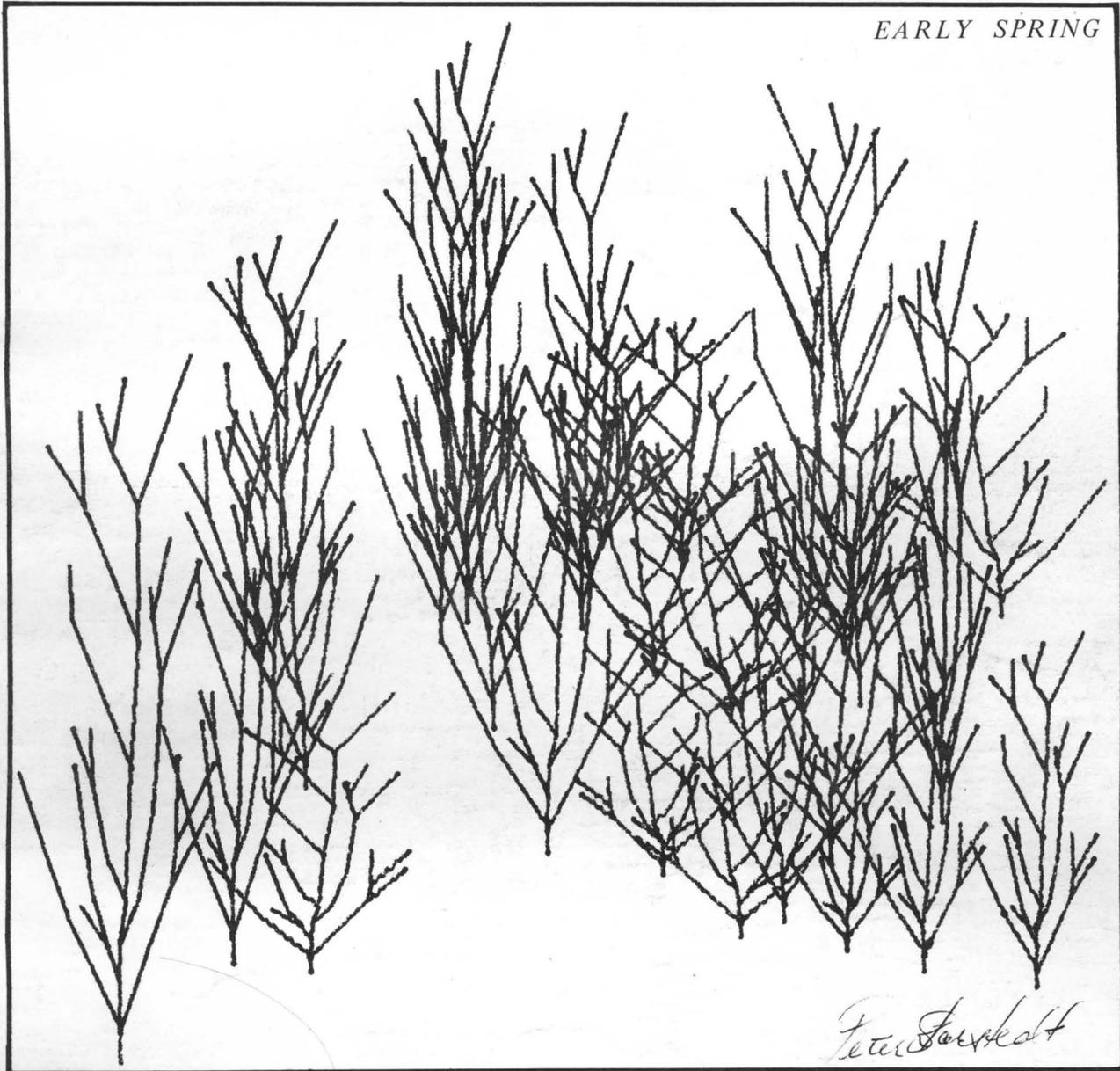


computers and people

formerly *Computers and Automation*



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IF YOU COULD PREVENT JUST ONE IMPORTANT MISTAKE BEFORE IT HAPPENED ■ ■ ■

