes	$225,000
Sigmatics, Newport Beach, Calif.	Defense Atomic Systems Agency Field Command, New Mexico	Provision of programming support for an automated financial management system	$219,380
Carnegie-Mellon Univ., Graduate School of Industrial Administration, Pittsburgh, Pa.	The Richard King Mellon Charitable Trusts	Development of a management information control system to upgrade efficiency of hospital administration; study of ambulatory care facilities	$200,000
National Archives	Ford Foundation	A two-year grant for indexing the papers of the Continental Congress	$150,000
M.I.T., Dept. of Architecture Architecture Machine Gp., Cambridge, Mass.	Graham Foundation for Advanced Studies in the Fine Arts	Support of a fellowship program for advanced study in computer-aided architecture	$40,000
RCA, Cherry Hill, N.J.	U.S. Army, Pacific	Seven Spectra 70 systems, having a sales value of $11.7 million, to provide automated logistic support for U.S. Troops in Sotheast Asia; contract includes an option for additonal 14 Spectras	—
Comma Corp.,	Data Processing Financial & General Corp., Diebold Computer Leasing, Inc., Randolph Computer Corp., and Talcott Computer Leasing	Computer maintenance agreements; authorizes Comma to sign computer maintenance contracts with any of leasing companies' customers, should they so desire; approximately $600 million of IBM/360 equipment is owned and leased by the four firms	—

NEW INSTALLATIONS

OF	AT	FOR
Control Data 3170 system	North Carolina Agricultural and Technical State University, Greensboro, N.C.	Administrative, training and scientific data processing applications; also plans to offer computer time to local small colleges (system valued at $600,000)
Control Data 3300 system	Massachusetts Registry of Motor Vehicles, Boston, Mass.	Building and maintaining automobile registration files; providing remote inquiry and retrieval system on driver record and related information; generating accident and statistical reports; preparing excise tax bills for cities and towns; issuing driver license renewals; other related applications
Control Data 7600 system	Westinghouse Electric, Westinghouse Nuclear Center, Monroeville, Pa.	Use in designing reactor systems for nuclear power plants
Hewlett-Packard 2000B system	J. C. Penney Company, Inc., New York, N.Y.	An in-house time-sharing system dedicated entirely to business applications
Honeywell Model 4200 system	Blue Cross of Southern California, Los Angeles, Calif.	The initial step in a major program to speed its data processing operations; second H4200 will be delivered in the spring
Honeywell 8200 system	The American Mutual Liability Insurance Co., Wakefield, Mass.	Replacing three present systems; H8200 will be used for writing and rating policies, collection, claims processing and administrative functions
IBM System/3	Auburn Hosiery Mills, Inc., Auburn, Ky.	Providing customers with in-depth data and same-day order filling
IBM System/3 Model 10	The Fate-Root-Health Co., Plymouth, Ohio	Labor and payroll reports, orders, invoices; later applications will include job order costing and production control
IBM System/360 Model 20	George R. Klein News Co., Cleveland, Ohio	Daily sales analysis of newspaper and magazines; helps 'keep stockroom empty'
IBM System/370 Model 155	Blue Cross and Blue Shield of Alabama, Birmingham, Ala.	Speeding benefit payments to over 1 million Alabama members; facilitating the full claims service for enrollees in Medicaid and in parts A and B of Medicare
IBM 1130 system	Samuel Gary Oil Producer, Denver, Colo.	Helping monitor oilfields of independent oil producer and handling complex division-of-interest accounting for producer's investors; also bill processing, cost accounting, monthly reports for state and federal governments
IBM 1800 system	The Budd Company, Automotive Division, Detroit, Mich.	Providing production reports; monitoring production of 250 machines which make automobile body components
NCR Century 100 system	Gemini Chit Fund Corp., Singapore	Processing some 22,000 depositor accounts
	Guaranty Bond State Bank, Mt. Pleasant, Texas	The heart of a new Central Information File
	Revillon, Paris, France	A variety of data processing tasks including billing, stock and statistical work; will later include the entire banking application
NCR Century 200 system	Alliance Machine Co., Alliance, Ohio	Inventory control, handling accounts payable; also processing accounts receivable and payroll
	U.S. Ceramic Tile Co., Canton, Ohio	Preparation of payrolls and general accounting
UNIVAC 418-II and 1106 systems	Swedish Government Office of Organization and Management (Statskontoret), Stockholm, Sweden (4 systems: two 1106s and two 418-IIs)	Use of the Centrala Bilregistret (Stockholm), the central automobile registration agency for Sweden; systems also be used for census work (systems valued at $4.6 million)
UNIVAC 1106 system	Mankato State College, Mankato, Minn.	Administrative and academic work; also for use by 3 other colleges and later some high schools
	New Holland Division of Sperry Rand Corp., New Holland, Pa.	Heart of multi-million dollar world-wide management information center (system valued at $2 million)
	Ontario Government, Computer Services Center, Toronto, Canada	Various departments of the provincial government requiring data processing including Treasury and Economics, Revenue, Labor, Lands and Forests, etc. (system valued at about $1.25 million)
UNIVAC 9200 system	Shrewsbury Borough Council, England	Local government applications including payroll, mortgage and investment loans and taxes
UNIVAC 9400 system	The Roman Catholic Archdiocese of New York, Data Systems Center	Use in administrative offices, education office and in student/teacher training; includes e.g., fund raising reports, pension plans for both layment and priests; grade reporting, student scheduling, etc.
XDS CE16 systems	Goodyear Tire & Rubber Co., Bakersfield, Calif.	Incorporation into process control systems to automate automobile seat cushion production facilities
XDS Sigma 3 system	Link-Miles Ltd., London, England	Use in flight simulator being built for BOAC; will be used to train pilots and flight engineers
XDS Sigma 5 system	American Council on Education	Assisting in studies of nation's higher education problems (over 400 colleges are participating); main use as massive data storage and computing system for researchers
XDS Sigma 6 system	University of Tulsa, Kendall Campus, Tulsa, Okla.	Student instruction; administrative processing; research activities (both for graduate students and faculty); and information storage and retrieval services for the petroleum industry — the North Campus will have a remote job entry terminal

