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February, 1974
Vol. 23, No. 2

computers and people

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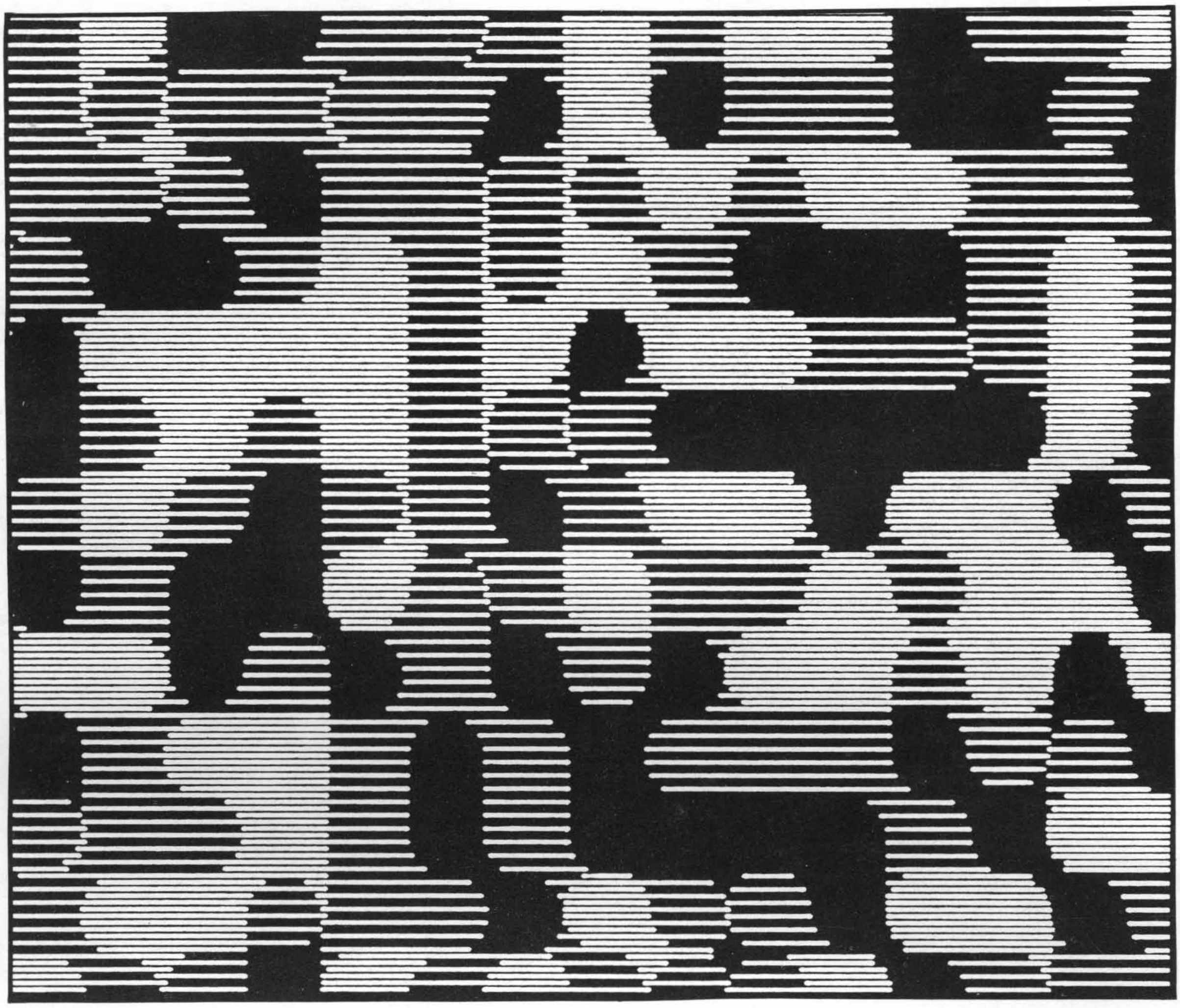

"COMPUTER TAPESTRY – DETAIL"

INVENTORY OF THE 36 ISSUES OF — TITLES AND SUMMARIES

THE NOTEBOOK ON COMMON SENSE, FIRST YEAR

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1. Right Answers — A Short Guide to Obtaining Them
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Vol. 23, No. 2
February, 1974

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computers and people

formerly *Computers and Automation*

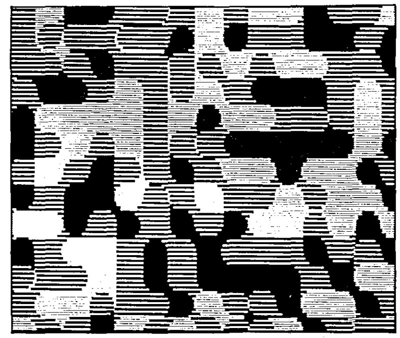
The magazine of the design, applications, and implications of information processing systems — and the pursuit of truth in input, output, and processing, for the benefit of people.

Unsettling, Disturbing, Critical . . .

Computers and People (formerly *Computers and Automation),* believes that the profession of information engineer includes not only competence in handling information using computers and other means, but also a broad responsibility, in a professional and engineering sense, for: the reliability and social significance of pertinent input data; the social value and truth of the output results. In the same way, a bridge engineer takes a professional responsibility for the reliability and significance of the data he uses, and the safety and efficiency of the bridge he builds, for human beings to risk their lives on.

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

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



Front Cover Picture

The author of this computer art, Manfred Mohr, Paris, France, reports: "Labyrinthic paths through a matrix are calculated. . . . The programs are written in Fortran IV, run on a CDC 6600 computer, and plotted on an X-Y incremental plotter."

Departments

Key

- [A] — **Article**
- [C] — **Monthly Column**
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- [F] — **Forum**

NOTICE

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"UNDERSTANDING TECHNOLOGY"

A recent very interesting and important book is *Understanding Technology* by Charles Susskind, a member of the faculty of the University of California at Berkeley, Calif.; the book was published in 1973 by The Johns Hopkins University Press.

Though not a long book (162 pages) it is full of keen observations and conclusions on significant topics, and well-selected and pertinent examples that provide evidence for his conclusions. He defines his subject technology as:

> man's efforts to satisfy his material wants by working on physical objects.

He comments on how surprising it is that:

> In a "liberal" education, technology is virtually ignored, despite its central place in contemporary culture – more important in many ways than the prevailing political system.

And he proceeds to present this vast subject in a well-organized guide through the territory, accompanied by many illuminating remarks, such as:

– The advent of adult education centered around evening study, can be traced to effective lighting.

– The greatest effect of improved transport technology has been the tremendous increase in the volume of commerce which ... contains the means of bringing the new abundance to all corners of the earth.

– The principle that workers engaged in mass production, suitably rewarded, also become consumers of their own products (including housing) played an important part in making the American standard of living the highest in the world – certainly a greater part than, say, social legislation ....

– Designing automated machinery to do some of the most boring jobs [is] an example of the way in which a problem created by technology is ultimately solved by more technology.

This important book affects the objectives of *Computers and People* (formerly *Computers and Automation*) in at least two ways.

First, it helps us see computers in perspective as a part of technology. A few of the interesting remarks of Susskind are these:

– The ability of the electronic digital computer to perform complicated calculations at great speed ... has made it the outstanding machine of the Second Industrial Revolution, an artifact that far eclipses any other in significance.

– The evolution of the high-speed digital computer from the primaeval ENIAC was a scientific and technological achievement of the first order, the more so since it was accomplished in about 15 years.

– A computer can adapt its store of knowledge automatically as a result of information that it has itself generated. ... This adaptive ability makes it seem that the computer can learn or understand, in other words, exhibit intelligence; and in fact the term "artificial intelligence" has been coined to describe this property.

People in the computer field need perspective. We need to see computers in the light of other kinds of technology; and we need to see technology in the light of man's surviving on this earth. There is hardly anything easier than "ignorance, prejudice, and a narrow point of view". But Susskind's book is a helpful antidote for this condition.

An even more important way in which this book affects the objectives of *Computers and People* is in its discussion of the ethics and social value of technology. When is a technologist doing good or doing harm? How should a technologist guide himself so that he does good? The answer which Susskind gives – and a description of the sharing of responsibility between the technologist and his society – is contained in Chapter 7, "Technology as a Social Force and as an Ethical Problem". This chapter makes use of reports on two important examples, one of a beneficial technology (Agricultural Extension in the United States), and one of an evil technology (the technology for putting to death millions of people, as developed in Hitler's Germany 1941-45). It also contains an excellent proposal for an Engineer's Hippocratic Oath, that an engineer use his engineering knowledge for the benefit of man.

We are very grateful to The Johns Hopkins University Press and to Charles Susskind for permission to reprint this chapter as an article in this issue of *Computers and People.* And we hope that a great many of our readers of that article will follow this up by reading the whole of this most worthwhile and significant book.

Edmund C. Berkeley
Editor

"UNDERSTANDING TECHNOLOGY"

by Charles Susskind

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AUTOMATED RECYCLING

Associate Professor Stephen D. Senturia
Room 13-3061
Massachusetts Institute of Technology
Cambridge, Mass. 02139

The Mountain of Refuse

Every person is responsible, on the average, for generating seven pounds of refuse per day. Even moderate-sized cities, therefore, are faced with a monumental refuse-disposal problem, roughly 1000 tons per day for a city of 250,000 population. Present solutions to this problem use one of two principal disposal methods — landfill, in which the refuse is thrown in a hole and covered with earth, and incineration, in which the refuse is burned and the residue is thrown in a hole and covered with earth.

These methods suffer from a variety of ills. Landfills are sources of severe air and water pollution, and are often breeding grounds for rats, flies, and other pests. Furthermore, the cost of land for landfill sites is becoming prohibitively high. Incinerators are very expensive to build and operate, are sources of air pollution, and rarely operate with the thoroughness and efficiency expected by the community.

In both methods, there is an irretrievable loss of both natural resources and energy. Energy is lost first because combustible material is discarded without first extracting its energy content by careful combustion and efficient recovery of heating values, and second, because the replacement of the refined and finished materials being thrown away requires energy in addition to new natural resources. At a time of severe energy shortages and of anticipated shortages in such goods as paper and metals, the continuation of these inefficient and wasteful disposal methods seems to operate against our national interest.

Voluntary Recycling

Many small communities, in response to these ills, have instituted voluntary recycling programs in which individual householders are asked to separate refuse into recyclable fractions such as paper, glass, and metals, and to bring the separated fractions to centralized recycling centers, often located at the town dump or incinerator. The goals of these programs are several, to save the natural resources and the energy that has been spent refining those resources into useful materials, to reduce pollution, and to reduce the landfill and/or incineration costs that the community must pay for disposal of the refuse. Some of these programs have been successful, usually in small, relatively affluent suburban communities where there is a high level of citizen awareness and participation. In large urban areas, successful voluntary recycling programs are rare.

Recycling by Machine

A team of researchers at the Massachusetts Institute of Technology supervised by Professor David G. Wilson and by the author has recently assembled a prototype recycling plant that would permit large-scale recycling in densely populated areas without requiring individual householders to separate and transport recyclable materials to recycling centers. The plant is designed to accept municipal refuse from ordinary collection vehicles, physically separate the refuse into individual items, and then sort the items into recyclable and non-recyclable fractions.

The key to successful operation of the plant is a computer which examines data from sensors and determines an output category on the basis of a pattern-recognition algorithm. Preliminary analyses of municipal refuse indicate that this kind of plant could separate 50 percent of the incoming refuse into recyclable components such as paper, glass, metals, and plastics, and in addition produce a significant savings in overall refuse-disposal costs.

A Model Plant

Figure 1 shows a model of the plant. Refuse trucks deposit their loads at the plant. Front-end loaders feed the refuse onto a conveyor which feeds a hopper (A), which in turn feeds a multi-deck vibrating screen (B). A fan (C) pulls loose sheets of paper nd plastic film off the top of the screen, and a magnet (D) removes ferrous objects. The items which drop through the bottom of the screen go to a shredder (E), a second vibrating screen for size sorting (F), and then to a vortex classifier for separation (G). The larger items, which do not fall

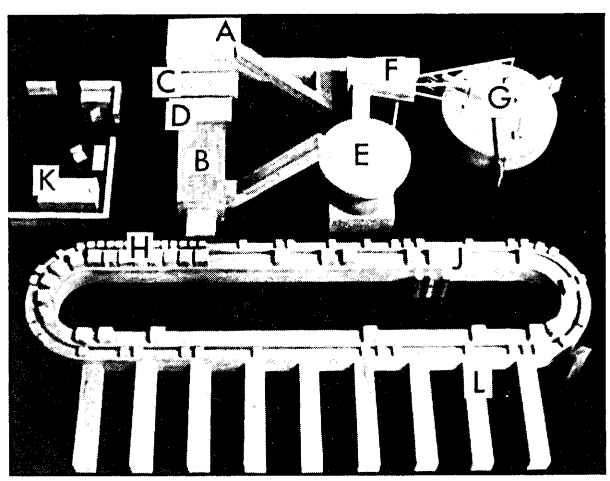


Figure 1

Block model of the MIT automated solid-waste separation plant: (A) Hopper; (B) vibrating screen; (C) fan; (D) magnet; (E) shredder; (F) vibrating screen; (G) vortex classifier; (H) carts; (J) sensor location; (K) computer; (L) dumping station.

"PRELIMINARY ANALYSIS OF MUNICIPAL REFUSE INDICATES THAT THIS KIND OF PLANT COULD SEPARATE 50% OF THE INCOMING REFUSE INTO RECYCLABLE COMPONENTS, AND IN ADDITION PRODUCE A SIGNIFICANT SAVING IN THE OVERALL COSTS OF REFUSE-DISPOSAL."

through the screen, are dropped from a feed conveyor into carts (H). The carts run on an oval track. Each cart has sloping sides and a slit in the bottom, so that the item falls to a position over the slit. Through this slit sensors (J) interact with the refuse item. Data from the sensors are fed to a computer (K) which decides how the item should be classified. The classification is then written on the cart which then moves past a series of dumping stations (L). When the cart reaches the correct dumping station the sloping sides of the cart retract, allowing rapid emptying of the cart. Once emptied the cart rejoins the queue awaiting filling.

The Sensors

The heart of the plant is the large-item sorter. Three sensors are used: 1) a commercial metal detector similar to the instrument used to search airline passengers for metallic objects; 2) an impact sensor, and 3) an infrared sensor. These latter sensors are novel developments of the MIT program.

The impact sensor consists of a small accelerometer mounted on a loudspeaker cone. The loudspeaker is driven with a signal which causes the accelerometer to vibrate up and down. As a cart is passed over the impact sensor, the vibrating accelerometer strikes the object through the slit in the cart, producing an acceleration waveform characteristic

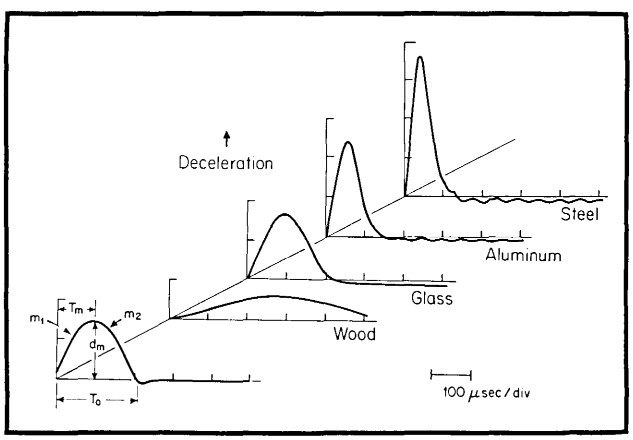


Figure 2
Selected deceleration waveforms from the impact sensor

of the material being struck. Figure 2 shows waveforms for selected samples of refuse. Data on the height, width, and ascending and descending slopes of the impact waveform are measured electronically, converted to digital form, and fed to the computer for processing.

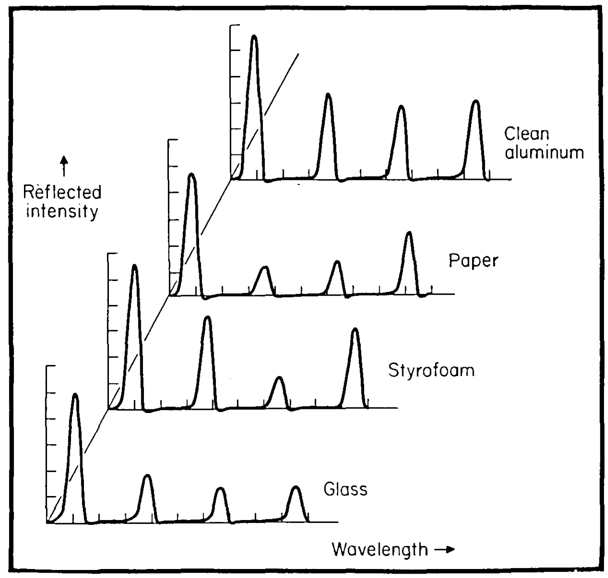
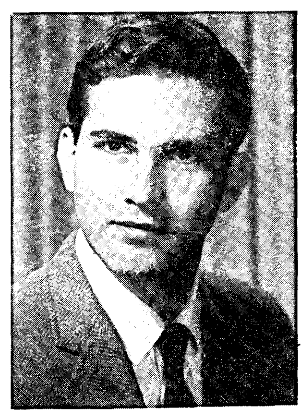


Figure 3
Selected reflection spectra from the infrared sensor



Stephen D. Senturia, Associate Professor of Electrical Engineering at the Massachusetts Institute of Technology, joined the department immediately after completing his education (Harvard, BA in Physics, 1961; MIT, Ph.D. in Physics, 1966). His research interests have included nuclear magnetic resonance and other physical studies in semiconductors, and most recently, polymeric semiconductors. A parallel thread in his research has been the application of the methods of physical measurement to practical problems. He is in charge of teaching MIT's survey course in basic electronics, and is the author of a textbook now in press. He is a member of Phi Beta Kappa, Sigma Xi, the American Physical Society, and the Instrument Society of America.

The infrared sensor is a special-purpose high-speed reflection spectrometer which measures the diffusely reflected light intensity at four selected infrared wavelengths. By careful selection of the particular wavelengths used, it is possible to make the relative intensities of the four wavelengths extremely sensitive to the material doing the reflecting. Figure 3 shows several typical spectra. The four peak heights are measured electronically, converted to digital form, and fed to the computer for subsequent processing.

Sorting by Computer

Data from the metal detector, the impact sensor, and the infrared sensor are collected for each refuse item and fed to the computer. The computer is programmed to process this data and yield a classification.

The Programming Method

The method used to develop this program has been borrowed from the lexicon of pattern recognition. The set of numbers collected for each item (one number from the metal detector, four numbers from the infrared sensor, and five numbers from the impact sensor) are considered to constitute a 10-dimensional vector D. The specific pattern-recognition method used, called linear separation, seeks to develop a matrix M which has d columns and c rows, d being the dimension of the data vector D and c being the number of categories into which separation is made. In linear separation algorithms, this matrix M is multiplied by the vector D yielding a c-dimensional vector C. If M is selected properly, the location of the maximum component of C will correspond to the category into which the data vector D should be classified.

TABLE 1

Iterative training of a
linear-separation pattern-recognition algorithm

1. Select trial matrix M

2. Select data vector of category k

3. Form product vector C

$$C = M \cdot D$$

4. Search C for position j of maximum component

5. If $j = k$ for data vector, select new data vector

   If $j \neq k$, adjust M, then select a new data vector

Repeat until all data vectors in the trial set are correctly classified.

The sorting matrix M is found by iterative techniques (see Table I). A set of typical data vectors with their correct classifications are stored in the computer. They are selected at random for one-at-a-time trials with M. An initial trial matrix is selected (a matrix containing all 1's is often used as a starting point). This trial matrix is multiplied by the first data vector. The position of the maximum of the product is compared with the category of the data vector. If they agree, a new data vector is selected at random and the process is repeated. If they do not agree, the matrix M is adjusted by adding a fraction of D to the k^{th} row and subtracting a fraction of D from all other rows. Then a new data vector is selected for another trial. This iterative process of correcting M is repeated until all data vectors in the original sample are classified correctly.

Once a matrix is found which can correctly classify all of the data vectors in a test sample, the program is ready to operate as a classifier. A new data vector is fed into the computer from the sensors. The matrix multiplication is carried out, and the position of the maximum in the product vector is declared to be "the classification" into which the item belongs. If the test data were selected wisely, and if the M are able to sort the test data, then the classification of the new item should be correct.