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- to help you solve problems
- to give you more tools to think with
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8

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

by Edmund C. Berkeley, editor,
anthologist, and author

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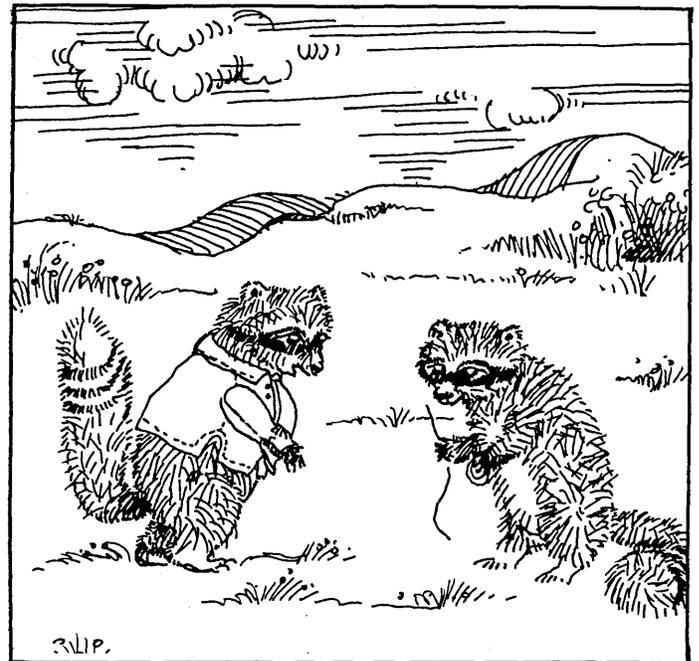
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THE TWO RACCOONS AND THE BUTTON

George Raccoon: Oh, darn, there's a button off my shirt.

Martha Raccoon: My dear, see if there isn't another shirt in your drawer that you can wear.

George: (searching) No, there isn't. That's the only clean white shirt; all the others are gray. And I have to wear a white shirt to-day; there's a meeting this morning with Mr. Wolf and Mr. Fox — we have a problem with the Bears, you know.

Martha: I'm sure there is another white shirt. *(She comes and searches the drawer.)* Well, there isn't one, you're right. Do you have the button?

George: Yes, here it is. Oh, Martha, are you going to sew it on for me right now? You're amazing, you're wonderful!

Martha: Give me the button. *(She swiftly sews the button on the white shirt, while he waits patiently.)* There's your shirt.

George: Oh, thank you — you're my dear Martha. You're the best and nicest help a Raccoon could ask for. I just don't know what I'd do without you.

Martha: (smiling) I know what you'd do, you big Raccoon — you'd sew it on yourself, just as you used to before you married me — and you'd save all that flattery.

George: (giving her a Raccoon hug) Not flattery, my dear — persuasion!

Persuade him with kindly gifts and gentle words.

— Homer, 850 B.C.

Persuasion's only shrine is eloquent speech.

— Aristophanes, 405 B.C.

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computers and people

formerly *Computers and Automation*

Management of Computer Systems

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by William E. McMillen, Director, Management Information Services, Questor Corp., Toledo, Ohio

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The use one makes of a computer is conditioned by the way one thinks about it; it can fill the role of ally instead of slave.