MONTHLY COMPUTER CENSUS

Neil Macdonald
Survey Editor
COMPUTERS AND AUTOMATION

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

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

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

The following abbreviations apply:

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

SUMMARY AS OF FEBRUARY 15, 1971

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL $(000)		NUMBER OF INSTALLATIONS In U.S.A.	Outside U.S.A.	In World	NUMBER OF UNFILLED ORDERS
Part 1. United States Manufacturers								
Autonetics	RECOMP II	11/58	2.5		30	0	30	X
Anaheim, Calif. (R) (1/69)	RECOMP III							
Bailey Meter Co.	Bailey 750	6/60	40-250	(S)	32	3	35	0
Wickliffe, Ohio (A) (2/71)	Bailey 755	11/61	200-600	(S)	6	0	6	0
	Bailey 756	2/65	60-400	(S)	13	5	18	6
	Bailey 855	4/68	100-1000	(S)	8	0	8	17
Bunker-Ramo Corp.	BR-130	10/61	2.0		160	-	-	X
Westlake Village, Calif.	BR-133	5/64	2.4		79	-	-	X
(A)	BR-230	8/63	2.7		15	-	-	X
(12/70)	BR-300	3/59	3.0		18	-	-	X
	BR-330	12/60	4.0		19	-	-	X
	BR-340	12/63	7.0		19	-	-	X
	BR-1018	6/71	23.0	(S)	-	-	-	-
Burroughs	205	1/54	4.6		25-38	2	27-40	X
Detroit, Mich.	220	10/58	14.0		28-31	2	30-33	X
(N)	B100/B500	7/65	2.8-9.0		-	-	-	-
(1/69-5/69)	B2500	2/67	5.0		52-57	12	64-69	117
	B3500	5/67	14.0		44	18	62	190
	B5500	3/63	23.5		65-74	7	72-81	8
	B6500	2/68	33.0		4	0	4	60
	B7500	4/69	44.0		0	0	0	13
	B8500	8/67	200.0		1	0	1	5
Computer Automation, Inc.	208/808	6/68	5.0	(S)	143	7	150	130
Newport Beach, Calif. (12/70) (A)	216/816	3/69	8.0	(S)	157	13	170	215
Control Data Corp.	G15	7/55	1.6		-	-	295	X
Minneapolis, Minn.	G20	4/61	15.5		-	-	20	X
(R)	LGP-21	12/62	0.7		-	-	165	X
(9/70)	LGP-30	9/56	1.3		-	-	322	X
	RPC4000	1/61	1.9		-	-	75	X
	636/136/046 Series	-	-		-	-	29	-
	160/8090 Series	5/60	2.1-14.0		-	-	610	X
	924/924-A	8/61	11.0		-	-	29	X
	1604/A/B	1/60	45.0		-	-	59	X
	1700	5/66	3.8		-	-	106-180	0
	3100/3150	5/64	10-16		-	-	83-110	C
	3200	5/64	13.0		-	-	55-60	C
	3300	9/65	20-38		-	-	200	C
	3400	11/64	18.0		-	-	20	C
	3500	8/68	25.0		-	-	15	C
	3600	6/23	52.0		-	-	39	C
	3800	2/66	53.0		-	-	20	C
	6400/6500	8/64	58.0		-	-	85	C
	6600	8/64	115.0		-	-	85	C
	6800	6/67	130.0		-	-	1	C
	7600	12/68	235.0		-	-	1	C
								Total: 160 E
Data General Corp.	NOVA	2/69	8.0	(S)	-	-	813	-
Southboro, Mass. (A) (2/71)	SUPERNOVA	5/70	9.6	(S)	-	-	102	-
	NOVA 1200	12/70	5.4	(S)	-	-	8	-
	NOVA 800	4/71	6.9	(S)	-	-	-	-
	SUPERNOVA SC	6/71	11.9	(S)	-	-	-	-
Datacraft Corp.	6024/1	5/69	54-200	(S)	9	-	9	4
Ft. Lauderdale, Fla. (A) (10/70) DC	6024/3	2/70	33-200	(S)	21	0	21	45
Digiac Corp.	Digiac 3060	1/70	9.0	(S)	25	-	-	5
Plainview, N.Y. (A) (12/70)	Digiac 3080	12/64	19.5	(S)	16	-	-	0
	Digiac 3080C	10/67	25.0	(S)	7	-	-	1
Digital Computer Controls, Inc.	D-112	8/70	10.0	(S)	9	1	10	200
Fairfield, N.J. (A) (2/71)								
Digital Equipment Corp.	PDP-1	11/60	3.4		48	2	50	X
Maynard, Mass.	PDP-4	8/62	1.7		40	5	45	X
(A)	PDP-5	9/63	0.9		90	10	100	X
(2/71)	PDP-6	10/64	10.0		C	C	23	X
	PDP-7	11/64	1.3		C	C	160	X
	PDP-8	4/65	0.5		C	C	1440	C