Current Progress

At the present time, a prototype version of the large-item sorter using only two sensors, the metal detector and the infrared sensor, has been put in operation. Items were loaded into the carts from a feed conveyor, were then carried over the sensors, and were dumped into output categories under direction of the computer. Four output categories were selected for this initial test, glass, metal, plastic, and cellulose. The computer was able to identify members of these various categories with better than 90% accuracy. This initial success is leading to improved computer programs to obtain both better sorting into existing categories and the development of new, more refined categories.

Looking Ahead

The MIT plant described above has several novel features in addition to the sensor-computer combination. This plant attempts a primary separation of totally heterogeneous refuse without prior size-reduction, either by shredding, incineration, or water treatment. Homogeneous items such as glass bottles and bundles of newspaper are left intact; size-reduction is used only where large-item classification is not possible. This approach is not only economical, but it should make possible the recovery of less contaminated end products.

Flexibility

Another novel feature of the MIT plant is its flexibility. Most sorting processes rely on a sequency of binary sorting operations, each operation requiring a separate piece of capital equipment. In the MIT plant, all items are treated identically, the sorting decision being made electronically. It is possible, therefore, to modify the operation of the sorting process merely by modifying a computer program. Thus as the market conditions for secondary materials change, the operation of the sorting plant can be correspondingly changed to sort out selective items known to bring a good return.

Looking ahead, separation plants of this type will be a necessary adjunct to solid-waste disposal systems, if only to reduce the load on the overtaxed incinerator and landfill capabilities of crowded urban areas. The technical feasibility of automatic separation has been demonstrated. It is now time to test these methods in the more rigorous laboratory of actual practice. □

The Computer Information System of the U.S. House of Representatives:

How Congress Uses the Computer

Robert D. Schlappe
5508 Dublin Court
Smithfield, Texas 76080

"The business manager has turned to the computer and its informational powers to improve the quality of his information and, hopefully, the quality of his decisions; it is time for Congress to do the same thing."

Why a House Information System?

There are at least three good reasons for the House of Representatives to have a computer-based information system: (1) to help the legislative branch of government regain equal status with the executive branch; (2) to increase the efficiency of the legislative process; and (3) to improve the quality of the legislation passed by Congress.

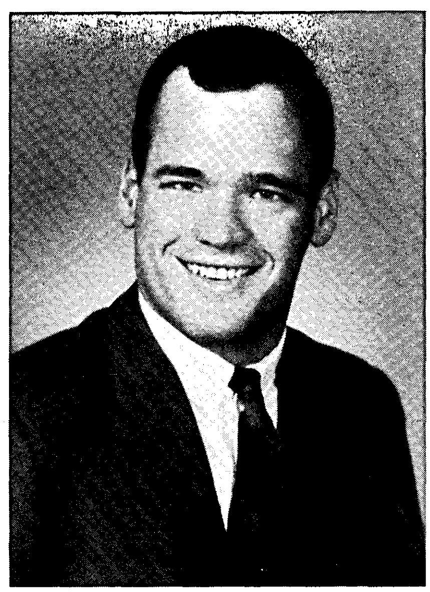
The conduct of the Vietnam War and the successful impoundment of appropriated funds by the executive branch have emphasized the inequity in power between the executive and legislative branches of government. One of the biggest inequities between the two branches is in the use of computer-based information systems. Historically, Congress has been spoon-fed information from the executive branch. In 1971 the House of Representatives finally took a step toward establishing its own computer-based information system, the House Information System (H.I.S.). The gross inequities between the computer capabilities of the two branches of government can be seen by comparing the annual computer costs of the House with agencies of various sizes within the executive branch. Table I gives this comparison.

TABLE I
Comparative Annual Computer Costs[1]
Fiscal Year 1972
(Costs in Thousands of Dollars)

	House of Rep.	Federal Deposit Corp.	Veterans Admin.	Dept. of Health Education & Welfare	Dept. of Defense
No. of Employees	122	102	1,967	5,927	77,829
No. of Computer Systems	2	1	64	88	3,415
Salaries	$1,422	$1,500	$23,599	$63,715	$784,682
Equipment	$632	$600	$3,521	$30,010	$254,218
Contracted Services	$158	$54	$263	$11,885	$158,289

If Congress is going to regain equity with the executive branch, it needs to have equal access to information. A computer system which gave Congress direct access to federal files would go a long way toward restoring equity.

Congress used to complete its business and adjourn its annual session before Thanksgiving. Now it not only stays in session the full year, but it is also postponing more and more important legislation to future sessions. In short, Congress is no longer able to get its work done. Energy legislation, welfare reform, tax reform, environmental legislation, and trade legislation are repeatedly shelved for the next session. Although some bills are shelved for



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political reasons, many are shelved because Congress doesn't have time to get to them. Several thousand pieces of legislation are introduced annually. If Congress is to effectively handle that volume of activity, it must increase its efficiency. The H.I.S. is a step in that direction.

Congress has to pass legislation on a vast variety of matters. One reads frequently of the growing complexities of business and the resultant difficulties which managers face in making decisions. The complexities of the problems facing Congress are greater than those facing any manager, and the results of Congressional decision affect a far larger number of people. The business manager has turned to the computer and its informational powers to improve the quality of his information and, hopefully, the quality of his decisions. It is time for Congress to do the same thing.

History of the House Information System

The House of Representatives acquired a computer in 1967 to assist the Clerk in his administrative duties. But it wasn't until the beginning of the Ninety-first Congress that the House took an interest in the use of the computer as an informational tool. After a series of studies, done by House subcommittees and staffs in cooperation with various private consulting firms, House Resolution 601 was passed in November of 1971. This resolution established initial funding of $1,500,000[2] for the House Information System staff and their activities. The funding was to cover the remainder of 1971 and the second session of the Ninety-second Congress. Prior to the establishment of the H.I.S. staff, the Clerk was using an IBM 360/50 computer at about ten percent of its capacity, according to a report to Congress from the Stanford Research Institute.[3]

The directives to the H.I.S. staff were to evaluate recommendations made in previous studies, to investigate existing House data processing capabilities, and to present a program that could be initiated to provide services utilizing information system technology.[4]

Current H.I.S. Services

The H.I.S. services now being rendered can be divided into four application areas: (1) administrative systems which provide support for office, clerical, and accounting functions; (2) legislative systems which directly support the legislative process of the House; (3) committee systems which support the administrative, investigative, and oversight functions of various committees; and (4) member systems which support the specific needs of individual Congressmen.

Administrative Systems

These systems provide support to the Clerk in his financial and accounting duties including payroll, member's allowances, and office inventory. In addition, one system provides for the indexing of reports filed in compliance with the 1971 Federal Election Campaign Act.

Legislative Systems

There are currently four applications within the legislative systems. One is the Electronic Voting System. This system includes two CDC 1700 computers and forty-eight consoles, located in the House Chamber, where members can vote by inserting their cards into the console and pushing a button. A running total of the vote as well as each member's vote are automatically displayed on boards located on the walls of the House Chamber. Each member has fifteen minutes to respond to a vote or quorum call by the Speaker. The voting system also keeps updated vote histories for each member. The installation of the Electronic Voting System cost $1,065,000.[5] Chairman Wayne Hays of the House Administration Committee figures the system will pay for itself in a year by cutting ten to twenty minutes off each quorum call and recorded vote.

Another legislative system is the Bill Status System. This system stores and disseminates information on all bills before the House. Members may obtain the information by calling the Bill Status Office and querying the legislative data base if they know the bill number, the sponsor, the committee referral, or the subject category.

A third legislative system is the Precedents Preparation System. This system assists the Parliamentarian in compiling and updating the Precedents of the House as required by law.

The fourth legislative system is the Legislative Calendar System. With this service the House computer is able to supply any member with the daily legislative calendar via a special computer line to the Government Printing Office.

Committee Systems

There are currently two committee systems in operation. One is the Committee Calendar System which assists in the publication of committee calendars. Twelve committees are currently using the service.

A second application is the Ad-hoc Committee Request System. Under this application, H.I.S. staff personnel perform special data processing activities as requested by various committees.

Three other committee applications are currently under study. One study is underway with the Committee on Banking and Currency to establish total information system requirements for that committee. If the study is successful, it should be generally applicable to other committees.

A second system is under study with the Joint Committee on Internal Revenue Taxation. Analytical procedures using mathematical models and simulation are being studied as means of fulfilling the Committee's analytical information requirements.

A third study is underway to determine a system for supplying the informational needs of the House Appropriations Committee.

Member Systems

Although no member systems are yet operational, work is underway to establish an automated mail addressing service which will provide an address data file of 10,000 names for each member of the House. This service will enable members to selectively mail to their constituency.

Congressmen's Attitudes Toward the H.I.S.

To determine the attitudes of members of the House of Representatives toward the computer, questionaires were sent to the twenty-four members of the Texas delegation. This delegation was chosen as a fairly suitable sample of the members of the House. The delegation contains three committee chairmen and members of nine different committees. It includes the member who has served the longest in the House as well as four members who are serving their first term. It also contains one female member. Eleven of the twenty-four questionnaires were returned. The following paragraphs give the results of the survey.

Increase in Efficiency

Ten of the eleven respondents indicated that the electronic voting system has reduced the time required for voting. Also, seven indicated that they and their staffs could accomplish more because of the computer services; however, two of these seven thought the increase in efficiency was marginal. None had reduced the size of their staffs because of the computer services.

Use of the H.I.S. Services

The most used service was the Bill Status System. Eight of the respondents reported that they used the service daily. One reported once a week usage, one occasional usage, and one rare usage.

The Legislative Calendar System is used less frequently with four members using the service daily, one weekly, one rarely, and four not using the service at all.

Eight members indicated they did not use computer services and seven indicated their staffs did not use computer services other than the Bill Status System and the Legislative Calendar System.

When considering possible future uses, only seven of the respondents were in favor of the automated mail addressing service, some indicating that they now mailed to everyone in their district. Only four members were in favor of being able to keep a record of campaign contributions in the computer. Eight of the eleven respondents said they had informational needs which they would like to see made available through a computer service; however, none elaborated on his specific need. Nine said they would now vote in favor of a bill to obtain a computer assuming the House did not already have one.

Informational Needs

Funding for the H.I.S. has only been in effect for two sessions of Congress, the second session of the Ninety-second Congress and the first session of the Ninety-third Congress. Most of the services, including the Bill Status System, have only been offered since January of 1973. Although the results of the survey do not indicate overwhelming results from the use of the H.I.S., the service is still too new and too limited to produce overshelming results. The important point to note is that the respondents of the survey recognized that they had unfulfilled informational needs which they thought could be filled by a computer-based information system.

Feasibility

In assessing the feasibility of a computer-based information system, one must consider technical feasibility, economic feasibility, and operational feasibility. The H.I.S. is technically feasible. The necessary hardware is available, and any software, which cannot be obtained off the shelf, can be produced given enough time and money.

The question of economic feasibility is much harder to answer. The House can appropriate the necessary funds for an H.I.S.; however, how is the individual Congressman going to justify the expenditure to his constituency? He will not be able to justify it on the basis of cost savings. Even if the H.I.S. does cut some costs, government expenditures are sure to rise. A skillful political opponent will surely be able to find figures to show the high cost of the H.I.S. and to correlate these figures with the steady increase of government expenditures. The only possibility of justifying H.I.S. expenditures will be improved legislation. However, it takes time for the effect of legislation to be fully realized, much longer than the two-year Congressional term. Thus the economic feasibility of the H.I.S. is questionable. Congressmen up for reelection, facing the resistance of the voters to government spending, might vote against funds for the H.I.S. just because they are afraid a vote for the H.I.S. could contribute toward a lost election.

The H.I.S. appears to be operationally feasible, based on the results of the survey. The respondents were aware that they had unfulfilled informational needs and were generally favorable toward the computer as an informational tool. The majority of Congressmen will support and use an effective H.I.S. because they will need it to properly do their jobs.

The Future

The H.I.S. is in its infancy. Considering the complexities of the informational needs of legislators, it will be a monumental task to build a total information system for Congress. Some Congressmen, however, already dream of such a system. Representative John Bradenas of Indiana forsees that the "Twenty-first Century lawmaker will have at his desk a keyboard console that will enable him to tap a vast amount of legal, economic, fiscal, and other information".[6]

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2. "Providing Funds for the Expenses of the Committee on House Administration to Provide for Maintenance and Improvement of Ongoing Computer Services for the House of Representatives and for the Investigation of Additional Computer Services for the House of Representatives," House Report No. 92-607 (to accompany H. Res. 601), November 4, 1971.
3. Congressional Quarterly Almanac, Vol. XXVII, 1971, pp. 754, 755.
4. Ryan, Frank, "Information Systems Support to the U.S. House of Representatives," Report No. 97-712, June, 1973.
5. Congressional Quarterly Almanac, Vol. XXVIII, 1972, p. 672.
6. "Congress Puts the Computer to Work," Nation's Business, Vol. 66, May, 1973, p. 72.

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Top Level Control of Data Processing: Some Guidelines

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"WE NEED TO REALIZE THAT DATA PROCESSING TECHNOLOGY IS ONLY THE LATEST IN A SERIES OF REVOLUTION-MAKING HIGH TECHNOLOGIES THAT ARE IMPACTING OUR CIVILIZATION."

Management by Objective

The subject of this article is the control of the data processing function.

First, let me establish some background beliefs. In the corporate world, the overriding characteristic of control is "management by objective". The manager of a profit center, division or subsidiary is responsible for achieving the objectives which have been agreed upon for his operation. He must integrate market penetration, asset minimization and profit maximization so as to produce an acceptable return on assets. There should be no question of the clarity and precision of that assignment. It is fair to say, however, that we in the corporate office monitor his performance and lend assistance.

The key to control is planning. In fact, without planning there is no such thing as control, and successful planning is at least half the battle. By planning, I do not mean simply projecting what is likely to happen, although projections of certain parameters represent an essential beginning. Perhaps the term "analytical planning" is apt. By this I mean the accomplishment of sufficient study, dissection and synthesis to discover what it is possible to accomplish. Planning is an everyday thing, not a tool stored in the closet to be pulled out once a year; a continuous effort is needed.

For each of our operating entities, our procedure is to set goals for the key factors:

— Sales
— Profits
— Total assets
— Return on assets.

The parameters used to check the acceptability of a set of goals are:

(1) The goals should be favorable compared with results being achieved by other successful companies.
(2) The goals should represent a challenging task requiring both good management and diligent effort for achievement.
(3) Attainment of the goals should be feasible.
(4) Growth of profit should be indicated.

Appropriate Systems for Planning and Measuring Performance

In addition to monitoring the operations of divisions and subsidiaries, we consider it a corporate responsibility to be sure that they have appropriate systems themselves to plan and measure their performance of division operations against their stated objectives, so that our confidence in achievement of the goals is maintained.

It might be said that the corporate role in control is really directed toward stimulating high level performance. Doing so means a high emphasis on analysis. Finding the better route does not come easy. A lot of effort is required in analyzing costs, expenses, fixed asset requirements, cash needs, etc. We don't by any means do it all in the corporate office. We have competent people throughout the corporation; however, we intend that the corporate staff guide the operating groups and set the tone for the quality of analysis which is needed in the competitive world.

The Role of Data Processing

Now I'll describe the data processing function itself as an important factor within the total corporate picture. Its importance lies not only in the expense incurred per se in data processing, but in the fact that today data processing is a significant element in the performance of nearly all company functions.

My emphasis will be on control by corporate management, rather than from within the department. Since my recent experience is with multidivisional corporations, some of my emphasis will be on the control of many data processing centers within a corporation. Thus, the two problems which I would like to address briefly in the article are:

(1) How to control the activities and expenditures of individual installations while allowing them to serve their divisions' needs.
(2) How to coordinate the development activities between divisions to achieve common system software and application programs, common equipment where this is feasible and to otherwise minimize duplication.

Data Processing as Seen from the Corporate Level

I think that it will be instructive if I expand upon these two problems briefly. At the divisional level, data processing is seen as a tool for making the operation of the business more efficient and for solving problems that are unsolvable by any other means. The major concern is frequently with the level of service, with running and maintaining ex-

Based on a talk at a conference on "Senior Management and the Data Processing Function" held by The Conference Board, New York, N.Y., November 1, 1973.

isting production programs, with producing new computerized systems and with the handling of occasional "one-shot" data processing requests. Budget is frequently superimposed on the operation as an additional input, almost as an afterthought.

At the corporate level, on the other hand, the main concerns are return on assets managed or return on investment, with the consequent emphasis on cost control and on maintaining a competitive stance in the industry. Without sufficient controls upon the data processing area, the divisional and corporate interests tend to clash. With proper controls within division and corporate managements, however, the two sets of goals will complement and reinforce each other.

The Nature of Top Level Controls

Let's consider what such top level controls might be. We will be aided considerably in our search if we realize that data processing technology is just the latest in a series of revolution-making high technology areas to impact our civilization. The revolutions in mass production manufacturing, in travel technology, and in electronics and communication technology have all brought with them problems of control. Such controls, when they come, are usually along the line of confining development to areas for which there is a market (and, therefore, a return) and of carefully controlling the development costs, manufacturing costs and other related costs. Since data processing is project-oriented, where projects consist of system development, the analogous control would be to confine development to projects for which there is a good return and to control carefully the development and maintenance costs.

It will be worthwhile to consider this analogy. In producing a new product, an engineering and manufacturing firm would be concerned with criteria such as the following:

- — Feasibility — Is it possible?
- — Producibility — Can it be done with present constraints on organization, equipment and finances?
- — Maintainability — Is it easily serviceable?
- — Marketability — Is there a need or desire for this product? What is the demand curve?
- — Salability — What is the competition? What can we sell at what price?

Of these criteria, the first three are clearly the concern of technicians and engineers, while the last two are the direct concern of management.

In using these five criteria in the control of data processing operations, the meanings change somewhat, but the impact remains the same. The market is now within the corporation; the demand curve relates need to return on investment and the competition is alternative systems and approaches. Careful consideration of these two areas is critical to the formulation of a division's data processing plan.

Feedback Control

Another analogy which we will find useful in determining and understanding guidelines for control of data processing is the analogy to the general problem of feedback control. This problem, stated in its simplest terms, is to modify the input to a system to produce the desired output from the system by measuring the output and "feeding back" to the input the required information. Thus, in simple terms, if the output is too low, we increase the input; and if the output is too high, we decrease the input.

A data processing operation is far more complicated than this, of course; it has many inputs and many outputs and many intermediate stages at which control is needed as well. One extremely simplified view of such an operation, for example, might include three outputs: a set of new procedures and capabilities; a budget, which is a bill for these procedures and capabilities, and a resulting return on investment. This data processing function would have five inputs: management priorities, required return on investment, the stream of requests for systems development; the present operating procedures; and the current production programs or systems. Budget would be considered an output, to indicate that unlike the other inputs discussed, it cannot be fixed.

One must also analyze which inputs primarily affect which outputs, and, therefore, which inputs might well be modified if the outputs are not as desired. Thus, for example, if the budget is too high, the priorities should be reexamined and a higher rate of return required for systems work.

Marketable and Measurable

The most significant aspects of this analogy, considered in the light of the first, are:

(1) All of the inputs and outputs of direct interest to management relate to what we called "marketability" and "salability"; i.e., to the procedures for running the business.
(2) The outputs must be quantifiable in order to be used properly to modify the inputs.

In short, in order for top management to control data processing effectively, it must relate data processing to the business procedures and business plans in such a way that the outputs from the department are measurable, not merely in qualitative terms such as good, bad, and not enough, but in quantitative terms.

Return on Investment

In this regard, I realize that some people are repelled by the "return on investment" concept when applied to data processing. This may be because difficulties in quantification afford a rationale for avoiding measurement. Sometimes it <u>is</u> hard to quantify the expected benefits; all the more reason in such cases to be cautious and to try harder for quantification of benefits before incurring the costs. We are surely beyond the day when companies obtained computers because their neighbors did. Costs are measured in dollars and so are results. The latter measure is not always easy for data processing systems, and that presents a challenge.

This same control philosophy is applicable to the lower supervisory levels of data processing. Functional supervisors are concerned with relating man-hours expended to work accomplished and with relating computer costs to computer utilization — both obvious feedback loops. Similarly, departmental management is concerned with relating predicted schedules to actual schedules, predicted costs to actual costs, predicted manpower requirements to actual manpower required and so forth. The detailed

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What to do BEFORE Your Computer Blows Up !!

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and

Jerolene A. Drefs
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"Frequently the plan originally designed is sound, but has deteriorated after a period of time when laxity has developed in the day to day administration of the plan."