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL $(000)	NUMBER OF INSTALLATIONS In U.S.A.	Outside U.S.A.	In World	NUMBER OF UNFILLED ORDERS
Digital Equipment Corp. (Cont'd)	PDP-8/I	3/68	0.4	C	C	3698	C
	PDP-8/S	9/66	0.3	C	C	1024	C
	PDP-8/L	11/68	-	C	C	3902	C
	PDP-9	12/66	1.1	C	C	436	C
	PDP-9L	11/68	-	C	C	48	C
	PDP-10	12/67	8.0	C	C	145	C
	PDP-11	3/70	10.5 (S)	C	C	546	C
	PDP-12	9/69	-	C	C	475	C
	PDP-15	2/16	17.0	6	C	15	C
	LINC-8	9/66	-	C	C	142	C
							Total: 1350 E
Electronic Associates Inc.	640	4/67	1.2	5	5	40	6
Long Branch, N.J. (A) (2/71)	8400	7/67	12.0	19	6	25	0
EMR Computer	EMR 6020	4/65	5.4	C	-	-	C
Minneapolis, Minn.	EMR 6040	7/65	6.6	C	-	-	C
(N)	EMR 6050	2/66	9.0	C	-	-	C
(12/70)	EMR 6070	10/66	15.0	C	-	-	C
	EMR 6130	8/67	5.0	C	-	-	C
	EMR 6135	-	2.6	-	-	-	-
	EMR 6155	-	-	-	-	-	-
				Total: 103 E	11		Total: 15 E
General Automation, Inc.	SPC-12	1/68	-	-	-	-	-
Anaheim, Calif.	SPC-16	5/70	-	-	-	-	-
(R) (6/70)	System 18/30	7/69	-	-	-	-	-
Hewlett Packard	2114A, 2114B	10/68	0.25	-	-	1075	-
Cupertino, Calif.	2115A	11/67	0.41	-	-	663	-
(A) (2/71)	2116A, 2116B, 2116C	11/66	0.6	-	-	1252	-
Honeywell Information Systems	G58	5/70	1.0	-	-	-	-
Wellesley Hills, Mass.	G105A	6/69	1.3	-	-	-	-
(A) (2/71)	G105B	6/69	1.4	-	-	-	-
	G105RTS	7/69	1.2	-	-	-	-
	G115	4/66	2.2	200-400	420-680	620-1080	-
	G120	3/69	2.9	-	-	-	-
	G130	12/68	4.5	-	-	-	-
	G205	6/64	2.9	11	0	11	-
	G210	7/60	16.0	35	0	35	-
	G215	9/63	6.0	15	1	16	-
	G225	4/61	8.0	145	15	160	-
	G235	4/64	12.0	40-60	17	57-77	-
	G245	11/68	13.0	3	-	3	-
	G255 T/S	10/67	17.0	15-20	-	15-20	-
	G265 T/S	10/65	20.0	45-60	15-30	60-90	-
	G275 T/S	11/68	23.0	-	-	10	-
	G405	2/68	6.8	10-40	5	15-45	-
	G410 T/S	11/69	11.0	-	-	-	-
	G415	5/64	7.3	170-300	70-100	240-400	-
	G420 T/S	6/67	23.0	-	-	-	-
	G425	6/64	9.6	50-100	20-30	70-130	-
	G430 T/S	6/69	17.0	-	-	-	-
	G435	9/65	14.0	20	6	26	-
	G440 T/S	7/69	25.0	-	-	-	-
	G615	3/68	32.0	-	-	-	-
	G625	4/65	43.0	23	3	26	-
	G635	5/65	47.0	20-40	3	23-43	-
	G655	12/70	80.0	-	-	-	-
	H-110	8/68	2.7	180	75	255	0
	H-115	6/70	3.5	30	-	30	-
	H-120	1/66	4.8	800	160	960	-
	H-125	12/67	7.0	150	220	370	-
	H-200	3/64	7.5	800	275	1075	-
	H-400	12/61	10.5	46	40	86	X
	H-800	12/60	30.0	58	15	73	X
	H-1200	2/66	9.8	230	90	325	-
	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-2200	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-8200	12/68	50.0	10	3	14	-
	DDP-24	5/63	2.65	-	-	90	X
	DDP-116	4/65	0.9	-	-	250	-
	DDP-124	3/66	2.2	-	-	250	-
	DDP-224	3/65	3.5	-	-	60	-
	DDP-316	6/69	0.6	-	-	450	-
	DDP-416	-	-	-	-	350	-
	DDP-516	9/66	1.2	-	-	900	-
	H112	10/69	-	-	-	75	-
	H632	12/68	3.2	-	-	12	-
	G3010	-	2.0	-	-	-	-
	G4010	-	6.0	-	-	-	-
	G4020	2/67	6.0	155	45	200	60
	G4040	8/64	3.0	45	20	65	X
	G4050	12/66	7.0	23	1	24	X
	G4060	6/65	2.0	18	2	20	X
	H1602	-	-	-	-	-	-
	H1642	-	-	-	-	-	-
	H1644	-	-	-	-	-	-
	H1646	-	-	-	-	-	-
	H1648	11/68	12.0	-	-	20	-
	H1648A	-	-	-	-	-	-

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IBM	System 3	1/70	1.1	0	0	-	-
White Plains, N.Y.	305	12/57	3.6	40	15	55	-
(N) (D)	650	10/67	4.8	50	18	68	-
(1/69-5/69)	1130	2/66	1.5	2580	1227	3807	-
	1401	9/60	5.4	2210	1836	4046	-
	1401-G	5/64	2.3	420	450	870	-
	1401-H	6/67	1.3	180	140	320	-
	1410	11/61	17.0	156	116	272	-
	1440	4/63	4.1	1690	1174	2864	-
	1460	10/63	10.0	194	63	257	-
	1620 1, 11	9/60	4.1	285	186	471	-
	1800	1/66	5.1	415	148	563	-
	7010	10/63	26.0	67	14	81	-
	7030	5/61	160.0	4	1	5	-
	704	12/55	32.0	12	1	13	-
	7040	6/63	25.0	35	27	2	-
	7044	6/63	36.5	28	13	41	-
	705	11/55	38.0	18	3	21	-
	7020, 2	3/60	27.0	10	3	13	-
	7074	3/60	35.0	44	26	70	-
	7080	8/61	60.0	13	2	15	-
	7090	11/59	63.5	4	2	6	-
	7094-1	9/62	75.0	10	4	14	-
	7094-11	4/64	83.0	6	4	10	-
	360/20	12/65	2.7	4690	3276	7966	-
	360/25	1/68	5.1	0	4	4	-
	360/30	5/65	10.3	5075	3144	8219	-
	360/40	4/65	19.3	1260	498	1758	-
	360/44	7/66	11.8	65	13	78	-
	360/50	8/65	29.1	480	109	589	-
	360/65	11/65	57.2	175	31	206	-
	360/67	10/66	133.8	9	4	13	-
	360/75	2/66	66.9	14	3	17	-
	360/85	12/69	150.3	0	0	0	-
	360/90	11/67	(S)	5	0	5	-
	360/195	-	232.0	-	-	-	-
Interdata	Model 1	12/70	11.0	45	1	20	70
Oceanport, N.J.	Model 3	5/67	20.0	N/A	-	260	X
(A) (2/71)	Model 4	8/68	15.0	280	20	300	90
	Model 5	11/70	25.0	9	1	40	30
	Model 15	1/69	35.0	N/A	-	64	13
NCR	304	1/60	14.0	15	2	17	X
Dayton, Ohio	310	5/61	2.5	8	0	8	X
(R) (2/71)	315	5/62	8.7	400	300	700	-
	315 RMC	9/65	12.0	150	45	195	-
	390	5/61	1.9	950	500	1450	-
	500	10/65	1.5	1100	1800	2900	-
	Century 100	9/68	2.7	1100	300	1400	-
	Century 200	6/69	7.5	350	90	440	-
Philco	1000	6/63	7.0	16	-	-	X
Willow Grove, Pa.	200-210,211	10/58	40.0	16	-	-	X
(N) (1/69)	2000-212	1/63	52.0	12	-	-	X
RCA	301	2/61	7.0	140-290	100-130	240-420	-
Cherry Hill, N.J.	501	6/59	14.0-18.0	22-50	1	23-51	-
(N)	601	11/62	14.0-35.0	2	0	2	-
(5/69)	3301	7/64	17.0-35.0	24-60	1-5	25-65	-
	Spectra 70/15	9/65	4.3	90-110	35-60	125-170	-
	Spectra 70/25	9/65	6.6	68-70	18-25	86-95	-
	Spectra 70/35	1/67	9.2	65-100	20-50	85-150	-
	Spectra 70/45	11/65	22.5	84-180	21-55	105-235	-
	Spectra 70/46	-	33.5	1	0	1	-
	Spectra 70/55	11/66	34.0	11	1	12	-
Raytheon	250	12/60	1.2	115	20	175	X
Santa Ana, Calif.	440	3/64	3.6	20	-	20	X
(A)	520	10/65	3.2	26	1	27	X
(2/71)	703	10/67	12.8 (S)	171	31	202	3
	704	3/70	9.8 (S)	14	78	49	
	706	5/69	19.0 (S)	54	14	68	11
Scientific Control Corp.	650	5/66	0.5	23	0	23	X
Dallas, Tex.	655	10/66	2.1	137	0	137	0
(A)	660	10/65	2.1	41	0	41	0
(6/70)	670	5/66	2.7	1	0	1	X
	4700	4/69	1.8	19	0	19	4
	DCT-132	5/69	0.9	45	0	45	23
Standard Computer Corp.	IC 4000	12/68	9.0	8	0	8	6
Los Angeles, Calif.	IC 6000	5/67	16.0	9	0	9	-
(N) (12/70)	IC 7000	8/70	17.0	4	0	4	5
Systems Engineering Laboratories	810	9/65	1.1	24	0	24	X
Ft. Lauderdale, Fla.	810A	8/66	0.9	111	5	216	32
(A)]	810B	9/68	1.2	75	1	76	26
(6/70)	840	11/65	1.5	3	0	3	X
	840A	8/66	1.5	36	2	38	X
	840MP	1/68	2.0	31	0	31	2
	Systems 86	-	10.0	0	0	0	2
UNIVAC Div. of Sperry Rand	I & II	3/51 & 11/57	25.0	23	-	-	X
New York, N.Y.	III	8/62	21.0	25	6	31	X
(A)	File Computers	8/56	15.0	13	-	-	X
(2/71)	Solid-State 80 I,II, 90, I, II, & Step	8/58	8.0	210	-	-	X
	418	6/63	11.0	76	36	112	20 E
	490 Series	12/61	30.0	75	11	86	35 E
	1004	2/63	1.9	1502	628	2130	20 E