Dangers to Computer Installations

There were 4,330 bombings across the United States in one recent 13-month period resulting in 384 injuries, 40 deaths and damages valued at $21,838,000,000.

In Ohio alone, where The Sherwin-Williams Company is located, there were 133 bombings, two personal injuries and one death.[1] In the underground newspapers, one can find articles with explicit instructions on how to destroy computer centers.

With this in mind, plus the ever-present threat of damage by fire or smoke, Sherwin-Williams decided that a plan should be devised to protect several systems considered vital to the continued operation of the company should a major disaster occur at headquarters. Although the company does have computer facilities at other locations, the four computers at headquarters are the most vital and are indispensable to continued operation.

Determination of Business Survival Information

People from the EDP area and the managers of the user departments jointly determined which information, procedures and computer systems were an absolute must for the health and vitality of the company. Once critical systems were identified, attention was turned to the development of recovery techniques for use in the event of some major disruption of normal headquarters operations. A recovery plan was laid out and data tapes considered critical were sent to a storage site removed from headquarters along with microfilm copies of the operating instructions for these critical systems. Object decks, related table decks and keypunch instructions for vital programs were put on tape and sent to the off-site storage area. Formalized plans for each system were stored in the off-site location as well as at headquarters. All information at the off-site location is kept locked and distribution of the keys is limited.

Four Major Areas of Concern

Recovery or contingency plans must provide for four major areas of concern.

First, arrangements must be made to make available, when needed, particular hardware-software configurations. Duplicate programs and operating instructions are useless, unless the company can provide the same computer configuration (including supporting software systems) for which they were designed. Since the stresses produced by an emergency situation are not conducive to very effective performance in changing operating procedures and even programs to fit a different computer configuration, arrangements for alternate computers should be made well in advance with frequent review of both the "home" and "alternate" systems. Periodic review is important, for the value of your backup plan could be severely limited should the "backup" computer be changed without proper notification and without corresponding revisions to the backup plan.

Second, operating instructions for the recovery procedures must be carefully documented and stored in a safe area away from the primary installation site. This should include not only the actual computer procedures, but all the manual procedures such as data preparation, balancing and others which are a critical part of successful operation. Equally important to the documentations is the training of those individuals who will be involved in the recovery operations. Vital time can be lost and expensive errors made when personnel are expected to handle unfamiliar activities during a period of stress.

Third, the programs themselves must be copied and stored where they can be properly secured and made readily available when needed. Proper maintenance of the "backup" program library is as important as its original creation. As a minimum, current copies of the object programs and their related "constant" or table data should be stored. Additional

1. Wackenhut, George R., "Business is the Target of Bombings and Bomb Hoaxes," *The Office*, September 1971, pp. 14-26.

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Mrs. Jerolene A. Drefs is presently with The Sherwin-Williams Company as an internal auditor specializing in EDP audits. Previously, Mrs. Drefs was the comptroller at The S.M. Hexter Co. She is also an experienced programmer-analyst. Mrs. Drefs is a graduate of the Cleveland State University and is a CPA in the state of Ohio.

documentation such as source programs and diagrams are also highly desirable once the immediate "restart" has been accomplished and the secondary recovery activities — such as reestablishing normal documentation in the main installation — begin.

Fourth, data files which are essential to continued company operation must be copied and stored in the off-site location. This task, more than any other, represents an ongoing, continuing effort. Each time one of these critical files is updated, the "off-site" backup file must also be updated. Further, provision must be made for keeping backup records of the "transactions" which will affect the latest generation on file (or procedures for recapturing the content of those transactions) as well as emergency alternate procedures for collecting data from currently occurring transactions until the main installation is again functioning normally.

Backup Tape Files

At Sherwin-Williams, magnetic tape is used as the primary form of data storage. The installation currently handles and controls a little over 5500 reels. Thus, the procedure employed to obtain and handle backup tape files is the most important continuing activity in the successful maintenance of an ongoing and meaningful contingency plan. In order to insure the greatest accuracy and least disruption possible, it was decided to make the selection and removal of tapes to the off-site storage facility for contingency backup, a part of the normal control operations for tape files. [Daily selection of contingency backup, a part of the normal control operations for tape files.] Daily selection of contingency files and scratching of expired files occurs under program control from a "Tapes Available" file.

In order to understand how the "backup" files are selected it is necessary to understand the tape handling procedures in effect. Each reel is identified with an external tape label such as that illustrated in Figure 1. File No. refers to the call letters of a specific system. All tapes in the Retail Sales System would have a file number beginning with RSLS followed by a numeric or alpha and numeric designation. The Vol. Serial area is nothing more than a sequential numbering system for identifying tape reels. As new reels are purchased, an external label is attached to the reel with the next sequential number on it. At the same time, the initial header label is created. All tapes are stored in racks in the library by these numbers. The "n" Vol. of "N" indicates that it may be reel 1 of 3 for that particular file. The Calendar Date indicates the month, date and year the tape was created. The Creation Date is the same date as the Calendar Date only expressed by day and year. The Scratch Date is the date on which the tape need no longer be saved.

THE SHERWIN-WILLIAMS CO.		
File No. PSCO3010		
Work Mo. 0971	Run No. 1	
Vol. Ser. 8596	1 Vol. of 1	
Cal. Date	Mo./Day/Yr. 10/14/71	
Scratch Date	Yr/Day 72/042	
USAGE		
JOB	ADDR.	DATE
PSC9K	3281	
TST	2185	
CREATION		
	71	287

Figure 1

Usage

The information under the heading "Usage" in the external label gives a bird's-eye view of what computer system created the tape, in what jobs it has been used and on which tape drives it was mounted.

Now to the information in the lower right-hand corner. PSCO identifies the system, 3 indicates system 130 and 183 tells on what tape drive the tape was created. The four computer systems and all the tape drives have been numbered for identification purposes. System 130 is an IBM 360/30, system 120 an IBM 360/40, et cetera. The drive the tape was created on is identified so that if trouble is experienced reading it, the drive which created the potentially bad tape can be identified and can also be used in a "last" attempt to recover the data.

The information in the top left-hand corner under "Usage" shows that after this tape was created, it was used in Job PSC9K and was physically mounted on tape drive 281 of the 130 system. Later it was used again in a test on tape drive 185 on the 120 system. (The first digit under Addr corresponds to the middle digit of the system's identification number.)

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TAPES AVAILABLE SHEET
FORM 70515

PAGE NO. ___ OF ___ PAGES

TAPES AVAILABLE AS OF (CHRONOLOGICAL DATE) ___

	SERIAL NUMBER	IDENTIFICATION		SERIAL NUMBER	IDENTIFICATION
1	8596	PSCO3010 72/042	26		
2	3520	BRACA1301 72/054	27		
3	2021	RSLS-D1101 72/059	28		
4			29		
5			30		
6			31		
7			32		
8			33		
9			34		
10			35		
11			36		
12			37		
13			38		
14			39		
15			40		
16			41		
17			42		
18			43		
19			44		
20			45		
21			46		
22			47		
23			48		
24			49		
25			50		

IN ORDER TO BE VALID FOR SCRATCHING, THE TAPE MUST PHYSICALLY MATCH BOTH REEL NUMBER AND FILE IDENTIFICATION LISTED ON THIS SHEET.

Figure 2

Technology as a Social and Ethical Problem

Dr. Charles Susskind
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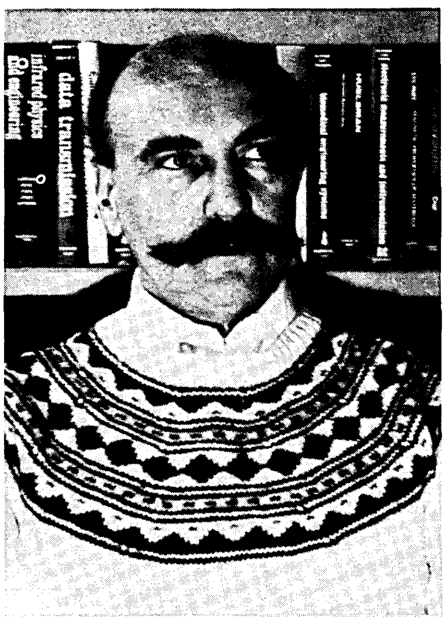
"The unmatched productivity of American farms is ascribed to the county agents' efforts. There can be no nobler calling than one that does so much toward fulfilling the greatest need of one's fellow beings and that holds the promise of banishing hunger from the face of the earth."

Technologist: Benefactor or Monster?

Technologist: benefactor or monster? is the question we may well ask. Along with the many benefits that technology has showered on those who have had the good luck to profit from them, it has also brought monstrous dangers: the possibility of nuclear warfare, overpopulation, the dehumanization of some people by mass society, the despoliation of the natural environment we claim to control. Should we allow technology's practitioner, the technologist, to force his will on society, or would we be better advised to stay his hand? Or is that not the problem: is the technologist an insignificant agent acting at the behest of societal forces far mightier than he?

The truth doubtless lies somewhere in between. The technologist is neither the master of our fate nor the helpless pawn of an inexorable historical process. In fact his role varies from case to case. The engineer who develops a new system of color television can scarcely be blamed if tasteless programs are shown; he has no control over programming. But the responsible engineer who plans a river dam to provide a source of hydroelectric power would consider his design incomplete if it did not also detail an estimate of the cost of the produced electricity in comparison with that from alternate sources, the effects of the project on irrigation and flood control, the recreation opportunities in the lake created behind the dam, and its topographical and ecological effects.



Charles Susskind was born in Prague and educated there and in England. He is a graduate of California Institute of Technology with a doctorate from Yale and is currently a faculty member at the University of California at Berkeley. He is also a writer, broadcaster, critic, and historian; as one of his profession's most erudite spokesmen, he can comment on both the dark and bright sides of technology more knowledgeably and authoritatively than outsiders.

An Engineer's Responsibilities

The recognition that an engineer's responsibilities extend beyond technical and economic considerations is long established and antedates more recent popular concerns with environmental and similar problems. Writing in the 1929 edition of the Encyclopedia Britannica (on "Engineer, Professional"), Alfred Douglas Flinn said:

> The engineer is under obligation to consider the sociological, economical and spiritual effects of engineering and operations and to aid his fellowmen to adjust wisely their modes of living, their industrial, commercial, and governmental procedures, and their educational processes so as to enjoy the greatest possible benefit from the progress achieved through our accumulating knowledge of the universe and ourselves as applied by engineering. The engineer's principal work is to discover and conserve natural resources of materials and forces, including the human, and to create means for utilizing these resources with minimal cost and waste and with maximum useful results.

Just how far does the engineer's responsibility extend? In the example mentioned previously, the planning of a river dam, should he be also held responsible for inequities that may arise in the resettlement of inhabitants from the area to be flooded? Should he concern himself with the scheduling of the distribution of water for irrigation purposes? Should he make it his business to see that a part of the new lakeshore is set aside for public parks? Or are these political questions, beyond his competence and not really amenable to technical solutions? When a public structure — a highway, a government building, or a state university — is planned, the state may invoke the legal principle of "eminent domain" to take over private property for reasonable compensation (or else a single, stubborn property owner could hold up the state, in more senses than one); but a disgruntled property owner may still blame the engineer who planned the struc-

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ture for any personal inconvenience and injustice that results.

The question of the technologist's responsibility for the consequences of his works thus appears to be enormously complicated. The unforgiving critic of technology puts full responsibility for all ramifications of technical inventions on their originators. The apologist sees technology as a means that society is free to use or not, as it chooses; according to this view, technology opens doors but does not compel men to enter. Yet that view is clearly disingenuous. It is expecting too much of man not to enter a door that has been invitingly opened for him, if only to find out what lies beyond. Moreover, society might well exercise some control over which doors to open, of assessing the effects of technological decisions beforehand. But perhaps the engineer should voluntarily restrain himself and act only in accordance with a strictly conceived code of ethics, one that would go beyond the well-established code governing the professional conduct of engineers to something approaching the principles to which physicians subscribe? Before we come to such an Engineer's Hippocratic Oath, we shall try to show that the technologist can be given neither full credit nor full blame for developments which at first blush appear to be largely technical in nature; society at large must answer for both good and bad. We shall illustrate the point by two cautionary tales, cases taken from recent history, one benign in its effects and one malignant.

Agricultural Extension

Agricultural Extension, the network of central services and county agents that provide leadership and carry information to farming communities throughout the USA, is widely given credit for the high efficiency of American agriculture. Started in the early 1900s in a predominantly agricultural land, the services of the county agents (whose work received federal recognition and support with the passage of the Smith-Lever Extension Act in 1914) quickly found a place in rural America.[1] They worked in cooperation with the agricultural colleges that had sprung up everywhere as a result of the passage of the Morrill Land-Grant College Act in 1862, as well as the agricultural experiment stations set up in most states after the Hatch Act (1887) had provided federal subsidies for agricultural research. Today the Cooperative Extension Service is financed jointly by the U.S. Department of Agriculture, by the states, and by local agencies, and has a professional staff of over 15,000, with local volunteers numbering more than 1 million in over 3000 counties. It all started with one community demonstration farm in Terrell, Texas, in 1903.

The man who started the system was a country teacher and farmer who acquired a technological education largely through his own efforts. Seaman Ashel Knapp (1833-1911), born of pioneer colonial stock on an upstate New York farm, was well educated by the standards of the day.[2] He attended Troy Academy in Vermont and Union College in Schenectady, N.Y., whose president was the remarkable pragmatist Eliphalet Nott (1773-1866) an inventor and educational innovator, one of the unsung heroes who pushed for a more widespread and more practical higher education in a day when the only college curriculum was the classical. After teaching for 10 years, Knapp injured his knee and on medical advice went back to the open-air life on a farm. He moved west, to Iowa, but suffered several setbacks because farm conditions there were different and no information for new settlers was available. He laboriously educated himself in scientific farming methods, and when he regained use of his leg in 1875, he determined to try out his newly acquired knowledge. He became an exceptionally successful breeder of pigs. By paying close attention to circulars that had begun to come from the new U.S. Department of Agriculture, he created a model farm that supplied brood stock to other farms all over the Middle West.[3] At the same time he became devoted to the idea of disseminating scientific farming methods with an almost religious missionary zeal. He helped to start the Farmer's Journal in 1872, became a frequent contributor, and finally the editor. He advocated setting up agricultural experiment stations and took part in the lobbying that led to the Hatch Act.[4] He spoke tirelessly to granges, breeders' and farmers' associations, and other groups. But he really hit his stride when he was appointed, in 1880, Professor of Practical and Experimental Agriculture and superintendent of the college farm at the Iowa State Agricultural College in Ames.

That institution (now the Iowa State University of Science and Technology) had been founded in 1869 as one of the land grant colleges. Under Knapp's leadership (he also served as president from 1884 to 1886) it became a center for teaching "a science in agriculture as distinct from the sciences related to agriculture." He created a new type of curriculum, leading to the degree of Bachelor of Scientific Agriculture. He tried to tell everyone about the importance of research, but there he was less successful. At a time of rising land prices farmers could turn a profit more quickly by real-estate speculation than by improving their farms. The total annual Iowa appropriation for research in agriculture and horticulture was $1500, and the college administration was subject to every political wind or even zephyr that blew from the state capital. Finally, Knapp had enough. In 1886, at the age of 53, he resigned and turned to an entirely new venture: supervising a large reclamation project in Louisiana to clear tidelands for the cultivation of rice, jute, and vegetables. For the next 17 years, he was involved in one agricultural venture or another in the South, traveling tirelessly all over the world, towards the end as a government plant explorer to study varieties in the Orient.

Working with Beverly Thomas Galloway (1863-1938) of the U.S. Department of Agriculture, Knapp next attempted to set up demonstration farms in several Gulf states in which the economic advantages of crop diversification and scientific farming would be made obvious. He soon found that showing how to do it on a government model farm was not enough, since a small farmer could not identify with an enterprise that was backed by the seemingly infinite resources of the federal government. The solution was the community demonstration farm, a scheme first tried in 1903 on Walter C. Porter's farm in Terrell, Texas. Eight Terrell businessmen and farmers were persuaded by the now 70-year-old Knapp to subscribe to a $450 indemnity fund to protect Porter against possible loss resulting from experimentation with new crops, fertilizers, and planting methods on 70 acres of his 800 acre farm; but he was to keep all profits if he came out ahead. In fact he came out $700 ahead on the 70 acres and announced that he would work his entire farm according to the new principles the following year.

The Idea Spread

The idea soon spread. Farmers throughout the area clamored for similar treatment. Almost inadvertently, Knapp had stumbled on the proper formula: keep the government on the sidelines, as an advisor, and motivate the farmer to make good in the eyes of his friends and neighbors by letting him reap full credit for any improvements resulting from innovation. Then a new challenge arose: an infestation of the boll weevil, an insect that threatened to wipe out cotton farming throughout Texas in 1903-1904. Knapp's demonstration method was promptly adapted to teaching the various remedies that had been worked out by government entomologists to fight the pest and his agents were able to stop the infestation wherever they went.

The agents thus emerged as the kingpins of the entire demonstration system. Financed at first entirely by local tax support and private contributions (notably $1 million from the General Education Board funded by John Davison Rockefeller, 1839-1937), and introduced in northern and western states by Galloway and by William Jasper Spillman (1863-1931), the county agents qualified for federal sponsorship with the passage of the Smith-Lever Act in 1914. By 1917, when the USA entered World War I, there were 1466 agents; their number was soon nearly tripled, partly by appointments of emergency agents made in the nationwide effort to feed America and her allies.[5] After the war, the county agent broadened his horizon beyond farm efficiency to such innovations as better drainage and irrigation, the control of plant and animal diseases, and advice giving on how to remodel homesteads and form marketing associations. He helped organize farm boys in 4-H clubs and girls in canning clubs.[6] With the flood of new government programs that followed the depression of the 1930s — control of soil erosion, deliberate reduction in the output of some farm products, resettlement, electrification, crop insurance — the county agent also became an interpreter of the new legislation and a long-range planner. He met yet another challenge during World War II, when agricultural production in the USA again rose sharply despite shortages in manpower and in farm machinery. Since then his concerns have again shifted, with increasing mechanization, to new managerial and marketing methods in what has come to be called "agribusiness", and to social, economic, and political problems arising from the inability of some small farms to hold their own in the face of the growing rationalization of agriculture.

County Agent: Technologist Par Excellence

The county agent thus emerges as the technologist par excellence, and the man who thought of the scheme as a great benefactor of mankind. Experts from all over the world come to study the system with a view to introducing it in their countries.[7] The unmatched productivity of American farms is ascribed to the county agents' efforts. There can be no nobler calling than one that does so much toward fulfilling the greatest need of one's fellow beings and that holds the promise of banishing hunger from the face of the earth.

Euthansia

Euthanasia is the practice of painlessly putting to death persons suffering from an incurable condition or disease. Anyone who has seen an aged relative or friend through a painful, terminal illness has wanted to stop the agony and to grant the sufferer the release of a painless death at the hands of a physician acting with the approval of the patient's family. Yet most thoughtful individuals, even when not held back by religious scruples (such as the prohibition against killing contained in the biblical Sixth Commandment), are appalled at the ease with which the practice of euthanasia can be perverted for criminal ends, as was amply shown by the Nazis during their short but diabolic rule — the twelve years from 1933 to 1945, during the second half of which they waged a world war whose outstanding feature was the huge number of civilians killed.[8]

Early in the war the Nazi leader, Adolf Hitler, asked his personal physician, Karl Brandt, to start a euthansia program directed against deformed children, the chronically ill, the incurably insane, and the aged. These "useless eaters" not only took up hospital space and medical services (including doctors and nurses) that would soon be at a premium, but they were also a source of embarrassment to the Nazi theory of the perfect master race. Patients in the condemned categories were selected from nursing homes, hospitals, and asylums by government teams under the direction of Dr. Herbert Linden and were moved to collecting centers and finally to euthanasia stations, where they were executed, usually by intravenous injections of carbolic acid, though shooting with a revolver was also recommended by the police officer in charge, Christian Wirth.

Such killings were not efficient and they could not be kept secret. The relatives, who had of course not been consulted, became suspicious of the stereotyped wording of the falsified death notices, sent from strange locations. The arrival of large batches of patients and the many cremations could also not be wholly camouflaged. Over 275,000 aged, insane, and incurably ill had been done away with before the program was shifted away from civilian facilities in late 1941, mainly because several churchmen had protested openly (some of them from their pulpits) that the notoriety of the practice had a demoralizing effect on the population and undermined the concept of authority.