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UNIVAC (Cont'd.)	1005	4/66	2.4	637	299	936	90 E
	1050	9/63	8.5	138	62	200	10 E
	1100 Series (except 1107,1108)	12/50	35.0	9	0	9	X
	1107	10/62	57.0	8	3	11	X
	1108	9/65	68.0	87	114	56	75 E
	9200	6/67	1.5	1051	822	175	850 E
	9300	9/67	3.4	387	49	144	550 E
	9400	5/69	7.0	8	0	3	60 E
	LARC	5/60	135.0	2	0	2	-
Varian Data Machines Newport Beach, Calif. (A) (2/71)	620	11/65	0.9	-	-	75	X
	620i	6/67	0.5	-	-	1300	400
	R-620i	4/69	-	-	-	50	30
	520i	10/68	0.4	-	-	150	330
	520/DC	12/69	1.6	-	-	25	25
	620/f	11/70	0.5	-	-	7	125
Xerox Data Systems El Segundo, Calif. (R) (2/71)	XDS-92	4/65	1.5	10-60	2	12-62	-
	XDS-910	8/62	2.0	150-170	7-10	157-180	-
	XDS-920	9/62	2.9	93-120	5-12	98-132	-
	XDS-925	12/64	3.0	20	1	21	-
	XDS-930	6/64	3.4	159	14	173	-
	XDS-940	4/66	14.0	28-35	0	28-35	-
	XDS-9300	11/64	8.5	21-25	1	22-26	-
	Sigma 2	12/66	1.8	60-110	10-15	70-125	-
	Sigma 3	12/69	2.0	10	0	10	-
	Sigma 5	8/67	6.0	15-40	6-18	21-58	-
	Sigma 6	6/70	12.0	-	-	-	-
	Sigma 7	12/66	12.0	24-35	5-9	29-44	-
	Sigma 9	-	35.0	-	-	-	-

Westin - *Continued from page 7*

peripheral equipment and expensive consulting services to recommend, design, and install information systems. This may represent a typical instance of early development costs of a powerful tool before its true potential is realized. Furthermore, in a capitalist system, with its basic principle of *caveat emptor*, the political answer may be that the consumer (even the government consumer) has to learn through some costly experiences just what the new mousetrap can and cannot do. There is at any rate nothing to suggest that socialist or communist nations have leaped over these early experimental stages, or that they have conducted them at lesser cost per advance.

Be all that as it may, our interviews show that a new tough-minded attitude has been developing among government professionals, agency officials, department executives, and key legislators who oversee data processing expenditures. This suggests that the first era of bandwagon effects and easy money may be over, and that systems in the 1970's will be under much more severe requirements to pay their way. Nevertheless, there may still remain a need – in the interests of protecting democratic government – for some new processes and institutions (or at least for even greater awareness by existing agencies) to review the creation and use of computerized information systems, not only to secure citizen rights to privacy and due process, but also to bring the political assumptions and policy preferences embedded in data bank systems under far better and more open public scrutiny than was true in the 1960's.

The detailed findings of our study deal with the early effects of data bank developments on the internal structures and role relationships of the government agencies that adopted them, with the changing relationships of those agencies to other government agencies, with some new patterns of intergovernmental relationships, and with the relationship of data bank-owning agencies to legislative and interest group processes. For these findings, and for a general analysis of possible trends in the next five years, readers will be able to consult our finished report.

CORRECTIONS

In the February 1971 issue of Computers and Automation, the following corrections should be made:

Page 18, Figure 5e: In #903, line 2, replace "SUBRAPUBIC" by "SUPRAPUBIC".

Page 42, "The Golden Trumpet": In the last paragraph, line 3, replace "Gold" by "Quin".

Page 49, col. 1: Replace "spectographic" by "spectrographic" in six places — the subheading at the top of the page, and in lines 10, 20, 30, 44, and 46.

Page 63, Advertising Index, col. 2, line 1: replace "Page 3" by "Page 2".

(The proofreader for certain parts of our February issue qualifies as Rip Van Winkle.)

TIME-SHARING PHONE BOOK

Eugene C. Gaines, Jr., Pres.
Time-Sharing Enterprises, Inc.
3401 Market St.
Philadelphia, PA 19104

Thank you for your letter requesting a review copy of our Time-Sharing Phone Book.

A copy is enclosed.

I hope things are going well for you and for your magazine.

A note of explanation -- the TIME-SHARING PHONE BOOK is intended to attract new users to time-sharing, by making them aware of the great wealth of time-sharing services which are as close as a local telephone call.

The time-sharing field needs help -- and new customers -- now. I will much appreciate your mentioning "helps you get started in choosing a time-sharing service" in anything you might wish to print about the Time Sharing Phone Book.

Siklossy - *Continued from page 15*

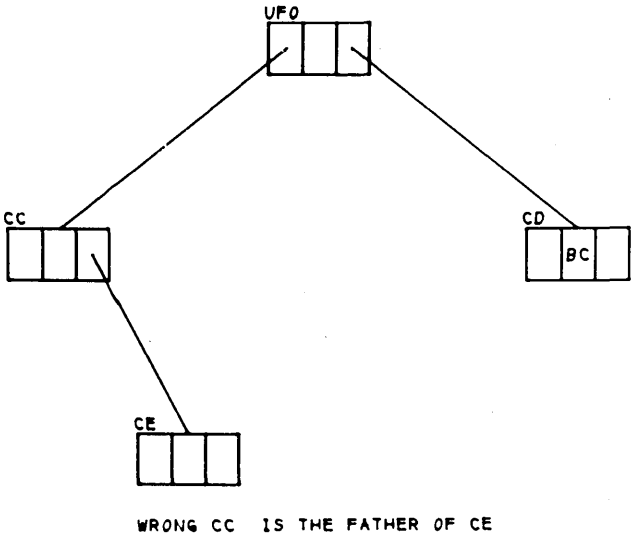


Figure 3. A quiz on another tree proposed by the student.

trees, since it draws them so prettily. But it knows more than has been apparent so far. The tutor can ask questions about the tree that the student has made it draw. Figure 3 shows the tutor's comment on an answer from the student. The student was asked to select a node from the tree and node CE was selected. The student was asked which node was the father of CE, and answered UFO.

Impossible Problems

The diagnostic capabilities represent a major asset of our teaching system. They free the designer from having to think out all possible answers a student might be expected to give. Maybe more important still, they are very helpful in making use of "impossible" problems for tutorial purposes. For example, in Figure 3, the question: "Which node is the father of BC?" does not make sense, since BC is not the label, but the contents of a node. Some other examples of impossible problems are:

Give me a set with -2 elements, (there are no such sets); Is the set A a subset of the set (B A C), (A is not a set). We feel that impossible problems have excellent pedagogical value, since we wish our students to learn not only *how to*, but also *when to* and *when not to*.

Conclusion

Computers know, or can be made to know, many of the subject areas that we wish to teach. We have given examples of two computer teaching systems that have, at their hearts, programs that understand, in an operative sense, what they are trying to teach. The two subject areas that we have described are elementary set theory and computer information structures. In the latter area, the competence of the computer tutor is enhanced by its superior display abilities. Using a CRT, past and present events can be exhibited concurrently, and dynamic motions can be explicated. □

Reference

Siklóssy, L. Computer Tutors that Know what they Teach, *Proceedings FJCC*, 1970, p. 251-255.

[2] The information structures teacher is programmed in FORTRAN on the CDC 6600 computer and uses the CDC 252 display system. The figures are photographic prints of microfilm pictures of the CRT.

CALENDAR OF COMING EVENTS

Mar. 1-3, 1971: Data Processing Supplies Association, Spring Membership Meeting, The Doral Hotel & Country Club, Miami, Fla. / contact: Data Processing Supplies Association, 1116 Summer St., Stamford, Conn. 06905

Mar. 1-3, 1971: First International Symposium on Fault-Tolerant Computing, Huntington-Sheraton Hotel, Pasadena, Calif. / contact: Dr. Francis P. Mathur, Sec'y, IEEE Technical Comm. on Fault-Tolerant Computing, Jet Propulsion Laboratory, Calif. Institute of Tech., 4800 Oak Grove Dr., Pasadena, Calif. 91103

Mar. 9-13, 1971: INEL 71, the 5th International Exhibition of Industrial Electronics, Basel, Switzerland / contact: Sekretariat INEL 71, CH-4000, Basel 21, Switzerland

March 10, 1971: Fourth Annual Symposium on Automatic Data Processing (sponsored by Federal Executive Board of Federal ADP Council of New England), Sheraton-Boston Hotel, Prudential Center, Boston, Mass. / contact: Thomas T. Donovan, Air Force Computer Operations Div. (MCCO), L. G. Hanscom Field, Bedford, Mass. 01730

March 17-18, 1971: Spring Conference of The Association for Systems Management, Royal York Hotel, Toronto, Ontario, Canada / contact: Donald T. Laughton, Chmn., Special Conference, North American Life Assurance Co., 105 Adelaide St. West, Toronto 1, Ontario, Canada

Mar. 22-24, 1971: Ninth Annual Symposium on Biomathematics and Computer Science in the Life Sciences, Univ. of Texas Graduate School of Biomedical Sciences / contact: Office of the Dean, Univ. of Texas Graduate School of Biomedical Sciences at Houston, Div. of Continuing Education, P.O. Box 20367, Houston, Tex. 77025

Mar. 22-24, 1971: Numerical Control Society's Eighth Annual Meeting and Technical Conference, Disneyland Hotel, Anaheim, Calif. / contact: William H. White, Numerical Control Society, 44 Nassau St., Princeton, N. J. 08540