Intervention of Religious Leaders

The fact that the energetic intervention of religious leaders in a domestic euthanasia action carried out against their coreligionists brought the action to an end shows that not even a highly oppressive, totalitarian government with wartime powers and a subservient press can afford to ignore the pressure of suitably channeled public opinion. The pity is that virtually no such opposition found expression when the Nazis placed the action under the control of party formations, put it out of sight in concentration camps, and finally shifted it to occupied territories and directed it against populations of other religions and nationalities in what was to become the greatest organized massacre in history.[9]

The party organization put in charge of the euthanasia program was the paramilitary Schutz-Staffel (defense echelon), or SS for short, and in particular the elite SS Death-Head units (whose members wore the dread skull-and-crossbones insignia), which ran the concentration camps and provided the technicians who were to engineer the mass exterminations. Henceforth, euthanasia victims would not be selected from among incurables but exclusively from concentration-camp inmates unfit for work. Inmates were selected for "invalid transports" by a commission that never saw the prisoners. "Merely paper work", wrote Dr. Mennecke, one of the commission members, to his wife from the concentration camp at Buchenwald near Weimar. (Both Mennecke and Brandt were hanged after the war for their part in the euthanasia program.) In 1943, a further directive restricted the euthanasia program to insane persons only. "All other prisoners unfit for work are to be absolutely excluded from this operation", the new order stated. "Bedridden prisoners are to be given suitable work, such as can be done in bed." But by this time, the "invalid transports" had become relatively unimportant, for the vastly larger program of exterminating members of inferior races was going at full blast.

Long-Range Plan of Extermination

With the occupation of the Soviet-held half of Poland after Hitler's surprise attack on the USSR in 1941, the Nazis got a chance to put into effect their long-range plan of exterminating all people considered racially and biologically inferior (the so-called Endlosung, or Final Solution) and removing all incorrigible political opposition. Since millions of persons were involved, the technical problems of secretly assembling and killing them and getting rid of the bodies were staggering. The first exterminations — of the non-Aryan population of the smaller Polish towns and of Communist party members and political commissars among Soviet prisoners of war — were relatively simple: the victims were marched out of town, told to dig a long ditch, and then shot in the back of the head at the edge of the ditch so that they fell in, layer upon layer, until the mass grave was full. (The Soviet poet Evgeny Yevtushenko's famed work, "Babi Yar," refers to the particularly large execution carried out in this way in a ravine of that name near Kharkov in the Ukraine.) But the system was clearly unsuited to mass exterminations, for reasons succinctly summarized by the French writer Jean-Francois Steiner:

(Beginning of Quotation)

> The method of shooting in itself gave rise to controversy among the [SS] technicians, who were divided into two schools: the "classics" and the "moderns". The first were advocates of the regulation firing squad at twelve paces and the coup de grace given by the squad leader. The second, who felt that this classic apparatus did not square with the facts of the new situation, preferred the simple bullet in the back of the neck. The latter method finally prevailed, because of its efficiency. It was here that the psychological problems vividly emerged.
>
> With a firing squad you never knew who killed whom. Here, each executioner had "his" victims. It was no longer squad number such-and-such that acted, but rifleman so-and-so. Moreover, this personalization of the act was accompanied by a physical proximity, since the executioner stood less than a yard away from his victim. Of course, he did not see him from the front, but it was discovered that necks, like faces, also individualize people. This accumulation of necks — suppliant, proud, fearful, broad, frail, hairy, or tanned — rapidly became intolerable to the executioners, who could not help feeling a certain sense of guilt. Like blind faces, these necks came to haunt their dreams. Paradoxically, it was from the executioners and not from the victims that the difficulties arose. Hence, the technicians took them seriously.
>
> Thus there arose, no doubt for the first time in the world, the problem of how to liquidate people by the millions. Today the solution seems obvious, and no one asks himself the question. In 1941, it was quite otherwise. The few historical precedents were of no use, whether it was a question of the extermination of the Indians by the Spaniards in South America or by the Americans in the United States, or again of the Armenians by the Turks at the beginning of this century. In these three cases, no attempt had been made at a new technique, no advance beyond the time-honored hanging and shooting, which, as we have seen, did not satisfy the technicians.
>
> It was necessary to invent a killing machine. With a methodical spirit that is now well known to us, the technicicans defined its specifications. It had to be inconspicuous to avoid arousing anxiety in the victims or curiosity in the witnesses, and efficient enough to be on a par with the great plans of the originators of the Final Solution; it had to reduce handling to a minimum; and finally, it had to assure a peaceful death for the victims.[10]

(End of Quotation)

The killing method that ultimately came to be used was one that had been tried in a tentative way during the euthanasia program: gassing by carbon monoxide. Engine exhaust was piped into the back of a hermetically sealed van loaded with 15-20 victims. The technique was clearly inadequate when it came to really large numbers, such as the 400,000 inhabitants of the Warsaw ghetto (whose fate has been so graphically described in John Hersey's 1950 novel, The Wall). That problem was solved by backing the van against a sealed building and piping the exhaust gases into it. Brought to assembly-line perfection by a young SS lieutenant named Kurt Franz at the Treblinka extermination camp near Warsaw, the system ultimately handled 2600 victims in 13 gas chambers with a 200-person capacity in 45 minutes, including the time needed to strip them, cut off the women's hair for use in the war economy, and removing wedding rings and extracting gold teeth from the corpses.

The Problem of the Disposing of the Bodies

That still left the problem of disposing of the bodies. At Treblinka, the first 700,000 were buried in the usual ditches before the chief of the SS, Heinrich Himmler, decided after an inspection that they would have to be disinterred and burned — a gigantic task that no one had anticipated at the start of the euthanasia program. Even with earthmoving machinery and an unlimited labor supply, it was hard to see how more than 1000 bodies could be handled per day, a rate at which it would have taken 700 days or nearly 2 years to do the job — even if the putrid corpses had not proved so very difficult to ignite. At that point an SS specialist in cremation was summoned, Herbert Floss, who had perfected a new technique at various smaller concentration camps and was itching to try it out on the really large scale that Treblinka afforded. He constructed a giant grill of railroad rails placed on concrete supports about one meter off the ground, on which the bodies were piled in layers and burnt in open air. The giant funeral pyres were an immediate success and the grisly job of excavation and burning began at once. It did not stop for several months.

The Largest Extermination Camp of All

In the meantime, the largest extermination camp of all had arisen in southern Poland at Oswiecim, known in most non-Slav languages as Auschwitz.[11] The commandant was an SS lieutenant colonel named Rudolf Hoess (not to be confounded with Hitler's deputy Rudolf Hess, who had flown to enemy Britain in 1941 in an alleged attempt to negotiate a peace treaty). Hoess made substantial improvements in killing technique (notably the use of prussic acid in place of carbon monoxide in the gas chambers) and in the methods of disposing of the corpses. Even Herbert Floss's efficient funeral pyres were inadequate for a plant that was to produce more than 4,000,000 bodies; crematories were needed. Also, for real efficiency, the reception hall (disguised as the dressing room of a public bath), gas chamber, and crematory were combined into a single building.

Further refinements were introduced later, including peepholes, tracks and electric elevators to convey the bodies, and special metallurgical furnaces in which dental gold was melted down into ingots of standard shape and size. Four plants were ultimately built at Birkenau near Auschwitz, two large ones and two slightly smaller. Each was surmounted by a large chimney. Grouped around the chimney of each of the two large crematories were nine furnaces, not unlike the blast furnaces used in steel mills, fuelled by coal and fanned by electric blowers. Each furnace had four openings. Three corpses could be placed simultaneously in each opening. Thus, 108 bodies could be burned by one crematory in a single operation, and about 360 by all four crematories. It took about half an hour to reduce a body to ashes — 720 per hour, or 17,280 each 24 hours, for the furnaces were often in operation day and night. In an emergency, several of the old open-air pyres could be also pressed into service. Peak production occurred on 29 June 1944, when over 24,000 people were gassed and burned in one 24-hour period.

Division of Responsibility

Division of responsibility between the technologist and the society that uses him cannot be reduced to a formula. In the two examples that we have described above in some detail, the assignment of credit and blame might appear to be a very simple matter indeed. Seaman A. Knapp, technologist extraordinary, introduced the county agent system of agricultural extension by which the application of agricultural research to American farm production caused it to rise to unmatched levels, so that the USA became the world's breadbasket and saw its methods copied by newly developing lands all over the globe; he must receive full credit for this splendid achievement. The technicians of the SS, Wirth, Franz, Floss, Hoess, and the rest, hold full responsibility for the horrors perpetrated by the Nazis, which they alone knew about and could have stopped.

Yet the objective historian would not see the matter in such simple terms. He would point out that Knapp was not really a technologist; except for three short college courses — on electricity, mechanics, and astronomy — his formal preparation was entirely in the classics and his brief tenure at a newly founded prairie college was based mainly on his reputation as a successful stock breeder and editor of a farm journal. Moreover, other factors, independent of the county agent system, probably had more to do with the success of American agriculture, such as unrestricted immigration, the Homestead Act of 1862 (by which the title to 160 acres of unoccupied land is transferred to any person who undertakes to improve it on payment of a nominal fee after five years of residence), the spread of the railroads, the rationalization of production and of distribution and a host of other developments quite unconnected with education and the dissemination of information. Viewed in this light, the unique contribution of the county agent system lies rather in the social and political realms, through enabling small farms to survive (which is not necessarily the best outcome from a purely technical viewpoint) and their owners to organize into viable production and marketing associations.

Knowledge by a Great Number of People

The responsibility for not stopping the Nazi holocaust might also be placed by the objective observer elsewhere than on a small group of technicians. Quite apart from the mass responsibility for allowing a group of criminals to take over a country's government, one cannot shuttle millions of people all over a continent and create a complex undertaking for disposing of them and of their possessions without sharing knowledge of it with tens of thousands of people. Beyond the SS and the army, there were the salaried workers, foremen, and managers of the industrial plants; the contractors who supplied materials and elevators, blowers, and furnaces for crematories; the railroad men who assembled and ran the deportation trains; and the welfare agencies that handled the distribution of the shoes and clothing from the dead. An SS general, Oswald Pohl, head of the SS supply and administration headquarters that was responsible for all concentration and extermination camps, admitted at Nuremberg that it was not true that only a handful of men in his organization knew; "in the case of textiles and valuables", he said, "everyone down to the lowest clerk knew what went on in concentration camps."[12]

Furthermore, none of the men named was really a technologist by training or occupation. Wirth, the manager of the first euthanasia program, was a policeman, superintendent of Stuttgart's criminal investigation division. Franz, in charge of prisoners at Treblinka, had been a waiter in a small town in Bavaria. Floss, the specialist in open-air cremation, was entirely self-educated. Hoess, the commandant of Auschwitz, had been a professional SS officer since 1934. In fact, except at the very beginning of the Nazi ascendancy, the SS had had difficulties all along in trying to recruit professional men. When the SS got hold of an engineer, they hung on to him.

Kurt Gerstein, Engineer

For instance, Kurt Gerstein, a mining engineer, had joined the Nazi party in 1933 but had subsequently been imprisoned and expelled for part-time religious activities that were held to be inimical to the new regime. When he asked for reinstatement after the war broke out, he was not only readmitted but given an opportunity to join the SS and assigned to its sanitation service, over the protests of party regulars. Moreover, there are strong indications that he deliberately joined because he wanted to find out more about the rumored euthanasia program — a resolve that was strengthened when his own chronically ill sister-in-law fell victim to it and which led him to embark on the extremely dangerous journey of active opposition.

Among students of the few exceptions to the monolithic blind obedience characteristic of the Nazi era, the case of this courageous engineer — the only SS officer known to have attempted to interrupt the extermination program by making its existence known to the world — has attracted much attention. A somewhat idealized portrayal of him appears in Rolf Hochhuth's play The Deputy. Archives of materials pertaining to Gerstein (who committed suicide in a Paris prison in July 1945, before his case had been fully sorted out from among those of the many war criminals then held by Allied authorities) have been established in the Kurt-Gerstein-Haus in Berchum near Hagen in Westphalia. Several book-length studies about him have been published, the most penetrating of which is Saul Friedlander's Kurt Gerstein: The Ambiguity of Good, which explores the nightmare world of a practicing Christian devoted to the self-imposed mission of arousing his countrymen and the world to the horrors of the extermination program.[13] Because of his expertise with minerals and chemicals, Gerstein, his worst suspicions about the euthanasia program quickly confirmed, soon found himself at its very heart: he was charged with disinfecting the clothing collected at the extermination camps and supplying the gas chambers with prussic acid. Devastated by his first visit to the extermination camps, Gerstein lost no time in blurting out the whole story to a Swedish diplomat he happened to meet on the train back to the capital, who duly passed it on to his neutral government, which in turn communicated the information to the British Foreign Office. Gerstein also made extensive disclosures to a fellow engineer serving in the air force, Armin Peters, and later to a Dutch colleague, the engineer H. J. Ubbink; he attempted to inform the Vatican legation, which threw him out; and spoke to many others, mainly Catholic and Protestant leaders and neutral diplomats. Gradually the story seeped abroad, confirming other accounts that were reaching the Allies and the Vatican from various sources. But no disclosures were made until the last year of the war, and no domestic protest could be organized.[14] Gerstein's effort remained an "appeal without echo", in Friedlander's words, "and Gerstein himself, an impotent witness, was caught up in the wheels of the machine he was trying to halt."

Our two cautionary tales, taken from opposite ends of the moral spectrum, thus show the futility of trying to apportion credit or blame for the effects of technological operations between society and those it employs to carry them out. But has not the technical expert, because of his special knowledge, a duty to do more than to make an objective presentation of the various solutions to a problem and to draw up balance sheets of the technical advantages and disadvantages of each? Should he sometimes set aside his scientific objectivity and make a special plea for one solution or another on the basis of nontechnical considerations? Will society be better or worse served if its decision makers cannot rely on the objectivity of the technical information on which they must base their decisions?[15]

A Set of Balance Sheets

What is evidently wanted is a set of balance sheets in which the relative merits of each solution to a technical problem are analyzed both on technical grounds such as safety, ease of operation, cost, reliability, maintainability, complexity, and esthetics; and on ethical grounds such as moral considerations, effects on the quality of human life, dignity, and other human values. How to weigh each of these attributes against the others remains an unsolved problem. The engineer is quickly out of his depth[16] and can justly claim that even minds generally assumed to be better suited than his to making moral judgments — philosophers, religious leaders, political and other social scientists — do not universally agree on ethical criteria for human action. One envies the framers of the American Declaration of Independence their easy assurance to "hold these truths to be self-evident, that all men are created equal, that they are endowed by their Creator with certain unalienable Rights, that among these are Life, Liberty, and the pursuit of Happiness." It was an excellent program and one that has stood the American republic in good stead, but that did not stop them (any more than it did the ancient Greeks, whose civilization is still held up as the model of a society built on human values) from enslaving their fellow men, a fact that we find abhorrent and immoral. Not even established religion is impervious to change. The last century alone has seen tremendous changes in the outlook of the Roman Catholic Church, for instance, with such papal encyclicals as Rerum Novarum (1891) of Leo XIII, Quadrigesimo Anno (1931) of Pius XI, and Mater et Magister (1961) of John XXIII; and Protestant theology has not exactly stood still, either, in the hands of a Reinhold Niebuhr (1892-1971) or a Paul Johannes Tillich (1886-1965).

Values change, if only because they depend on knowledge; and conversely the advance of knowledge depends on values, for example the value of free dissemination of knowledge and the value of truth. Yet some critics minimize this interdependence and hold that to base value judgments on knowledge — even knowledge of history, say, or anthropology — is dangerous if it leaves out intuition and tradition (to say nothing of divine revelation). Still others fall back on the moral law embodied in the categorical imperative of Immanuel Kant (1724-1804): Act only as if the maxim from which you proceed were to become, through your will, a universal law. That seems a perfect prescription for the absolutely good will of a rational being, and moreover one independent of theological considerations; yet even well-meaning men do not always act as they ought, but rather according to inclination.

Pity then the poor engineer, who must pick his way through a thicket of contradictory and changing philosophical systems, holding now intuition, now experience or conscience supreme, and either the state or religion or some other external authority as the ultimate arbiter of individual conduct.

Criteria Based on Common Sense

Yet a set of criteria based on common sense cannot be all that difficult to construct. Consider a tentative program, a list of values that a distinguished American jurist and civil servant, A. A. Berle, Jr., got off in no more time than it took to write a magazine article:

1. People are better alive than dead.
2. People are better healthy than sick.
3. People are better off literate than illiterate.
4. People are better off adequately than inadequately housed.
5. People are better off in beautiful than in ugly cities and towns.
6. People are better off if they have opportunity for enjoyment — music, literature, drama, and the arts.
7. Education above the elementary level should be as nearly universal as possible through secondary schools, and higher education as widely diffused as practicable.
8. Development of science and the arts should continue or possibly be expanded.
9. Minimum resources for living should be available to all.
10. Leisure and access to green country should be a human experience available to everyone.[17]

(please turn to page 28)

JANCURA, DREFS — *Continued from page 17*

Tapes Available Records

Each day, all tape files newly created are recorded on the "Tapes Available Sheet" (see Figure 2) by the tape librarian. The information for each reel is obtained from the external label. In addition to the tape serial number, the file number and the scratch date are recorded. The "Tapes Available List" is the key to the control of the 5500 tapes in the library. The list is keypunched daily and the cards are used to create a "Tapes Available File" on magnetic tape which is sorted in reel number within file identification number.

The "Tapes Available File" is checked daily by a program which identifies both those files (and thus tape reels) which are "critical" and those files which are to be scratched. The critical data is copied for off-site contingency storage. Only tapes listed in the daily "scratch list" can be scratched, thus alleviating many of the problems caused by errors in human judgment when manually determining scratch dates. An inventory listing of all tapes at headquarters and those at the off-site storage location is produced.

Periodic Audit Desirable

Because of the importance of the contingency plans to the company and because one missing tape could cause an entire system and all of the preliminary planning to be nullified, it is essential that the contingency plan be current and executable at all times. For this reason, a periodic review and audit of the proposed procedures is highly desirable. An audit program of a contingency plan should contain the following procedures:

1. Record any tapes on the off-site list that are not physically at the contingency site and trace their whereabouts through the tape log book. (Figure 3 shows the Tape File History which gives the following information: reel number, work month, creation date, scratch date, a history of every job in which the file was used, when it left the library and when it returned to the library.)
2. Record any tapes physically off-site that are not on the off-site list and determine reasons for this.
3. Record all the programs, table decks, operating instructions and unit record instructions needed to run the critical systems. Then trace them to the master tapes where this information is stored to be certain they are all present. Any exceptions should be noted and followed up.
4. Read the Contingency Plans and determine if all the information needed is clear. Remember that should these plans be called into action, it will be a time of crisis. Item, as which tape to use (such as present month, last year, prior month), should be readily ascertainable.
5. Take one or two of the Contingency Plan flow charts and "walk through" the system. That is, pretend headquarters was destroyed and only the information at the off-site location is available. Using the flow charts and the operating instructions, be certain you have all the programs, tabledecks, input data, master files and instructions needed to go to another location and start

TAPE FILE HISTORY
FORM 70008 REV. 10/70

REEL SERIAL NUMBER & WORK I. D.					RETENTION CYCLE DATE		CODE	ISSUE AND RECEIPT LOG								
1	2	3	4	WORK MO. OR RUN #	EFF.	EXPR.	✓	JOB	OUT	IN	JOB	OUT	IN	JOB	OUT	IN
8596				9/71	71/287	72/042		PSC	11/15	11/16						

										FACTORY	RETENTION	FILE NO.
USAGE											120	PSC03010
USAGE												

Figure 3

running the job. Make certain that the tapes for the proper period are available — not some older generation which should have been scratched. Check that the computer planned for use in an emergency has all the features that normal operating programs may be calling for.

6. Inquire as to separation of duties. The tape librarian working in the headquarters' library should not be the same person that is transporting and caring for the off-site tapes.
7. Tapes should be stored in locked cabinets or preferably in a vault. The keys or combination should be restricted to a few people.
8. Check the physical attributes of off-site area storage. Are fire extinguishers plentiful and strategically placed? How secure is the room itself?

By following this program, an opinion can be formed on how reliable the Contingency Plan is. Frequently the plan originally designed is sound, but has deteriorated after a period of time when laxity has developed in the day-to-day administration of the plan.

Continued Vigilance

Programs and documentation are an important asset of a company. Replacing them is costly, particularly in a time of emergency. Keeping duplicates of programs on magnetic tape and instructions on microfilm in another location is comparatively inexpensive. Carefully planned file storage and pre-determined emergency procedures in many instances actually make continued operation possible. Continued vigilance to safeguard the validity and usefulness of these contingency plans is a small price to pay for prompt restart of vital information services. □

HENNESSEY – *Continued from page 15*

information required by divisional management on progress against the system development plan, budget, and required return on investment and the trend information required by corporate management are only natural adjuncts to these.