Mar. 22-25, 1971: IEEE International Convention & Exhibition, Coliseum & N.Y. Hilton, New York, N.Y. / contact: IEEE Headquarters, 345 E. 47th St., New York, N.Y. 10017

Mar. 23-26, 1971: Third National Meeting of the Information Industry Assoc., Host Farm Resort, Lancaster, Pa. / contact: Paul G. Zurkowski, IIA Washington, 1025 Fifteenth St., N.W., Washington, D.C. 20005

Mar. 29-Apr. 2, 1971: Datafair '71 Conference, Nottingham Univ., Nottingham, England / contact: Datafair '71 Conference Office, The British Computer Society, 21 Lamb's Conduit St., London, W.C.1, England

Apr. 1-2, 1971: ACM Symposium on Information Storage and Retrieval, Univ. of Maryland, College Park, Md. / contact: Dr. Jack Minker, Computer Science Center, Univ. of Maryland, College Park, Md. 20742

Apr. 1-2, 1971: Virginia Computer Users' Conference, Virginia Polytechnic Institute and State Univ., Blacksburg, Va. / contact: Prof. Bruce Klein or Joe Collins, Computer Science Dept., VPI & SU, Blacksburg, Va. 24061

Apr. 5-8, 1971: The First National Educational Technology Conference, American Hotel, New York, N.Y. / contact: Conference Manager, Educational Technology, Englewood Cliffs, N.J. 07632

Apr. 13-16, 1971: Ninth Annual Convention of the Association for Educational Data Systems, Royal York Hotel, Toronto, Ontario, Canada / contact: AEDS Convention, P.O. Box 426, Don Mills, Ontario, Canada

May 3-5, 1971: Data Processing Supplies Association, Affiliate Membership Meeting, Copenhagen, Denmark / contact: Data Processing Supplies Association, 1116 Summer St., Stamford, Conn. 06905

May 11-13, 1971: IEEE (Institute of Electrical and Electronic Engineers) 1971 Region Six Conference, Wood Lake Inn, Sacramento, Calif. / contact: Dr. D. H. Gillot, Co-Chmn, IEEE Region 6 Conference, Sacramento State College, Dept. Of Electrical Engineering, 6000 Jay St., Sacramento, Calif. 95819; or, Dr. R. F. Soohoo, Program Chmn., IEEE Region 6 Conference, Univ. of California at Davis, Dept. of Electrical Engineering, Davis, Calif. 95616

Classified Advertisements

IBM ENGINEER RECEIVES $50,000 AWARD

Michael J. Ambrosio
IBM Systems Development Division
Poughkeepsie, NY 12602

IBM Senior Engineer William F. Beausoleil has received a $50,000 award for an outstanding contribution. A check for the award amount was presented to Mr. Beausoleil on Jan. 26 in Poughkeepsie, N. Y., for his work in devising a low-cost technique that results in significant increases in usable monolithic circuit memory modules for computers.

During his 14 years in IBM, Mr. Beausoleil has received nine other awards. He also holds five U.S. and eight foreign patents.

Announcement

COMPUTER DIRECTORY AND BUYERS' GUIDE, 1971

The 17th annual COMPUTER DIRECTORY AND BUYERS' GUIDE issue of Computers and Automation, a special directory issue, will be published in June 1971. It will contain more than twenty kinds of valuable reference information, including an alphabetical Roster of Organizations in the field of computers and data processing and a Buyers' Guide of Products and Services in the computing field. All listings in the DIRECTORY issue are FREE.

If your organization has recently entered this field — or if you are not sure that we have your organization's name on our mailing list to receive an entry form for this year's directory — please use the entry form appearing in the 1970 directory issue (or a copy of it) — or write us at once asking for an entry form:

Directory Editor
Computers and Automation
815 Washington Street
Newtonville, Mass. 02160

Entry forms will be mailed shortly. The closing date for receipt of entry forms for this year's directory is April 15, Thursday, in our office.

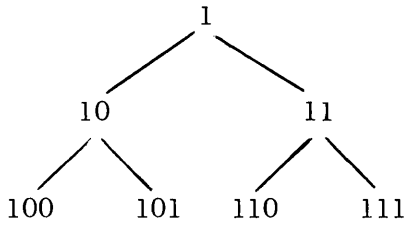
c.a PROBLEM CORNER

Walter Penney, CDP
Problem Editor
Computers and Automation

PROBLEM 713: A FAMILY PROBLEM

"What's that you're drawing — a family tree?", asked Joe coming upon Pete deep in thought.

"Well, in a way, yes. You might say it's a family tree of three-bit numbers", said Pete, pointing to the diagram he was studying.



"It's something that came up in our Data Structure course."

"Nice, but except for showing that each number has two descendants in the next generation I don't see much to it."

"The idea is that if we have a tree like this with all the binary numbers from 1 to $2^n - 1$ and scanned it from left to right we'd like to know what would be the kth one we hit", Pete explained.

"What do you mean by scanning from left to right?", asked Joe.

"It's what's called postorder. In this example we'd have 4, 2, 5, 1, 6, 3, 7."

"Well, it shouldn't be too difficult to figure out the position of any number or the number in any position."

What number is in position k?

Solution to Problem 712: A New Gematria?