The Steering Committee Interface

The steering committee is becoming increasingly popular as an interface both between divisional data processing and divisional management and between divisional data processing and corporate data processing. This committee, usually formed of the top divisional personnel in finance, manufacturing, engineering, administration and data processing, with a representative from the corporate office, is responsible for the development of management priorities and for the establishment of procedures for the reexamination of business procedures, for the generation of a high quality portfolio of systems development investments and for auditing the cost and effectiveness of new system development.

Members of the steering committee are responsible for using their collective best judgment in cases in which more rigorous cost benefit analysis is difficult to apply. For example, they must estimate the relative worth to their division or subsidiary of engineering-manufacturing lead time reduction and the relative value of customer service and product support systems. The steering committee, therefore, controls the inputs to divisional data processing and monitors the outputs from that organization, steering the outputs in the direction set forth in the division's data processing plan. It is, in effect, one way of exercising divisional control on the feedback loop to assure effective systems development.

Management Control of Computing

Not all of the questions regarding such controls have been answered, of course. Historically, management's concern has been primarily with total budget and, more recently, with the return on investment for systems development and with the data processing budget as a percentage of total sales dollars. Clearly, a more sophisticated approach is needed. One such approach is to identify all of the fixed costs in the data processing operation, such as machine rental, program maintenance and the like. The balance of the budget then represents the possible investment in systems development, and it is this latter figure that should be compared to alternative ways of spending/investing such funds. The industry is currently looking for a better solution to this aspect of the control problem.

Heublein, Inc.

There are several companies that have taken the above approach to management control of computing. The one with which I am most familiar is Heublein, Inc., which has had central control of computing for some time now. The controls there include corporate-wide standards on:

- — Project control/charge-back systems.
- — Methodology of computer measurement.
- — Media security and insurance coverage.
- — Equipment procurement and feasibility studies.
- — Contract terms and processing.
- — Short-range and long-range planning format.

United Aircraft Corporation

United Aircraft Corporation, which has a computing operation of approximately 1700 people and $50 million, is now headed in a direction similar to that of Heublein. Some divisions, like Hamilton Standard, already use many of the management controls described above. The others are instituting similar controls, and the corporation now has a director of data processing and a small corporate staff to help determine standards and oversee their application.

These controls, in addition to those applied at Heublein, cover the formulation of divisional data processing plans, including hardware, software, machine complement and application programs. The corporate office, considering what standards it wishes to impose or what common systems it wishes to have purchased or developed, then makes up a corporate data processing plan against which progress can be measured. In addition, a major effort is made to identify all computer R&D and to isolate the resulting costs. This must be done in order to assess properly the cost of systems development.

At United Aircraft, we believe that the isolation of R&D costs, the elimination of wasteful duplication both in systems software development and in applications development, and the rigorous application of the basic controls — namely, quantifying the outputs desired, measuring the outputs against a data processing plan and using the results to correct the basic data processing inputs — will give us good, firm control over our data processing operations. □

NAYMANDIJ:

A Game for People and Computers — Part 2

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In the January issue of "Computers and People" we published a description of a new game, Naymandij, for people and computers. In this game an array of random (or pseudo-random) digits contains a "Definite Systematic Modification" made by the player Nature, and Man has to guess how Nature disturbed the randomness. Nature must choose an operation that can be expressed in not more than four English words.

Table 1
NAYMANDIJ GAME COMPUTER PROGRAM — EDITION 1
COMMANDS IMPLEMENTED

nDm	Set the dimensions of the array to be n rows by m columns. Initially, 10 by 20.
nD	Change the number of rows to n, without changing the number of columns.
FT	Print a frequency distribution of the entire array.
FR	Print a frequency distribution for each row.
FC	Print a frequency distribution for each column.
F	Print all three of the above.
G	Generate a new array of random digits.
nG	Generate, initializing the random number generator to n.
nIm	Input a new value for the element in row n, column m.
nIR	Input new values for row n.
nIC	Input new values for column n.
I	Input a new array.
P	Punch the array on paper tape.
R	Read a new array from paper tape.
nT	Print all occurrences of digit n.
nTF	Print all occurrences of n and following digits.
nTP	Print all occurrences of n and preceding digits.
nTU	Print all occurrences of n and upper digits.
nTL	Print all occurrences of n and lower digits.
nTO	Print all occurrences of n and orthogonally adjacent digits.
nTD	Print all occurrences of n and diagonally adjacent digits.
nTS	Print all occurrences of n and all surrounding digits.
nTH	Print all occurrences of n and horizontally adjacent digits.
nTV	Print all occurrences of n and vertically adjacent digits.
W	Print the entire array.

"Rubout" deletes one character at any time.
"Line-feed" deletes a line of input.

We remarked that a programmer in the role of Man could apply his ingenuity making neat little subprograms that would enable him to quickly analyze the puzzle without doing much hard work. For example, he should be able to ask the computer program for a report on the frequency distributions of digits in the puzzle as a whole, or by row, or by column, or by other arrangements.

Following the writing of this article, we made such a program, "Naymandij Game, Edition 1". In Table 1 we show the commands for analyzing a Namandij Puzzle which were implemented in this program.

The command R (read) followed by the command FT (print a frequency distribution of the entire array) produces the results shown in Table 2, the frequency distributions of the 200 digits in each of the six puzzles.

Table 2
FREQUENCY OF DIGITS 0 TO 9 IN THE SIX PUZZLES

Puzzle 741-	Digit: 0	1	2	3	4	5	6	7	8	9	Total Frequency
1	19	12	18	44	20	21	14	20	18	14	200
2	21	13	20	17	29	21	17	17	24	21	200
3	26	11	29	19	24	22	15	18	20	16	200
4	19	20	13	22	20	26	22	18	22	18	200
5	26	11	29	19	24	22	15	18	20	16	200
6	15	16	19	18	23	26	19	16	21	27	200

Puzzle 741-1

Table 1 shows there are 44 3's in Puzzle 1 instead of some number near an expected 20. This is a great clue that Nature's systematic operation has something to do with 3's. The command 7TF (print all occurrences of 7 and the following digit) reveals Nature's rule:

> Make 3 follow 7

which is the solution for puzzle 741-1.

Puzzle 741-2

In the case of Puzzle 2, the command 4T (type all 4's) reveals a tell-tale line of ten 4's stretching from the lower left to the upper right. So the solution is:

Make line of 4's.

Puzzle 741-3

The command 2T (type all 2's) shows that every 2 touches another 2. The solution is:

Make 2's couples.

Puzzle 741-4

The command 2T (type all 2's) shows no 2 at all in the central third of the array. So the solution is:

Eliminate central 2's.

If Nature changed each 2 to some definite other digit, the evidence appears to be insufficient to decide which digit.

Puzzle 741-5

The command FR (print a frequency distribution for each row) shows that the frequency of each of the digits 1, 3, 5, 7, 9 in row 1 is zero. So the solution is:

Make row 1 even.

Puzzle 741-6

No command in Edition 1 of the computer program reveals the solution to puzzle 6. But if we look at column 16 by itself, we find 9, 9, 8, 6, 5, 5, 4, 3, 3, 1. The digits appear to be randomly selected; and so a very reasonable guess for the solution is:

Reverse sequence column 16.

We plan to publish a Naymandij Puzzle in each issue of "Computers and People".

Puzzle 741-1

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

Analysis: Type all 7's and following digit

```
R
7TF
. . . . . . 7 3 . . . . 7 3 . . . . . .
. . . . . . . . . . . 7 3 7 3 . . . . .
7 3 7 3 . . . . . . . . . . . . 7 3 . .
. 7 3 . . . . . . . . . . . . . . . . 7
. 7 3 7 3 . . . . . . . . . . . . . . .
. . . . . . . . . . . . 7 3 . . . . . .
. . . . . . . . . . . 7 3 7 3 . 7 3 . .
. . . . . . . . . . . . . . . . . 7 3 .
. . . 7 3 . 7 3 . . . . . . . . . . . .
. . . . . 7 3 . . . . . 7 3 . . . . . .
```

Solution: Make 3's follow 7's.

Puzzle 741-2

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

Analysis: Type all 4's and look

```
R
4T
. . . . . . . . . . . . . . . . . . 4 .
4 . . . . . . . . . . . . . . . 4 . . .
4 4 . . . . . . 4 . . 4 . . 4 . . . . .
. . . . 4 . . . . . . . 4 . . . . . . .
. . . . . . . 4 . . 4 . . . . . . . . 4
. . . . . . . . 4 4 . . . 4 . . . . . .
. . 4 . 4 . 4 . . . . . 4 . . . . . . .
. . . . 4 4 . . . . . . 4 . . 4 . . . .
. . 4 . . 4 . . . . . . . . . . . . . .
4 . . . . . . . . . . . . . . 4 . . . 4
```

Solution: Make line of 4's

Puzzle 741-3

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

Analysis: Type all 2's and look

```
R
2T
. . . . . . . . . 2 2 . . . . . . . . .
. . . . . . . . . . . . . 2 2 2 . 2 . .
. . . . . . . . . . . . . . . 2 . 2 . .
. . . . . . . . . . . 2 . 2 2 . . . 2 .
. . . . . . . . . . . 2 . . . . . . 2 .
. . . . . 2 . . . . . . . . . . . . . .
. . . 2 . 2 . . . . . . 2 . . . . . . .
. . . 2 . . . . . . . . 2 . . . . . . .
. . . . . . 2 2 . . 2 . . . . 2 . . 2 2
. . . . . . . . . . 2 . . . . 2 . . . .
```

Solution: Make 2's couples

Puzzle 741-4

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

Analysis: Type all 2's and look

```
R
2T
. . . . . . . . . . . . . . . . . . . .
. 2 . . . . . 2 . . . . . . . . . . . .
. . 2 . . . . . . . . . . . . . . . . .
. 2 2 . . . . . . . . . . . . . 2 . . .
. . . . . . . . . . . . . . . . . . . .
. . 2 . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . . .
. . . . . . . . . . . . . . . . . . 2 .
. . . . . . . 2 . . . 2 . . . . . . . .
. . . . 2 . . 2 2 . . . . . . . . . . .
```

Solution: Eliminate central 2's

Puzzle 741-5

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

Analysis: Make frequency distribution by row and look

R
FR

Digit:

Row	0	1	2	3	4	5	6	7	8	9
1:	7	0	7	0	2	0	1	0	3	0
2:	2	0	2	2	3	4	2	1	1	3
3:	2	0	1	4	0	4	1	3	4	1
4:	3	1	1	3	1	3	2	1	2	3
5:	4	1	4	2	2	2	2	1	1	1
6:	1	2	4	3	4	0	0	4	1	1
7:	3	0	3	2	3	2	1	1	3	2
8:	1	3	2	1	3	2	0	3	1	4
9:	2	2	3	1	3	3	4	0	1	1
10:	1	2	2	1	3	2	2	4	3	0

Solution: Make row 1 even

Puzzle 741-6

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

Analysis: Type column 16 by itself and look

```
. . . . . . . . . . . . . . . 9 . . . .
. . . . . . . . . . . . . . . 9 . . . .
. . . . . . . . . . . . . . . 8 . . . .
. . . . . . . . . . . . . . . 6 . . . .
. . . . . . . . . . . . . . . 5 . . . .
. . . . . . . . . . . . . . . 5 . . . .
. . . . . . . . . . . . . . . 4 . . . .
. . . . . . . . . . . . . . . 3 . . . .
. . . . . . . . . . . . . . . 3 . . . .
. . . . . . . . . . . . . . . 1 . . . .
```

Solution: Reverse sequence column 16 □

SUSSKIND – *Continued from page 23*

Few would find fault with these propositions. They do not constitute a specific program or deal with such ethical problems as prejudice or dishonesty, but anyone looking for some general guidelines by which to assess the advisability of a new technological undertaking could do worse for a start than to consider it against nonquantitative criteria such as the above. They are certainly more useful in that regard than the American engineer's Code of Ethics, which was got up by the several engineering societies mainly to govern the relations of "professional" engineers (that is, individuals or partnerships that offer professional services in much the same way as lawyers) with each other and with their clients. For the engineer himself, something on a loftier moral plane is needed.

An engineer's Hippocratic Oath can be developed in analogy with the principles attributed to the school of Hippocrates of Cos (c. 460-c. 370 B.C.), the great Greek physician who first separated the practice of medicine from superstition and philosophy and based in on observation and reason. Like medicine, engineering is above all concerned with improving the human condition, and there are other parallels between the two professions as well, both in the preparation of their practitioners and in their practice. An oath based on Hippocratic teachings is administered to graduates of many modern schools of medicine. An amended version of it is suggested here for engineering graduates:

AN ENGINEER'S HIPPOCRATIC OATH

I solemnly pledge myself to consecrate my life to the service of humanity. I will give to my teachers the respect and gratitude which is their due; I will be loyal to the profession of engineering and just and generous to its members; I will lead my life and practice my profession in uprightness and honor; whatever project I shall undertake, it shall be for the good of mankind to the utmost of my power; I will keep far aloof from wrong, from corruption, and from tempting others to vicious practice; I will exercise my profession solely for the benefit of humanity and perform no act for a criminal purpose, even if solicited, far less suggest it; I will speak out against evil and unjust practice wheresoever I encounter it; I will not permit considerations of religion, nationality, race, party politics, or social standing to intervene between my duty and my work; even under threat, I will not use my professional knowledge contrary to the laws of humanity; I will endeavor to avoid waste and the consumption of non-renewable resources. I make these promises solemnly, freely, and upon my honor.[18]

We have seen that much of the responsibility for the uses of technology lies with society. Blaming engineers for the shortcomings of technological society makes about as much sense as blaming the failure of a new play on the stagehands. On the contrary, we may come to look to the engineer for moral guidance. If the engineer subscribes to principles such as the above, the leaders and representatives of the rest of society can do no less. Only by the concerted efforts of all can the abuses of technology be avoided. We may paraphrase Clemenceau and say, technology is too important to be left to the engineers.[19] □

Editorial Note: Footnotes 1 to 19 are stated in the book *Understanding Technology* on the pages applying to Chapter 7. We regret there is not space to publish them here.

NAYMANDIJ Puzzles

Neil Macdonald
Assistant Editor

NUMBER PUZZLES FOR NIMBLE MINDS — AND COMPUTERS

A "Naymandij" puzzle is a problem in which an array of random (or pseudo-random) digits produced by the first player, "Nature," has been subjected by Nature to a "Definite Systematic Operation" – and the problem for Man is to discover what Nature did.

Certain rules apply to Nature's Definite Systematic Operations:

a. The operation must be performed on all the digits of a definite class which can be designated; for example, "all central 6's".

b. The entire operation has to be expressible in not more than four English words; for example, "replace 2's by 7's".

c. The operation must produce a result that displays some kind of evident, systematic, rational order, and completely removes some kind of randomness.

d. The operation must change at least 6 digits from their original random value.

e. The value and the position of all digits not in that definite class must remain unchanged.

The second player, "Man," studies the puzzle so produced, and tries to figure out what Nature did. Can you figure it out? (Man is not required to express the operation in no more than four words; only Nature is so required.)

We invite our readers to send us solutions together with human programs or computer programs which will produce the solutions.

NAYMANDIJ PUZZLE 742

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

For more information about Naymandij as a puzzle and as a game for two players (one or both of whom is aided by a computer), see the two articles in the January and February 1974 issues of *Computers and People.* For the solutions to the six Naymandij Puzzles in the January issue, see the article in this issue.

NUMBLES

Neil Macdonald
Assistant Editor

NUMBER PUZZLES FOR NIMBLE MINDS — AND COMPUTERS

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

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

We invite our readers to send us solutions, together with human programs or computer programs which will produce the solutions.

NUMBLE 742

```
      Y O U        Y O U
x       M E    +     M E      M = B
    -------    ---------
      A M E    = N Y B
    O L O
    -------
  = L O V E
```

10823 16936 45410 87523 125

Solution to Numble 741

In Numble 741 in the January issue, the digits 0 through 9 are represented by letters as follows:

A = 0	R = 5
F = 1	T = 6
I = 2	B = 7
E = 3	H = 8
S = 4	P = 9

The message is: The best step, the first step.

ADVERTISING INDEX

The Assassination of the Reverend Martin Luther King, Jr., and Possible Links With the Kennedy Murders — Part One

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The Eggs and Sausage Man

An athletic-appearing man walked into Jim's Cafe, 411 S. Main, in downtown Memphis, Tenn., about 4:30 p.m. on April 4, 1968. He ordered eggs and sausage. His mood and manner evoked the attention of at least two persons — the black waitress who took his order, and the white owner, Lloyd Jowers. The memory of the customer's face and figure remains firmly etched in the minds of both Jowers and his waitress, more than five years after the event.

At 6:01 p.m. the same day, about an hour after the eggs and sausage man had digested his last morsel, wiped his plate clean with a biscuit, paid his bill and left the cafe, Jowers heard an exploding sound in back of his cafe.

The Assassination of Dr. Martin Luther King

A sniper had assassinated Dr. Martin Luther King, Jr., as he stood on the balcony of the second floor of the Lorraine Motel, an establishment that catered exclusively to blacks, less than a block away from the cafe.

Wayne Chastain of Memphis, Tenn., is a veteran newspaper reporter and southern journalist with experience on several metropolitan dailies in Texas including El Paso, Houston, Dallas and San Antonio, as well as on the St. Louis Globe-Democrat and a Memphis daily. He had traveled with Dr. King's entourage on and off for two years prior to the assassination. He had spent the last two days of King's life covering his speeches in Memphis prior to the shooting. He was on the murder scene within 10 minutes after Dr. King was shot. He interviewed eyewitnesses for one of the first comprehensive news accounts to the nation of Dr. King's death. A native Texan and a graduate of the University of Texas with a bachelor's degree in history and political science, Mr. Chastain also spent several months in early 1964 investigating and researching the assassination of President Kennedy, Jack Ruby's link with Lee Harvey Oswald and a group of pro-Cuban arms runners, and other activities related to Kennedy's death. Months before The Warren Commission's report, which was published in the fall of 1964, Mr. Chastain — after exhaustive interviews with hundreds of witnesses — had reached the conclusion that President Kennedy's death was the result of a plot involving paramilitary professionals financed by a group of wealthy, right-wing Texans with strong connections with former high officials with the Central Intelligence Agency as well as lower echelon CIA personnel still assigned to the bureau. The present installment is an excerpt from a forthcoming book entitled: Who Really Killed Dr. King — And The Kennedys? A Disturbing View of Political Assassinations In America.

"The shot sounded as if it were fired in back of the cafe," Jowers said. "At the time I thought it was just a backfire from a truck."

The killer fired a single rifle shot. The bullet pierced Dr. King's lower right jaw, ripping open a wide, flap-like area extending from his lower face, upper neck and upper shoulder. The shell, however, shattered into fragments, later making it impossible for ballistic experts to ascertain the exact weapon from which it was fired. The bullet apparently traveled in an upward trajectory[1] because witnesses maintained the impact thrust Dr. King's body in an upward motion, literally lifting him off his heels and into the air. The official version, however, disputes the upward trajectory and maintains the shot was fired from the second story rooming house above Jim's Cafe, rather than from a site in back of the cafe.

Chauffeur Witnesses Slaying

Solomon Jones, Dr. King's chauffeur, stood on the ground floor below the balcony and was looking up in Dr. King's face as Dr. King leaned down on the balcony and asked Jones if he needed an overcoat. Jones said he was looking directly in Dr. King's face when a red splotch flashed across his chin and upper chest.

"He seemed to float up in the air and come down on his back," Jones told this writer less than 30 minutes after King was shot. "I heard the shot and turned around and saw a man with a white sheet on his face in some bushes over there." Jones pointed to a clump of bushes to the right of the back door of Jim's Cafe. Jones said he thought the gunman threw something from the bushes and then "hunkered down again" as if he were going to fire another shot. (A famous writer[2], however, has related a slightly different version of Jones' story.) Jones told this writer on that night that when the man "hunkered down", that he, Jones, ducked down behind Dr. King's Cadillac parked directly under the second story railing, because he thought he might be shot if the gunman was going to fire again. Seconds later, when people were rushing onto the Lorraine parking lot from all directions — including policemen, firemen and plainclothesmen — Jones rose up from behind the Cadillac and again looked over to the clump of bushes. Jones told this writer he was positive he saw the same man he saw a few minutes before — sans white sheet on his face and sans weapon — stand up from the bushes again. He walked out of the bushes at a slow pace, and casually joined a group of firemen running toward the Lorraine (a fire station was at the corner of South Main Street, less than a half block from Jim's Cafe). Jones said he kept his eye on the man and suggested to this writer that he was psychologically paralyzed for a few seconds as the man walked right onto the Lorraine property with the firemen and got within 25 feet of him.

"The guilty plea of James Earl Ray amounts to nothing more than the fact that his attorneys had advised him that he was deemed as guilty under the Tennessee homicide statute as the man who fired the shot. . . . Judge Battle not only attempted to stop Ray before Ray could blurt out details of a conspiracy in open court, but Battle was aided by Ray's own defense attorney, Percy Foreman."

"Things were happening so fast," Jones said. "I believe he got within 25 feet of me, but he didn't have any sort of weapon. There was so much confusion at that point. People were running over to the motel in every direction it seemed. The man wore a jacket and I believe a plaid shirt. Suddenly, he just seemed to vanish in the crowd."

Chauffeur's Story Not Believed

Jones said he broke himself from the frozen stance and jumped into the Cadillac (the motor had been running at the time King was shot) and attempted to drive off the motel property to see if the man had fled down adjoining streets. But Jones was hemmed in by incoming police cars and an ambulance. At that point, Jones said he began concentrating on getting Dr. King into an ambulance and received permission from police to drive the Cadillac behind the ambulance to the hospital.

Jones said the police never believed his story. This writer wrote a byline article that appeared in the afternoon daily the next day, relating Jones' story. Neither Jones nor this writer were subpoenaed as witnesses at the trial of James Earl Ray, although other reporters were.

Motel Owner's Wife Dies of Heart Attack

Walter Bailey, a black man who had been employed 20 years by The Holiday Inns of America Inc., owned the Lorraine Motel. This motel was named after his wife, who managed the motel during the day when he was at work. Bailey and his wife had invested their life savings in the Lorraine Property and had made the Lorraine a going concern.

Less than 30 minutes after the shooting of Dr. King, Mrs. Bailey dropped dead of a heart attack.

The attack came after she had learned of Dr. King's death on the second floor. Before the attack and seconds after she had been informed of the shooting, an employe told this writer Mrs. Bailey groaned: "My God, what have I done?"

A very religious woman, Mrs. Bailey had been an ardent admirer of Dr. King. The employe told this writer that Mrs. Bailey became as excited as a "school girl" when her husband told her a few days before that Dr. King was going to stay at The Lorraine on his next visit to Memphis.

Dr. King's Earlier Visit to Memphis

Dr. King had been in Memphis two weeks before to lead a march of black sanitation workers, who were on strike against the City of Memphis. The event had spawned national headlines because young, black militants turned the intended peaceful demonstration into a massive riot and caused the governor to declare martial law in Memphis and call out the National Guard. Time magazine described the event as the "beginning of the long, hot — and bloody — summer of 1968" in the following week's issue.

Dr. King left Memphis after the riot and vowed he would return to the city and lead a peaceful demonstration. The week before, he had completed plans to lead the Poor People's March from Mississippi to Washington, D.C., and now he not only would lead a peaceful march through the city of Memphis in April, but that Memphis would probably be the first major stop on his summer march to Washington.

In order to make the next march a peaceful one, however, Dr. King realized he had to make certain concessions to the young, black militants who had sparked the riot, violence, and destruction, so that he could contain them.

These black militants had bitterly criticized Dr. King for staying at the posh Holiday Inn — Rivermont, a symbol of white affluence in Memphis, a dazzling edifice that towered 15 stories above the bluffs of The Mississippi River near the Memphis & Arkansas Bridge. King had also used the hotel as his press headquarters.

Thus, one of the concessions Dr. King made to the militants was to move out of the hotel and into a black motel. When Mrs. Bailey learned this fact from her husband, she quickly prepared her best suite on the first floor, according to the employee.

Fraudulent Advance Security

Then, on April 2, a day before King was supposed to arrive in Memphis, Mrs. Bailey received a visit by a man she presumed to be black, but whom an employee later warned her was a white man pretending to be black. He identified himself as an advance security man for Dr. King's Southern Christian Leadership Conference. The employee sensed the visitor was a "white man imitating a black". Mrs. Bailey later laughed off the employee's suspicions, pooh-poohing the idea that a white man would imitate a Negro.

The employee described the visitor as about six feet tall, with a "physique like a football player". He had strong facial features and "penetrating black eyes", and "looked more Indian than he did Negro", the employee said.

The visitor — whether he be black, white or Indian — was later a mystery to members of Dr. King's entourage. They acknowledged that a white member of the Justice Department's Civil Rights Division traveled with King and kept adjoining rooms, but that he did not fit the description of Mrs. Bailey's visitor. Nor were there any black members of SCLC that fitted the description — either in the Atlanta or Chicago offices. Memphis SCLC leaders such as Rev. Billy Kyles and Rev. James Lawson said they knew of no local black SCLC officials who acted as advance security for Dr. King's arrival, or could fit the description given by the employee.

The purported black visitor asked Mrs. Bailey to show him Dr. King's suite. When he saw it was on the first floor, he said: "No, no, Mrs. Bailey. This simply won't do. Dr. King always likes to stay on the second floor overlooking a swimming pool."

Mrs. Bailey quickly reversed the arrangements. She cancelled an earlier reservation she received for an upstairs suite overlooking the swimming pool. She prepared it for Dr. King's arrival.

Jim's Cafe

On the day Dr. King was killed, an observer could peer out the back door of Jim's Cafe and almost see the balcony of The Lorraine where Dr. King was standing when the fatal shot was fired. If endowed with a good baseball pitcher's arm, he could step out the back door, walk several feet to the right, wind up, and let go with a ball that could strike anyone standing on the balcony. From inside the cafe, the view of the balcony was partially obscured by a clump of bushes, and trees with broken limbs hanging down. The same observer, outside the back of the cafe, could walk several feet to the left (or north) and could not see the balcony. The motel balcony from the back door of the cafe is less than a city block away.

The Lorraine Motel is on Mulberry Street, which runs parallel with Main Street. On the day Dr. King was killed, the lot in back of Jim's Cafe was thick with brush overgrowth. One week after King was killed, however, the bushes, the thick brush and limbs from the trees were mysteriously cut, on orders from someone inside The City of Memphis government's parks division. The result was an unobstructed view of the balcony from a bathroom window upstairs over Jim's Cafe. The window is left — or north — of the Cafe's back door. This is the room from which the Memphis police, the FBI and the Shelby County Attorney-General's office would later contend that the fatal shot was fired — a trajectory that would be in a downward direction toward the spot where King stood.

The Mysterious Man

What was the significance of the "eggs and sausage" man's visit to Jim's Cafe?

The man — clad in a dark sweater, expensive-looking white dress shirt but no tie — aroused the curiosity of Jowers and his waitress.

"He just wasn't our regular run of customer," Jowers said. "His physique reminded me of a football player or college athlete, but his voice suggested that he was older and more mature."

The waitress described him as "very handsome" with dark eyes and dark wavy hair. She said he reminded her of an Indian because of his "high cheekbones" and because of his taciturn mood.

"He was quiet, did not smile, short on words, and seemed to grunt whenever I said anything to him," she said.

To this very day, the waitress believes this man — not James Earl Ray — fired the shot that killed Dr. King. For this reason, this writer will not reveal her name, nor that of the motel employee.

Jowers, however, said he is not afraid. "If they were going to do anything to me, they would have done it a long time ago".

Jowers said the eggs and sausage customer appeared — and smelled — clean. He did not reek of alcoholic fumes. He appeared "dead sober" — a physical state that set him apart from most of Jowers' customers.

"He did not seem to be on dope either," Jowers said. "I have seen too many of these hop-heads. I can tell by looking at their eyes, and their arms if they are uncovered. I became curious as to why he was down in this part of town. He was husky and handsome enough that he would not have to come to this part of town if he were looking for a whore or an easy lay."

Main Street's South End

The South end of Memphis' Main Street is an area of blight. It marks the periphery of the city's massive black ghetto. The businesses on this end of Main Street are largely operated by whites in a long row of two story buildings.

Many of the buildings contain vacancies. Many doors and display windows are boarded up. Planks have replaced glass in many of the display window openings. "For Lease" signs are plastered on many of the deserted sites. The second stories are used as stock rooms, and warehouses in many of these buildings. Other second story sites are rented out as living quarters to poor whites. On streets running parallel with Main Street, as well as perpendicular to it, there are black businesses and many decaying residences now occupied mostly by black families.

South Main parallels the Mississippi River. The waves of "Old Man River" splash against the levee less than five streets away, separated by the Illinois Central Railroad tracks. Jim's Cafe is less than a quarter of a mile to the Memphis & Arkansas Bridge, a juncture that connects with Interstate 55 headed north to St. Louis about 300 miles away, and Interstate 40 which runs west to Little Rock less than 150 miles away.

Above Jim's Cafe, there is a rooming house occupied exclusively by poor whites. Although Jowers scrupulously avoids using the word "flophouse", this is how many of his neighboring businessmen characterize the rooming establishment. (Technically, Jowers is correct, because a flophouse denotes a large barracks-like space where all tenants sleep on cots, and an interior devoid of rooms and partitions.)

The particular rooming house above Jowers' Cafe included on the day in question "winos", redeemed alcoholics "trying to shake the habit", and working whites, poor, but resentful because they had to live with boozers who kept them up all night fighting and drinking.

"Another reason we remember the man who ordered eggs and sausage was because not many of our customers order those two items at that time of day," Jowers said. "Also, the man did not order either a beer or a set-up and did not have a bottle — that struck us as very unusual also. He came in our place just to eat, apparently."

Aside from the physical attraction the customer exuded, the waitress remembers him for another reason.

A Disgruntled Customer

"The man kept going over to the wall where the telephone was located but he never picked up the phone," the waitress said. "He looked at the wall and appeared to be angry about something. There was a telephone book nearby but he didn't bother using it. I thought he might have forgotten a telephone number or something!"

The waitress recalls asking him if he needed the phone book to look up a number. She remembers him "grunting", which she assumed to be a negative response, but does not remember what he actually said. She said she could not tell if he had any kind of accent or not, because he would "just always mumble when I said something to him".

The man ate his order there. He drank a cup of coffee. He left about 5 p.m.

Then, at 6:01 p.m., Jowers said he recalls hearing the shot that supposedly killed King. "It sounded as if it came from the back of the cafe rather than upstairs in the rooming house, where the police said the killer fired it," Jowers said. "At the time, I thought it was a backfire of an automobile over on Mulberry Street (approximately in front of the balcony of The Lorraine)."

James Earl Ray

The official FBI and police investigation today contends the fatal shot that killed King came from a bathroom window upstairs in the rooming house by James Earl Ray, 41, then an escaped convict from the Missouri State Prison. Ray today is serving a 99-year sentence for the murder of Dr. King after he pleaded guilty in Criminal District Court in Memphis in exchange for the 99-year sentence. It is always relevant to point out, however, Ray's guilty plea cannot be logically interpreted necessarily as the confession of a man who actually fired the shot that killed King. Coupled with the fact that Ray stated in open court words to the effect that there had indeed been a conspiracy, Ray's guilty plea amounts to nothing more than the fact that his attorneys had advised him that he was deemed as guilty under the Tennessee homicide statute as the man who fired the shot. This is the so-called "felony murder" rule — namely, anyone who participates in the commission of a felony that results in a homicide is as guilty in the eyes of the law as the man who actually caused the homicide. Because the felony committed here was murder itself, it would almost be superfluous to say that one who conspires with another to commit murder is as guilty as the man who actually carries out the execution of the crime.

Conspiracy?

It is relevant to point out that in the February 1969 hearing in which Ray pleaded guilty, he appeared eager to clarify the question as to whether there was a conspiracy behind Dr. King's death.[3] The late W. Preston Battle, the Memphis judge who presided over the Ray hearing, had neither the legal nor intellectual curiosity of U.S. Judge John Sirica, who heard the Watergate case in Washington, D.C. Judge Battle[4] not only attempted to stop Ray before Ray could blurt out details of a conspiracy in open court, but Battle was aided by Ray's own defense attorney, Percy Foreman of Houston.[5] Foreman appeared more anxious to shut his client up than the prosecution on the subject of conspiracy. It was Foreman's own remarks which had prompted Ray to stand up and object to the "no conspiracy theory", but Foreman immediately entered objections to his own client's testimony by insisting on two points: one, the prosecution presented no evidence of conspiracy; and two, any evidence of conspiracy would have nothing to do with that particular trial nor with having any effect on his client's guilty plea and the subsequent sentence. Battle quickly upheld Foreman's objections.

Today Ray is appealing his guilty plea. Asking for a new trial, based upon Percy Foreman's improper and "unethical" representation, Ray's appeal has gone through the state courts and has been rejected. He is now appealing through the federal courts. He is represented by Robert Livingston, a Memphis attorney; and Bernard Fensterwald, a Washington, D.C. attorney who is also representing James McCord in the Watergate case. Fensterwald is also executive director of the privately financed Committee To Investigate Assassinations.[6]

As most readers know, Ray was arrested at the London International Airport by Scotland Yard agents after he had eluded the FBI in the U.S., fled to Canada, later flew to England, then to Portugal for several days. His arrest at the London Airport came when he had returned to England and was prepared to fly to Brussels on a forged passport.

Ray became the chief suspect when Memphis Police Inspector N.E. Zachary found a bundle near the foot of the stairwell leading to the rooming house over Jim's Cafe. The bundle contained the rifle which the FBI would later say was the murder weapon because of shells found with it that were of the same caliber as the bullet that shattered in King's body. Wrapped in a bedspread which contained fibers from the trunk of Ray's car, the bundle also contained a radio with Ray's Missouri State Prison serial number on it; a suitcase with clothing belonging to a man smaller than Ray as well as clothing belonging to Ray; and binoculars with Ray's fingerprints on them. Tracing them to a Memphis store where the binoculars had been purchased the day before, police also obtained a statement from a clerk that identified Ray as the purchaser.

Cafe Investigation

Back at the cafe after King was killed, Jowers had said he thought the blasting sound to the rear of his cafe and toward Mulberry Street was the backfire of a truck. Minutes after the sound, police swarmed over the area, taking positions in front of the cafe. They told Jowers no one could leave the cafe. (About 5:30 p.m., after the eggs and sausage man left, the cafe had filled with workers who had just gotten off duty at a nearby paper company. It was payday and many of them came to cash pay checks and drink beer.)

"The police were rushing around like chickens with their heads cut off," Jowers said. "They did not seem to know where the shot was fired. I later learned it was almost an hour before they went upstairs to the rooming house to question anyone up there. Before that, and minutes after the shooting, they were inside my cafe. Some of the officers went back to the kitchen and out the back door."

A police captain, Jowers said, questioned him at length about the customers he had during the day and if he had any suspicious looking customers. Jowers quickly recalled the "eggs and sausage man".

Jowers said: "When I told them about his movements, the captain called over some plainclothesmen to question me. They could have been FBI men because they did not look familiar and I know at least by face most of the Memphis detectives."

The captain and the plainclothesmen seemed very interested in the "eggs and sausage man". They also questioned the waitress, and examined the table where he sat, and the wall near the telephone, Jowers pointed out.

The plainclothesmen left. The police captain told Jowers: "If that 'eggs and sausage man' comes back, you get on the phone and call us immediately. He is probably our man."

(In the next installment — "The Eggs and Sausage Man Returns")

Footnotes

1. Jim Bishop, The Days of Martin Luther King Jr. (G.P. Putnam & Sons), P-61. Bishop accepts a conspiracy theory behind King's murder but paradoxically accepts some key assumptions of the official "non-conspiracy" theory — namely that the shot was fired from a second story bathroom window over Jim's Cafe. Thus, he must accept the downward trajectory conclusion of Dr. Jerry Francisco, Memphis medical examiner who performed the autopsy on King's body. Francisco ignored eyewitness testimony that Dr. King was hunched over the balcony railing, looking down to the ground floor when the shot was fired. Francisco's pure medical findings cannot be faulted — namely, the bullet entered King's lower right jaw, severed the neck from the spinal cord with fragments coming to rest at the back of his neckline. Note, in a leaning position, Dr. King's lower jaw would be on a lower plane than the rear of his neckline. Viewed within this frame of reference, Dr. Francisco's medical findings would be consistent with an upward trajectory. A brilliant forensic pathologist, Dr. Francisco has been bitterly criticized by Memphis defense attorneys for anticipating what the prosecution wants to prove in a given case, and then extrapolating legal conclusions from his medical findings to corroborate the prosecutor's theory. His findings were bitterly disputed in two other widely-publicized Memphis murders. One involved a wealthy Memphis merchant convicted largely on Dr. Francisco's medical testimony. The conviction was reversed on appeal. Dr. Robert Hausmann, a noted American forensic pathologist, and assistant medical examiner of New York City, gave expert medical testimony for the defense, rebutting all of Dr. Francisco's findings. An appellate judge said Dr. Hausmann's rebuttal testimony was sufficient to have justified a directed verdict in the defendant's favor.
2. Gerold Frank, An American Death (Doubleday & Co.), P-283. Frank relates Jones' story in one paragraph from second hand sources, indicating he never interviewed Jones. Frank also cites another witness, Harold (Cornbread) Carter, who corroborates Jones' story about a man in the bushes. Again, Frank only relates Carter's story by citing official reports, indicating he never talked personally with Carter. This writer was unfortunate in that he did not get to talk to Carter on the night of the slaying, but I reached him several weeks later. He related substantially the same story, but indicated he had been subjected to police pressure. Carter's story was essentially this: he had been in the bushes drinking wine and had fallen asleep. The shot woke him up. He saw a man in an adjoining hedge jump up, and throw something over his head and then almost step on him running from the bushes. Carter was jailed shortly afterwards for public drunkeness. Ray's defense attorneys deemed Carter's story significant because: 1) he was white; 2) he had never seen or talked to Jones before the slaying; and 3) he was on record as telling his story to police on the night of the slaying before police had constructed the upstairs bathroom as the scene of the crime.
3. Harold Weisberg, The Frame-Up, Distributed by E. P. Dutton & Co., P-106, 107.
4. John Seigenthaler, A Search For Justice, (Aurora Publishers), PP-187-188/ P199. Author Seigenthaler, editor of The Nashville Tennessean, one of the most respected metropolitan dailies in the Mid-South, severely takes Judge Battle to task for not putting Ray on the witness stand and eliciting details about the conspiracy Ray suggested that led to Dr. King's death. As Judge Sirico did in the Watergate case, Judge Battle had the authority to do this because Ray at that point could not plead self-incrimination as he had already pleaded guilty.
5. Frame-Up, P-103. Weisberg points out the curious fact that only Foreman said there "was no conspiracy" in open court. The prosecutors only said there was "no evidence of conspiracy" in King's death.
6. As the reader will learn later on, Fensterwald obtained a rap sheet and other data on a man that the Committee has tentatively identified as the "eggs and sausage man". More will be said in a subsequent article about this tentative suspect, under the code-name of "Jack Armstrong". □

ACROSS THE EDITOR'S DESK

Computing and Data Processing Newsletter

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APPLICATIONS

UW HOSPITALS USING COMPUTER INTERVIEWS TO AID SUICIDE PREVENTION

University News and Publications Service
University of Wisconsin-Madison
Bascom Hall
Madison, Wisc. 53706

The Wisconsin Department of Health and Social Services reported 447 suicides in Wisconsin every year from 1966 to 1970. Psychiatry Prof. John H. Greist says, "The actual rate is probably twice that. It's impossible to tell how many deaths attributed to other things are really suicides. There is a real need for suicide prediction."

People who have tendencies toward suicides can be helped — if they are identified in time. The Suicide Risk Prediction Program at the University of Wisconsin (UW) Hospitals now uses a computer to determine potentially suicidal people. Questions appear on a screen and the patient types in answers. The interview takes from 45 minutes to three hours. The computer makes a prediction on the likelihood of suicide in two and one-half minutes.

A program developer, Prof. Greist says that many people actually prefer discussing personal problems with the computer. "If, for example, a person is talking about influenza symptoms, he usually prefers talking with a doctor. But when talking about problems that may be socially deviant, many prefer the computer. It's a nonjudgmental interviewer that doesn't raise its eyebrows at anything."

And the computer makes fewer mistakes than a doctor. "In a study done to determine how accurate the computer is in determining potential suicides, we found that the computer was right 70 per cent of the time, and the clinicians, only 40 per cent," Dr. Greist said.