The three cases which involved all six letters are CB × ED = ABEF, DB × ED = CABF and EB × DD = CADF. Of these only the last (corresponding to 235 × 221 = 51935) has one letter occurring three times and the other letters once each.

Readers are invited to submit problems (and their solutions) for publication in this column to: Problem Editor, Computers and Automation, 815 Washington St., Newtonville, Mass. 02160.

ADVERTISING INDEX

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

c.a NUMBLES

NUMBER PUZZLES FOR NIMBLE MINDS –AND COMPUTERS

Neil Macdonald
Assistant Editor
Computers and Automation

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

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

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

Stuart Freudberg
Newton High School
Newton, Mass.

NUMBLE 713

```
    M A N I S
  × T H E
  ---------
    H C R T H H
  A F E I S L        CFL = STM = CTN
  S O A H C S
  ---------
= R A D D I R D H    4278  0963  5595
```

Solution to Numble 712

In Numble 712 in the February issue, the digits 0 through 9 are represented by letters as follows:

S = 0	F, V = 5
R = 1	N = 6
H = 2	E = 7
T = 3	O = 8
D = 4	U = 9

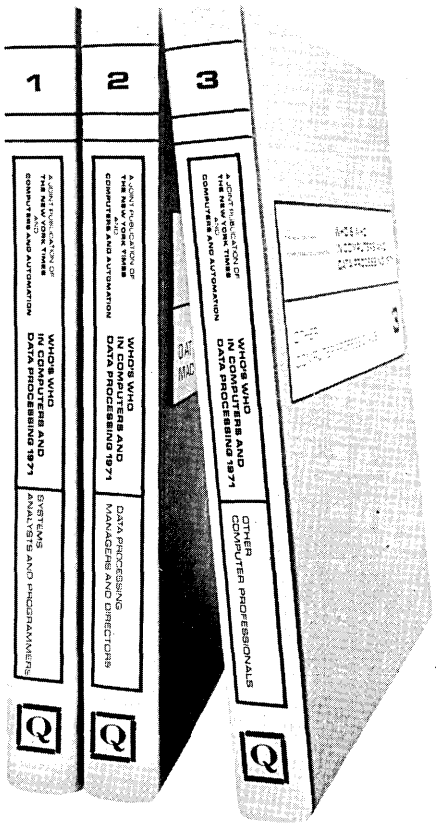
The message is: The fed hound never hunts.

Our thanks to the following individuals for submitting their solutions – to **Numble 711**: C. L. Agrawal, Claymont, Del.; Marijoe Bestgen, Riverdale, N.Y.; Debra Bruno, Cliffside Park, N.J.; T. P. Finn, Indianapolis, Ind.; John H. MacMullen, Eden Prairie, Minn.; L. J. Mathiason, Chillicothe, Ohio; G. P. Petersen, St. Petersburg, Fla.; Vincent K. Roach, New York, N.Y.; Harold L. Smith, Thomson, Ga.; and Robert R. Weden, Edina, Minn. – to **Numble 7012**: Marijoe Bestgen, Riverdale, N.Y. and G. P. Petersen, St. Petersburg, Fla. – to **Numble 7011**: Bill Call, Saginaw, Mich. and Lee Olson, Delaware, Ohio – to **Numble 7010**: SSG Raymond L. Cowen, Gunter AFB, Ala. and Krishna Moorthy, Kanpur, India.

The New York Times and
Computers and Automation
announce a practical guide to
the most elusive components in computers and data processing...

PEOPLE

Who they are...
What they do...
Where they do it...



Until now, it has been well-nigh impossible to keep track of the thousands of highly skilled professionals engaged in the world's fastest growing profession.

The painstaking task required to inventory the qualifications and backgrounds of the 15,000 most necessary professionals in every branch of the computer field has now been accomplished. The oldest magazine in the field, *Computers and Automation,* and the information retrieval services of *The New York Times* have pooled their resources to produce the Fifth Edition of

WHO'S WHO IN COMPUTERS AND DATA PROCESSING

This is the most extensive register of computer professionals ever published – the first of its kind in seven years. It is arranged for your convenience in three volumes:

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Each of the more than 15,000 specialists is covered by a separate capsule biography detailing: *Birth Date ... Education ... Year Entered Computer Field ... Title ... Honors ... Memberships ... Special Skills* (from applications to logic to sales) ...

PLUS both home and business addresses. For example:

> CHAPIN, Ned / consultant / born: 1927 / educ: PhD, IIT; MBA, Univ of Chicago / entered computer field: 1954 / main interests: applications, business, logic, management, programming, systems, data structures / title: data processing consultant / organization: InfoSci Inc, Box 464, Menlo Park, CA 94025 / publications, honors: 3 books, over 50 papers; member, over 12 associations; CDP; lecturer for ACM / home address: 1190 Bellair Way, Menlo Park, CA 94025

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815 Washington St., Newtonville, Mass. 02160

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COMPUTER DIRECTORY AND BUYER'S GUIDE Comprehensive geographical listing of: Computer and data-processing services, commercial time-shared services, courses and seminars, consulting services, leased equipment, software, campus computer centers, computer associations, users groups. PLUS: More than 2,000 applications of computer and data processing equipment, a world computer census – *and more!* Order now at $20 (after publication, $25)

C8