Besides being available day or night, the computer is more economical than a clinician. Between 8 a.m. and 5 p.m. weekdays a computer interview costs $3, and only $1.50 other times. The patients, who voluntarily agree to the computer interview, are seen by the staff if the computer determines they are high suicide risks. The program was developed by Prof. Greist in conjunction with UW industrial engineering Prof. David H. Gustafson.

SCOFFLAWS DON'T GET FAR IN MONTREAL

Peter R. Sigmund
Sperry Univac
P.O. Box 500
Blue Bell, Pa. 19422

Motorists take traffic tickets seriously in Montreal. They have no choice.

A computer coordinates the collection of fines for motor vehicle violations with the persistency of a bloodhound, levying increasingly severe penalties if the offender doesn't pay. As the last straw, it even issues "warrants for commitment" of dyed-in-the-wool scofflaws who disregard its mailed notices.

The computerized system, called SYCOM (System of the Municipal Court) is so reliable that the city recovers about 95 per cent of fines for moving or parking violations. SYCOM handles about 750,000 parking and 250,000 moving violations each year in the City of Montreal, whose population is about 1,300,000. The central computer is a UNIVAC 1106 from Sperry Rand Corporation's Sperry Univac Division.

Here's how the system works: Police officers return information on motor vehicle violations each day at their own stations. The data is checked and entered into the computer's FASTRAND II memory. The 1106 then sends a notice to the motorist with the date of the violation, the registration, year, and make of his car, and the time limit for paying the fine.

If the fine for a moving violation isn't paid, the penalty is increased and the computer issues a summons to appear before the Municipal Court. If the motorist remains recalcitrant, he is "judged by default," and the 1106 inssues a "Notice of Judgment" with a stiffer fine. Finally, the computer may issue a warrant to take the offender into custody.

SYCOM uses about 15 per cent of the computer's capacity. The 1106 also handles the city and urban community data processing needs for some 27 departments.

EARTH RESOURCES PRODUCTION PROCESSING SYSTEM DEVELOPED BY PHILCO-FORD CORPORATION

Northern California Public Relations Dept.
Aerospace and Communications Operations
Phildo-Ford Corporation
3939 Fabian Way
Palo Alto, Calif. 94303

Incredible amounts of earth resources information, with uses ranging from better map making to monitoring crop disease to controlling pollution, are being generated by the Skylab spacecraft and by related "underflights" of five highly instrumented NASA aircraft.

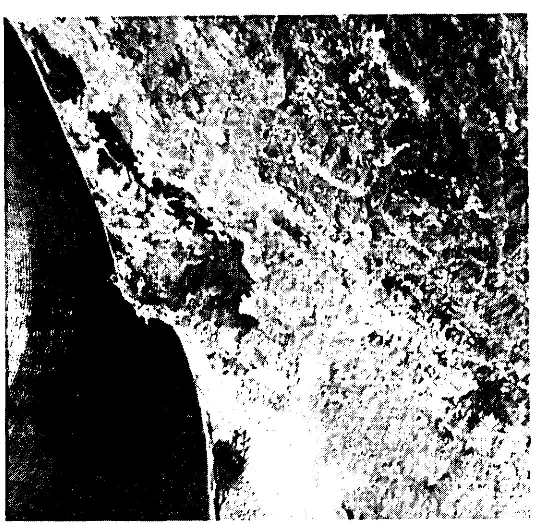
In technical terms, it's estimated that roughly 337-billion computer "bytes" of earth resources data will have been accumulated between the first Skylab launch in June and final splashdown of the current Skylab spacecraft.

If this much information were relayed to earth via systems used for Apollo moon missions, transmission alone would take nearly two years. For this reason, astronauts and pilots hand-carry the earth resources information back to Mission Control Center, at Johnson Space Center, Texas, recorded on 28- and 14-track computer tapes.

To process so much data and make it usable by scientists, Philco-Ford Corporation — prime contractor to NASA for engineering and operations support at the Mission Control Center — developed the Earth Resources Production Processing System.

According to Robert T. Benware, director of Phil Philco-Ford's Houston Operation, the processor is ususual in many ways. "This is the first time minicomputers have been used to handle such a tremendous volume of data," he said. "The key to successfully using small computers to do such a big job was the development of a unique interface controller and new software concepts that keep error rate low. By doing this, we were able to save more than half-a-million dollars over the cost of a large system."

The Production Processor performs its task in several steps. The data from 28-track Skylab tapes is first transferred to 14-track tapes of the type used by "underflight" aircraft. A Preprocessing Subsystem then converts all 14-track tapes to 9-track, computer-compatible tape, and summaries of preliminary findings are furnished to principal scientific investigators. From these, investigators can select specific areas for which they want complete data provided.



— This partial image, provided by NASA and originally in color, came from data generated by the spectral scanner aboard Skylab. It covers a portion of Northern California near the City of Eureka; at left is the Pacific Ocean. These non-photographic pictures are useful in mapping, agriculture, forestry, geology, hydrology and oceanology.

Next comes the data processing phase, where sensor information requested by scientists is put in usable form. Readings are converted to standard engineering units, data is sorted and tabulated, and various geometric and radiometric corrections are made. The information is analyzed, correlated and edited, then sent back to the scientists.

Some tapes are also prepared for image processing. A Production Film-Converter Subsystem accepts both raw and corrected data from 9-track tapes and plots it on a microfilm printer, producing detailed images of the geographic areas scanned by Skylab and aircraft sensors. Approximately a million bits of data are required to produce one 4-by-4-inch microfilm image.

Philco-Ford modified standard, off-the-shelf microfilm equipment for this task instead of designing new, highly specialized hardware. The modifications permit processing of information from several different types of sensors by making only minor changes in software parameters.

MINICOMPUTER MATCHES COLORS OF FABRICS

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

Precise color control plays a crucial role in a textile company's production and sales. A 1,000 pound batch of yarn that is one shade off the desired color must either be redyed or sold at a reduced price.

Avondale Milles, Sylacauga, Ala., one of the world's largest textile dyeing operations, is using a Nova 1200 computer, made by Data General Corporation, to control a system that has cut off-shade problems by 40 per cent, and has raised production 10 per cent by increasing efficiency. The computer is the central processor of a direct digital control system made for dyehouses by Information Laboratories, Inc., of Charlotte, N.C. Their process control systems also are used in the petrochemical industry.

The key computer-controlled processing areas at Avondale Mills are the drug room, where dyes are mixed, and the individual dye machines. In the drug room, the Nova 1200 chooses the proper combination of 12 chemicals, selects the correct mixing tank, and notifies the operator when the mixing is complete.

Once yarn is loaded into one of Avondale's kiers, or dyeing vats, an operator in the central control room types instructions to the computer, indicating which machine is ready for operation, and which dye cycle should be used for that machine. The computer then takes over, first injecting the dye, then monitoring and adjusting the pressure and temperature within a vat. This maintains conditions that allow a specific dye to react best with a particular fiber.

Seventy-eight of Avondale's 100 keirs are under computer control. Before the system was installed, an operator had to watch each dyeing machine constantly, and try to maintain proper conditions by opening and closing valves at the proper time. Avondale managers said the computer-controlled dyeing operation allows them to produce a product of unexcelled quality; and the operators now are working at other jobs where their skills are better used.

EDUCATION NEWS

"COMPUTER BLACKBOARD" ASSISTS IN TEACHING FINANCE AT NU

Ben Harrison
Northwestern University News
2530 Ridge Avenue
Evanston, Ill. 60201

Computer-controlled television monitoring sets and terminals are being used in the classroom at Northwestern's Graduate School of Management to help teach finance and economics by providing instant printout solutions to complex management problems.

Funded by a $31,300 grant from the Exxon Foundation, the "Exxon-Northwestern on-line computer blackboard" uses portable computer terminals and television monitors in the classroom. Eugene M. Lerner, professor of finance, and William J. Breen, associate professor of finance, prepared the grant proposal to Exxon Foundation for this experiment in teaching techniques.

For example, said Breen, the "computer blackboard" provides examples of real business situations to answer "what if?" type of questions. "In one course currently offered, the computer is programmed to provide a macro-model of the U.S. economy," Breen said. "Then various 'what if?' type questions are fed into it to see resulting changes. An illustrative question is: 'what happens to income and interest rates if the Federal Reserve raises bank reserves?'"

Other computer programs have been prepared on leasing programs, linear program models in finance (use of mathematical techniques to solve financial questions) and corporate reports to include income statements, balance sheets, and cash-flow statements for 1,800 companies for the last 20 years.

"Cases which professors use on the 'computer blackboard' are designed to assist in the teaching of finance, not to make programmers of students," Breen said. He said that students may spend as much time as necessary to evaluate answers from the "computer blackboard". Students are provided with flow charts of the program, well-documented program listings, and sample printouts, as well as copies of the TV output generated during the classroom experience.

The "computer blackboard" system consists of eight closed-circuit television monitoring sets and two computer terminals which may be moved from classroom to classroom.

GHETTO LIFE THROUGH COMPUTER SIMULATION

News Bureau
Division of Public Information
Oklahoma State University
Stillwater, Okla. 74074

History students at Oklahoma State University are getting a feel for the frustrations and pressures of ghetto life without ever leaving the campus. Through computer simulation, the students assume roles as ghetto residents. Using data stored in an IBM System/360 Model 65, they can simulate up to 10 years of ghetto life.

"Many of our students grew up in rural communities and believe people in the ghetto fail to get ahead because they're lazy and avoid education and employment opportunities," said history Prof. Charles M. Dollar. "Those attitudes usually change quickly when students discover everyday ghetto obstacles during the computer simulation sessions."

Working at typewriter terminals tied to the computer, students decide how much time to allocate to education, work, recreation and neighborhood improvement. A player in the "ghetto game" earns reward points as he improves his condition. The points can be earned for completing high school and college or for moving through various job levels into the professional ranks.

The number of simulated hours a student may invest varies according to the role he plays, Dr. Dollar said. For example, a divorced mother can invest only half the hours available to an unmarried woman with no children.

Those who decide to further their education may encounter other frustrations. There may be no room for them in trade schools or colleges. Some may be able to go to school only part time because they support families. Dollar said players sometimes discover their limited educations qualify them only for unskilled employment.

The computer has been programmed to randomly assign other chance factors that further frustrate students. Such setbacks as illness, pay reductions and even the possibility of becoming a robbery victim are considered. When these penalties are assessed, a student's score is reduced to slow his progress.

William V. Accola, formerly of the OSU Computer Center staff, helped Dollar write the computer simulation program. Financial support for this project and other computer-assisted learning efforts in history and the social sciences came from the OSU Research Foundation, the National Endowment for the Humanities and the Gulf Oil Foundation.

COMPUTER-RELATED SERVICES

ENGLAND'S KIDNEY MATCHING SERVICE TOPS THE 1,000 MARK

Brooks Roberst & John Aeberhard
Carl Byoir & Associates, Inc.
800 Second Avenue
New York, N.Y. 10017

In Bristol, England, a computer-based kidney matching service has topped the 1,000 mark. The service is operated for the National Tissue Typing reference laboratory by the South Western Regional Hospital Board.

The National Organ Matching and Distribution Service went into operation under the auspices of the Department of Health on February 1, 1972, embracing 26 donor centers across the UK as well as three coordinating centers in Europe. It is involved in twice as many kidney transplants in proportion to population as are being done in the United States, and handles at least 90 per cent of all UK kidney transplants.

The service centralizes tissue-typing information on all patients awaiting kidney transplants at the participating centers and compares it with similar data on the donor. There is a severe shortage of donor kidneys, and the time between known availability and the transplant operation can be no more than 16 hours; ideally it is less than 10. Therefore, the service operates 24 hours a day, 365 days a year, with an on-call duty officer, computer operator and tissue-typing serologist.

Because of the complexities of the matching process and the importance of speed, the service is feasible only with computer help. The key to the matching process lies in identifying antigens which, if present in the transplant and not in the host, would provoke the formation of antibodies in the host's blood, causing rejection of the kidney. These antigents are identified by blood sera known to contain specific antibodies. More than 100 blood sera are used nationally for reference purposes. The work of identifying them requires extensive computer support, involving large matrix comparisons. The South Western Regional Hospital Board's computer center provides this support on a bureau basis, as well as running the matching programs immediately when a donor kidney becomes available.

On the average this happens once or twice a day but as many as eight matchings have been undertaken in a 24-hour period. From the time the telephone rings in the computer center announcing an available donor to the time the duty operator calls the National Tissue Typing laboratory with the results of the computer run only 10 to 15 minutes elapse, with the record standing at four minutes.

The information provided by the computer lists the 10 best matches near the donor center, also nationally within the UK and finally on a European basis when necessary. It notes the quality of the match, the degree of urgency of need on the part of the waiting patient, the blood group and particular antibodies that have been identified. On the basis of this information the National Tissue Typing laboratory makes the choice of recipient and then everything swings into action to get the kidney to the right place in time.

THIRD PARTY ESCROW SERVICE

International Computer Programs, Inc.
2506 Willowbrook Parkway
Indianapolis, Ind. 46205

A new and certainly different software service has been initiated by ICP. Entitled the Third Party Escrow Service, it was created to solve the problem of a software buyer whose vendor does not provide the source code.

The solution of this problem arises by means of a three-way agreement between the buyer, his vendor and ICP. The international information service pledges to maintain all source decks, documentation, etc., in a bank vault under fully insured conditions for the life of the contract. In this way, should the vendor be in a position of inability to support the package for one reason or another, his source program remains available to the buyer.

It was due to interested inquiries about such a service, from many subscribers to the ICP Quarterly, that the Third Party Escrow Service became a reality.

MISCELLANEOUS

DYNAMIC CONSUMER MARKET PREDICTED FOR MICROELECTRONIC CALCULATORS

Jack Hefley
Microelectronic Product Division
Rockwell International Corp.
3430 Miraloma Avenue
Anaheim, Calif. 92803

"The true consumer market for microelectronic calculators is just beginning to emerge, and its potential is in the billions of dollars worldwide."

This assessment was made by Harold L. Edge, vice president and general manager of the Microelectronic Product Division, in a review of the calculator industry. The division is a major manufacturer of consumer calculators for mass merchandisers and other electronic equipment companies and produces a wide range of industrial products.

Edge said results experienced by the industry in 1973 pointed to a rapidly growing consumer interest in microelectronic calculators. "The growth of the market is dramatically evident in calculators sold through retail stores," he said. "Just two years ago, there was virtually no market in this segment."

The hand-held, microelectronic calculators with a memory capability, shown at the left, were leaders in calculator sales this past Christmas season. The market for "consumer" calculators didn't even exist before 1969, but now is valued at half a billion dollars a year worldwide.

The greatest retail impact in 1973 was in the following three categories of calculators: (1) the so-called "low end" models, capable only of adding, subtracting, multiplying and dividing; (2) the basic models, which have the above capabilities and also offer full-floating decimal positioning, percent key, repeat operations, constant operations and memory; and, (3) the specialty calculators, which include "slide rule," scientific, finance and conversion models.

"The advent of the low end calculator is the natural consequence of trying to cash in on the mass consumer market," said Edge. "It's interesting to note that although these low end calculators have the largest potential market in their own right, they are also expected to promote increased sales for more sophisticated calculators. Experience has shown that low end calculators serve as the natural customer steppingstone to machines with greater capability."

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Burroughs Corporation, Detroit, Mich.	Societe de Banque Suisse (Swiss Bank Corporation), Basel, Geneva, and Zurich	Six medium-scale B3700 computers, 200 System and Communications Processors, and 1,000 on-line terminal units	$20+ million
GTE Information Systems Inc., subsidiary of General Telephone & Electronics Corp., Stamford, Conn.	Bache & Co. Inc., New York, N.Y.	High-speed global data communications system to handle world-wide securities and commodities traffic with a "customized" network covering 131 Bache offices and 52 stock and commodity exchanges in 11 countries	$12 million
Pertec Corp. (ASE), El Segundo, Calif.	Singer Business Machines Div., The Singer Co., San Leandro, Calif.	Cathode-ray tube (CRT) terminals over a three-year period to be marketed for use with Singer's "System Ten"	$11 million (approximate)
Wyle Laboratories, El Segundo, Calif.	National Aeronautics and Space Administration (NASA)	"Instrument Support Services"; includes design and modification of special purpose data acquisition display and control systems; programming and operating on-line computers; providing complex instrument calibration, maintenance, and documentation services	$8+ million
Calspan Corporation, Buffalo, N.Y.	Western Electric Co.	Tasks associated with Safeguard anti-ballistic-missile system; a subcontract from Western Electric for the U.S. Army	$6.2 million
Information International, Inc., Los Angeles, Calif.	U.S. Navy	A GRAPHIX I technical manual republication system (a stand-alone information recycling facility); it reads printed pages of existing technical manuals into computer form; corrected/updated information is republished into human-readable form using International's COMp 80 microform photocomposition unit	$4 million
Computer Sciences Corp. (CSC), El Segundo, Calif.	Atomic Energy Commission (AEC), Nevada Operations Office, Las Vegas, Nevada	Computer facilities management; supports AEC and its contractors at Nevada Operations and other Federal Government agencies	$3+ million
Honeywell, Inc., Wellesley Hills, Mass.	Seattle-First National Bank, Seattle, Wash.	Purchase of Honeywell Model 6080 central processor to replace one of two models currently on lease; system will handle general banking applications	$2 million
Terminal Data Corporation, Van Nuys, Calif.	Burroughs Corporation, Detroit, Mich.	Microfilm equipment	$2.4 million
National Cash Register Co., Dayton, Ohio	Reynolds and Reynolds Co., Dayton, Ohio	1,000 adding machines which print figures in special typeface that can be read by electronic optical readers	$1.2 million
GTE Sylvania Inc., subsidiary of General Telephone & Electronics Corp., Stamford, Conn.	Massachusetts Dept. of Public Works, Waltham, Mass.	Installation and maintenance of closed-circuit television traffic monitoring equipment in Greater Boston area; equipment will be part of surveillance and control system to improve traffic flow and safety conditions on three interstate highways	$1.1 million
Ampex Corporation, Marina del Rey, Calif.	Xerox Corporation, El Segundo, Calif.	TMA model tape drives for use in the off-line model of new Xerox 1200 computer printing system	$1+ million
CSP Inc., Burlington, Mass.	U.S. Government	Three Digital Signal Processing Systems built around CSP-30 computer; will be used for speech research applications	$500,000+
Digital Equipment Corp., Maynard, Mass.	Gallaudet College, Washington, D.C.	Major expansion of DECsystem-10, to permit students from adjoining elementary and secondary schools for the deaf to participate in special computer-supported instruction programs	$225,000
Data 100 Corp., Minneapolis, Minn.	Department of Interior, U.S. Geological Survey	Up to 20 Model 78 remote batch terminals on an as-needed basis, with option of increasing aggregate order to a total of 30 terminals; rental income may be in excess of $1.7 million during 3-year period if all options are fully exercised	—
Data 100 Corp., Minneapolis, Minn.	State of California, Business and Transportation Agency, Sacramento, Calif.	25 computer terminals consisting of 19 Model 71 and 6 Model 78 remote batch terminals; systems will produce $700,000 in rental income during 2-year contract period	—
Measurex Corporation, Cupertino, Calif.	Greenwood Mills, Greenwood, S.C.	A Computer Control System providing digital computer control of a polyester double knit finishing operation	—
The Singer Co., Business Machines Div., San Leandro, Calif.	Ohrbach's, New York, N.Y.	MDTS* electronic point-of-sale systems for 12 stores in the New York and Los Angeles areas; systems include Model 902 electronic terminals with Model 705 tag readers and Singer System Ten* computers	—
Univac Div., Sperry Rand Corp., Blue Bell, Pa.	Litton Educational Publishing Inc., div. of Litton Industries, New York, N.Y.	A Univac 90/70 Computer System to speed up textbook production and distribution service to high schools, colleges, special schools, and business firm libraries	—

NEW INSTALLATIONS

OF	AT	FOR
Burroughs B 6700 dual system	The Dime Savings Bank of New York, N.Y.	On-line banking service to tellers in eight offices located around the New York Metropolitan area
Burroughs B 6700 system	Lomas and Nettleton Company, Houston, Texas	Data communications between computer center and company's seven regional service centers (system valued at $1.9 million)
Digital Equipment DECsystem-10	Ramada Inns, Inc., Phoenix, Ariz.	Managing all data for nationwide reservation service, and handling major accounting and payroll tasks (system valued at more than $1.7 million)
Honeywell Model 316 system	Van Den Berghs & Jurgens Ltd., Purfleet, Essex, England	Controlling movement of pallets holding food products in an 11-level warehouse; system will handle 70 pallet inputs an hour and 85 pallet outputs per 24 hour day (part of $1.7 million system)
Honeywell Model 2020 system	E. T. Barwick Mills Ltd., Bolton, Lancashire, England	Providing inventory recording and order processing, and accounting routines (system valued at more than $120,000)
	Treasury Department, State of Oregon, Salem, Ore.	Banking and cash-flow management, fund accounting, investment accounting, budgetary administration and safekeeping functions (system valued at $160,000)
Honeywell 6030 system	University of Bologna, Bologna, Italy	Administrative tasks, statistical research on university population, automation of student library, and for "business games" in cooperation with university's Management Studies Institute
Honeywell dual Model 6040 system	BancOhio Corporation, Ohio National Bank, Columbus, Ohio	All data processing for the corporation and affiliated banks; 6060 will be installed later (system valued at $3.1 million)
IBM System/370 Model 168	Calspan Corporation, Buffalo, N.Y.	Expansion of computer technology into new commercial and scientific markets (system valued at $4 million)
NCR Century 50	Williams Energy Company, Tulsa, Okla.	Computerizing customer and dealer billing procedures; encoders will be located in Williams' district sales offices around the nation; each will communicate with a computer located in one of firm's regional accounting offices
NCR Century 101 system	Jacome's, Tucson, Ariz.	Use in a complete electronic sales-recording and credit-authorization system, including 50 NCR 280 point0of-sale terminals and two NCR 723 data collectors
	National College of Business, Rapid City, S.D.	Teaching of computer programming; also for student scheduling and general accounting
NCR Century 251 system	Kansas State Bank and Trust Co., Wichita, Kansas	Expanding processing capabilities and conversion of Central Information File (CIF) to on-line operations
NCR Century 300 system	Louis Cron Ltd., Basle, Switzerland	Serving as nucleus of extensive on-line network linking firm with its affiliated companies; system replaces a smaller computer
	Bassin Parisien Savings Bank Center, Gaillon, France	Nucleus of new on-line Central Information File System serving nine savings banks with 83 branches
	Midi II Savings Bank (Caisse D'Epargne et Prevoyance) Toulon, France	Nucleus of new on-line Central Information File System serving a total of 24 savings banks with 100 branches
Univac 1106 system	Bassani-Ticino Group, Milan, Italy	Center of information system to serve all organizational units of the Group; applications include production control and personnel administration for Varese facility, and also provide data processing services for other users within Bassani-Ticino Group (system valued at $1.16 million)
	Department of Finance, State of Ohio, Columbus, Ohio	Present and projected requirements of the Bureau of Motor Vehicles and State Highway Patrol (system valued at $4.2 million)
Univac 1108 system	Gulf Research & Development Co., Gulf Pittsburgh Research Center, Pittsburgh, Pa. (3 systems)	Seismic data processing and production research; two systems were installed in Gulf's Houston facility (system valued at approximately $6 million)
Univac 1110 system	British Petroleum (BP) Trading Ltd., London, England	Centralizing data processing activities now being performed at several company locations in the U.K. (system valued at approximately $7 million)
	Fiat, Turin, Italy	Administrative, statistical and engineering applications (system valued at approximately $11.2 million)
Univac 9480 system	H and S Bakery, Baltimore, Md.	Route accounting, bake estimates, inventory control, general accounting and payroll processing
	Target Trust Group, United Kingdom	Processing all new policy applications, distribution vouchers and warrants and will maintain files for on-line access

MONTHLY COMPUTER CENSUS

Neil Macdonald
Survey Editor
COMPUTERS AND PEOPLE

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

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

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

The following abbreviations apply:

- (A) -- authoritative figures, derived essentially from information sent by the manufacturer directly to COMPUTERS AND PEOPLE
- 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 PEOPLE
- (N) -- manufacturer refuses to give any figures on number of installations or of orders, and refuses to comment in any way on those numbers stated here
- (R) -- figures derived all or in part from information released indirectly by the manufacturer, or from reports by other sources likely to be informed
- (S) -- sale only, and sale (not rental) price is stated
- X -- no longer in production
- \- -- information not obtained at press time and/or not released by manufacturer

SUMMARY AS OF JANUARY 15, 1974

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 2. United States Manufacturers I-Z							
IBM	305	12/57	3.6	40	15	55	-
White Plains, N.Y.	650	10/67	4.8	50	18	68	-
(N) (D) (Jan. 1974)	1130	2/66	1.5	2580	1227	3807	-
	1401	9/60	5.4	2210	1836	4046	-
	1401-G	5/64	2.3	420	450	870	-
	1401-H	6/67	1.3	180	140	320	-
	1410	11/61	17.0	156	116	272	-
	1440	4/63	4.1	1690	1174	2864	-
	1460	10/63	10.0	194	63	257	-
	1620 I, II	9/60	4.1	285	186	471	-
	1800	1/66	5.1	416	148	564	-
	7010	10/63	26.0	67	17	84	-
	7030	5/61	160.0	4	1	5	-
	704	12/55	32.0	12	1	13	-
	7040	6/63	25.0	35	27	62	-
	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-I	9/62	75.0	10	4	14	-
	7094-II	4/64	83.0	6	4	10	-
	System/3 Model 6	3/71	1.0	8	-	-	-
	System/3 Model 10	1/70	1.1	8	-	8	-
	System/3 Model 15	-	-	-	-	-	-
	System/7	11/71	0.35 and up	16	-	16	-
	360/20	12/65	2.7	7161	6075	13236	1780
	360/22	9/71	4.6	1000	300	1300	-
	360/25	1/68	5.1	1112	759	1871	1287
	360/30	5/65	10.3	5487	2535	8022	-
	360/40	4/65	19.3	2454	1524	3978	1363
	360/44	7/66	11.8	109	57	166	39
	360/50	8/65	29.1	1136	445	1581	662
	360/65	11/65	57.2	604	144	748	562
	360/67	10/65	133.8	65	6	71	99
	360/75	2/66	66.9	50	17	67	12
	360/85	12/69	150.3	11	1	12	55
	360/90	11/67	-	5	-	-	-
	360/91	-	-	1	-	-	-
	360/190	-	-	13	2	15	-
	360/195	4/71	232.0	-	-	9	48
	370/115	-	-	-	-	-	-
	370/125	4/73	8.2-13.8	1	-	-	-
	370/135	5/72	14.4	13	-	-	-
	370/145	9/71	23.3	2	-	-	-
	370/155	2/71	48.0	4	-	4	-
	370/158	-/73	49.5-85.0	1	-	-	-
	370/165	5/71	98.7	3	-	-	-
	370/168	-/73	93.0-170.0	2	3	5	-
	370/195	6/73	190.0-270.0	-	-	-	-
Interdata	Model 1	12/70	3.7	244	75	319	-
Oceanport, N.J.	Model 3	5/67	13.1	-	-	200	X
(A) (Oct. 1973)	Model 4	8/68	8.5	274	115	389	32
	Model 5	11/70	X	70	20	90	X
	Model 7/16	-/74	-	-	-	-	-
	Model 7/32	-/74	-	-	-	-	-
	Model 15	1/69	20.0	40	24	64	X
	Model 16	5/71	X	1	6	7	X
	Model 18	6/71	X	2	7	9	X
	Model 50/55	5/72	-	75	10	85	115
	Model 70	10/71	-	466	116	582	107
	Model 74	2/73	-	41	8	49	126
	Model 80	10/72	-	15	3	18	30
	Model 85	6/73	-	1	-	-	-

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
Microdata Corp.	Micro 400/10	12/70	0.1-0.5	139	0	139	-
Irvine, Calif.	Micro 800	12/68	0.2-3.0	2927	810	3737	-
(A) (Sept. 1973)	Micro 1600	12/71	0.2-3.0	914	95	1009	-
NCR	304	1/60	X	5	2	7	X
Dayton, Ohio	310	5/61	X	8	0	8	X
(N) (R) (Jan. 1974)	315	5/62	7.0	255	200	455	-
	315 RMC	9/65	9.0	55	35	90	-
	390	5/61	0.7	160	325	485	-
	500	10/65	1.0	1100	1750	2850	-
	251	1/73	20.5	5	-	5	-
	Century 50	2/71	1.6	582	0	582	-
	Century 100	9/68	2.6	1175	784	1959	-
	Century 101	12/72	3.7	52	3	55	-
	Century 200	6/69	7.0	576	335	911	-
	Century 300	2/72	21.0	7	8	15	-
Philco	1000	6/63	X	16	-	-	X
Willow Grove, Pa.	200-210,211	10/58	X	16	-	-	X
(N) (Jan. 1969)	2000-212	1/63	X	12	-	-	X
Raytheon Data Systems Co.	250	12/60	X	115	20	135	X
Norwood, Mass.	440	3/64	X	20	-	-	X
(A) (July 1973)	520	10/65	X	26	1	27	X
	703	10/67	12.5	(S) 179	33	212	0
	704	3/70	7.2	(S) 300	100	400	40
	706	5/69	19.0	(S) 75	17	92	1
Standard Computer Corp.	IC 4000	12/68	9.0	9	0	9	2
Los Angeles, Calif.	IC 6000-6000/E	5/67	16.0	3	0	3	-
(R) (June 1972)	IC 7000	8/70	17.0	4	0	4	1
	IC-9000	5/71	400.0	(S) 1	0	1	-
Systems Engineering Laboratories	SYSTEMS 810A/810B	6-66/9-68	1.8/2.6	388	31	419	-
Ft. Lauderdale, Fla.	SYSTEMS 71/72	8-72/9-71	0.9/1.0	21	6	27	-
(A) (Jan. 1974)	SYSTEMS 85/86	7-72/6-70	6.0/10.0	58	4	62	-
Texas Instruments Inc.	960	6/70	X	-	-	-	X
Houston, Tex.	960A	11/71	0.2-2.7	-	-	-	-
(A) (June 1973)	980	5/68	X	-	-	-	X
	980A	8/72	0.3-2.7	-	-	-	-
UNIVAC Div. of Sperry Rand	9200	6/67	1.5	1360	616	1976	-
Blue Bell, Pa.	9300/9380	9/67	3.4	795	675	1470	-
(A) (Aug. 1973)	9400/9480	5/69	7.0	212	228	440	-
	9700	-	-	3	11	14	-
	418 III	6/63	11.0	40	77	117	-
	494	-	-	62	46	108	-
	1106	-	-	61	143	204	-
	1108	9/65	68.0	163	92	255	-
	1110	-	-	11	17	28	-
	I & II	3/51 & 11/57	X	23	-	-	X
	File Computers	8/56	X	13	-	-	X
	LARC	5/60	135.0	2	0	2	-
	1107, UIII, 490/1/2, 418II, 1004/5, 1050, SS80/90	-	X	2063	1442	3505	X
UNIVAC - Series 70	301	2/61	7.0	143	-	-	-
Blue Bell, Pa.	501	6/59	14.0-18.0	17	-	-	-
(A) (Feb. 1973)	601	11/62	14.0-35.0	0	-	-	-
	3301	7/64	17.0-35.0	74	-	-	-
	Spectra 70/15, 25	9/65	4.3	18	-	-	-
	Spectra 70/35	1/67	9.2	95	-	-	-
	Spectra 70/45	11/65	22.5	265	-	-	-
	Spectra 70/46	11/68	33.5	30	-	-	-
	Spectra 70/55	11/66	34.0	10	-	-	-
	Spectra 70/60	11/70	32.0	18	-	-	-
	Spectra 70/61	4/70	42.0	7	-	-	-
	70/2	5/71	16.0	63	-	-	-
	70/3	9/71	25.0	7	-	-	-
	70/6	9/71	25.0	24	-	-	-
	70/7	12/71	35.0	7	-	-	-
	EMR 6020	4/65	5.4	15	1	16	0
	EMR 6040	7/65	6.6	6	0	6	0
	EMR 6050	2/66	9.0	15	2	17	0
	EMR 6070	10/66	15.0	7	8	15	0
	EMR 6130	8/67	5.0	34	13	47	0
	EMR 6135	-	2.6	36	5	41	4
	EMR 6145	-	7.2	-	-	-	8
	EMR 6140	-	-	-	-	-	0
Varian Data Machines	620	11/65	X	-	-	75	X
Newport Beach, Calif.	620i	6/67	X	-	-	1300	X
(A) (Mar. 1973)	R-620i	4/69	-	-	-	80	-
	520/DC, 520i	12/69;10/68	-	-	-	500	150
	620/f	11/70	X	-	-	207	X
	620/L, 620/L-00C	4/71;9/72	-	-	-	740	101
	620/f-100	6/72	-	-	-	100	43
	620/L-100	5/72	-	-	-	200	235
	Varian 73	11/72	-	-	-	40	39
Xerox Data Systems	XDS-92	4/65	1.5	43	4	47	-
El Segundo, Calif.	XDS-910	8/62	2.0	170	10	180	-
(N) (R) (Jan. 1974)	XDS-920	9/62	2.9	120	12	132	-
	XDS-930	6/64	3.4	159	14	173	-
	XDS-940	4/66	14.0	33	3	36	-
	XDS-9300	11/64	8.5	25-30	4	29-34	-
	XDS-530	8/73	7.6	-	-	-	-
	Sigma 2	12/66	1.8	163	36	199	-
	Sigma 3	12/69	2.0	21	1	22	-
	Sigma 5	8/67	6.0	32	14	46	-
	Sigma 6	6/70	12.0	3	-	-	-
	Sigma 7	12/66	12.0	31	7	38	-
	Sigma 8	2/72	18.0	5	-	-	-
	Sigma 9	10/71	35.0	9	-	9	-

CALENDAR OF COMING EVENTS

Feb. 19-22, 1974: 3rd Annual National Communications Week Convention, Chase-Park Plaza Hotel, St. Louis, Mo. / contact: David C. Brotemarkle, Communications Systems Management Assoc., 1102 West St., Suite 1003, Wilmington, DE 19801

Feb. 22, 1974: Minicomputer Instructional Systems Conference, St. Louis, Mo. / contact: Ralph E. Lee, Computer Center, University of Missouri-Rolla, Rolla, MO 65401

Feb. 26-28, 1974: Computer Conference (COMPCON), Jack Tar Hotel, San Francisco, Calif. / contact: Jack Kuehler, IBM Corp., P 35, Bldg. 025, Monterey & Cottle Rds., San Jose, CA 95114

Mar. 4-8, 1974: Numerical Control Conference and Exhibition, Milan, Italy / contact: CEU—UCIMU's Exhibition Centre, Via Monte Rosa 21, 20149 Milano, Italy

Mar. 7, 1974: Computer Law Association meeting, Washington, D.C. / contact: Robert P. Bigelow, 28 State St., Room 2200, Boston, MA 02109

Mar. 25-29, 1974: IEEE International Convention (INTERCON), Coliseum & Statler Hilton Hotel, New York, N.Y. / contact: J. H. Schumacher, IEEE, 345 E. 47th St., New York, NY 10017

Mar. 27-29, 1974: Data Processing Symposium, Univ. of Calif., Los Angeles, Calif. / contact: Tom Mincer, Continuing Education in Engineering and Mathematics, Univ. Ext., UCLA, P.O. Box 24902, Los Angeles, CA 90024

April 3, 1974: Minicomputers — Trends and Applications, Nat'l Bureau of Standards, Gaithersburg, Md. / contact: Harry Hayman, 738 Whitaker Ter., Silver Spring, MD 20901

April 8-11, 1974: Computer Aided Design, Int'l Conference & Exhibition, Univ. of Southampton, Southampton, England / contact: Inst. of Civil Engrs., Great George St., Westminster, London SW1, England

April 9-11, 1974: Optical Computing Symposium, Zurich, Switzerland / contact: Samuel Horvitz, Box 274, Waterford, CT 06385

April 21-24, 1974: International Circuits & Systems Symposium, Sir Francis Drake Hotel, San Francisco, Calif. / contact: L. O. Chua, Dept. of EE, Univ. of Calif., Berkeley, CA 94720

April 21-24, 1974: 1974 Annual Assoc. for Systems Management Conf., Dallas Convention Center, Dallas, Tex. / contact: R. B. McCaffrey, ASM, 24587 Bagley Rd., Cleveland, OH 44138

May 2-3, 1974: 10th Annual National Information Retrieval Colloquium, Holiday Inn, Philadelphia, Penna. / contact: NIRC, P.O. Box 15847, Philadelphia, PA 19103

May 5-8, 1974: Offshore Technology Conference, Astrohall, Houston, Tex. / contact: Offshore Tech. Conf., 6200 N. Central Expressway, Dallas, TX 75206

May 6-10, 1974: 1974 National Computer Conference & Exposition, McCormick Place, Chicago, Ill. / contact: Dr. Stephen S. Yau, Computer Sciences Dept., Northwestern University, Evanston, IL 60201

May 7-10, 1974: 12th Annual Assoc. for Educational Data Systems Convention, New York Hilton Hotel, New York, N.Y. / contact: Thomas A. Corr, Nassau Community College, Stewart Ave., Garden City, NY 11530

May 13-17, 1974: European Computing Congress (EUROCOMP), Brunel Univ., Uxbridge, Middlesex, England / contact: Online, Brunel Univ., Uxbridge, Middlesex, England

May 13-17, 1974: International Instruments, Electronic and Automation Exhibition, Olympia, London, England / contact: Industrial Exhibitions Ltd., Commonwealth House, New Oxford St., London WC1A 1PB, England

May 14-17, 1974: 6th Annual APL International Users Conference, Sheraton Hotel, Anaheim, Calif. / contact: John R. Clark, Orange Coast College, 2701 Fairview Rd., Costa Mesa, CA 92626

May 20-24, 1974: Computer Week IV: DPMA, ASM, ACM, TIMS, SCYL, Statler Hilton Hotel, Buffalo, N.Y. / contact: William P. Hanley, Erie County Department of Health, Buffalo, NY 14202

June 11-13, 1974: 1st Annual Automotive Electronics Conference and Exposition, Cobo Hall, Detroit, Mich. / contact: Robert D. Rankin, Rankin Exposition Management, 5544 E. La Palma Ave., Anaheim, CA 92807

June 23-26, 1974: 1974 Annual International Conference & Busi-Exposition, Auditorium & Convention Hall, Minneapolis, Minn. / contact: Data Processing Management Assoc., 505 Busse Highway, Park Ridge, IL 60068

June 24-26, 1974: Design Automation Workshop, Brown Palace Hotel, Denver, Colo. / contact: ACM, 1133 Ave. of the Americas, New York, NY 10036

June 24-26, 1974: 5th Conference on Computers in the Undergraduate Curricula, Washington State Univ., Pullman, Wash. / contact: Dr. Ottis W. Rechard, Computer Science Dept., Washington State Univ., Pullman, WA 99163

July 9-11, 1974: Summer Computer Simulation Conference, Hyatt Regency Hotel, Houston, Tex. / contact: M. E. McCoy, Martin Marietta Data Systems, Mail MP-198, P.O. Box 5837, Orlando, FL 32805

July 15-19, 1974: 1974 Conference on Frontiers in Education, City University, London, England / contact: Conf. Dept., Institution of Electrical Engineers, Savoy Place, London, England WC2R 0BL

July 23-26, 1974: Circuit Theory & Design, IEE, London, England / contact: IEE, Savoy Pl., London WC2R 0BL, England

July 23-26, 1974: International Computer Exposition for Latin America, Maria Isabel-Sheraton Hotel, Mexico City, Mexico / contact: Seymour A. Robbins, National Expositions Co., Inc., 14 W. 40th St., New York, NY 10018

Aug. 5-10, 1974: IFIP Congress 74, St. Erik's Fairgrounds, Stockholm, Sweden / contact: U.S. Committee for IFIP Congress 74, Box 426, New Canaan, CT 06840

Aug. 5-10, 1974: Medinfo 74, St. Erik's Fairgrounds, Stockholm, Sweden / contact: Frank E. Heart, Bolt Beranek and Newman, Inc., 50 Moulton St., Cambridge, MA 02138

Aug. 21-23, 1974: Engineering in the Ocean Environment International Conf., Nova Scotian Hotel, Halifax, Nova Scotia / contact: O. K. Gashus, EE Dept., Nova Scotia Tech. Coll., POB 100, Halifax, N.S., Canada

Sept., 1974: 2nd Symposium IFAC/IFIP/IFORS, Cote d'Azur, France / contact: AFCET, Secretariat des Congres, Universite Paris IX, Dauphine 75775 Paris Cedex 16, France

Sept. 9-12, 1974: INFO 74, Coliseum, New York, N.Y. / contact: Clapp & Poliak, Inc., 245 Park Ave., New York, NY 10017

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