The Profession of Information Engineer and the Pursuit of Truth

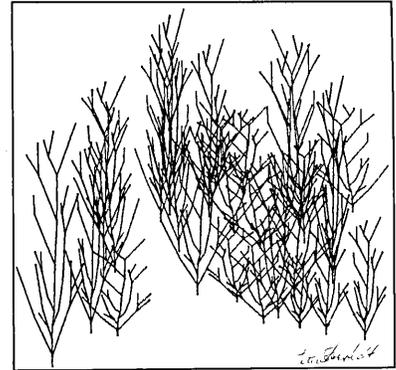
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From *The Boston Globe* of March 20, 1974

James Earl Ray, convicted killer of the Rev. Martin Luther King Jr., says he did not act alone but was part of a conspiracy to kill the black civil rights leader, according to a National Enquirer article. "There was definitely a conspiracy to kill Martin Luther King," he is quoted as saying. "I was not alone in it. I can prove I wasn't in the room when the shot was fired."

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Front Cover Picture

Early Spring, by Peter Skarstedt, was produced as part of his work in a course in computer art taught by Grace C. Hertlein, Asst. Professor. Peter is a student in the Department of Computer Science, California State University, Chico.

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NOTICE

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

ATTITUDES TOWARDS A COMPUTER

It is a great pity to have to read once again in the introduction of a recent book (see the quotation on the facing page) remarks as stupid, as narrow, and as wrong as the following excerpts from its introduction:

- The computer is nothing more than an electronic piece of equipment that can be manipulated by man to achieve his goals.
- When people (programmers) give it the wrong instructions, it has no way of knowing this. . . .
- . . . to train this slave to function correctly, one must develop an understanding of the computer and how it works.

First, the computer is far more than just "a piece of electronic equipment". It has capacities far greater than the usual "piece of electronic equipment". The computer, when programmed correctly and completely, is like a jet airplane for the human mind. It makes possible what was before impossible - in the same way as a jet airplane makes possible transportation that was previously impossible.

The programmed computer can perform accurately, completely, reliably, and swiftly a great many functions of thinking: calculating, reasoning, problem-solving, learning, self-improving, and so on. It can do many of these operations far better and far faster than any human mind. C. P. Snow, the English scientist and scholar, said on one occasion that the computer is by far the most revolutionary machine ever made by man.

Second, a computer can be programmed to apply many tests to whatever it is asked by an operator or a programmer to do. Even the telephone number dialing system - to use the example which Kushner and Zucker use - can on many occasions report back "the number which you have dialed is not in working order; please check again the number you wish to dial".

In fact, a simple device could be attached to any telephone which would: (1) allow the dialer to dial only any one of a specified set of numbers, and (2) would require certain unlocking actions if other numbers were to be dialed. But since the telephone company profits from unreported wrong numbers dialed, there is no economic incentive for the telephone company to develop such a device for the protection of its subscribers.

In regard to protection for programmers, see for example the article "DWIM ('Do What I Mean'), the Programmer's Assistant" by Warren Titelman, published in the April 1972 issue of *Computers and Automation*. This describes how a computer can be programmed to help a programmer overcome a great many of his natural mistakes.

It simply is not true that "When people . . . give the computer the wrong instructions, it has no way of knowing this. . . ."

Finally, it is nonsense to say "to train this slave to function correctly, one must develop an understanding of the computer and how it works". In the first place, the computer is not "a slave" but "an ally"; and to think of the computer as "a slave" instead of "an ally" is an invitation to snobbishness, arrogance, hubris, and errors, which interfere with doing a good job.

Also, it is not true that one has to understand a computer in order to make it function correctly. It is not necessary to understand the telephone in order to make the telephone function correctly. It is not necessary to understand a motor car in order to make a motor car function correctly. All I need for such devices is the minute portion of understanding which enables me to use or program the device. Here is where modern efficiency arrives. I need just enough understanding of the black box which is a telephone or a motor car or a computer which enables me to put in certain inputs that bring me certain desired outputs. Compared with all that there is to be understood about the inside of the black box, the amount of understanding I need is minute, almost microscopic.

The attitude expressed in such remarks as these should really disappear from the field of computers and data processing. This attitude is obsolete.

Edmund C. Berkeley

Edmund C. Berkeley
Editor

FORUM

Articles for Computers and People

1. From Robert P. Teutsch
Software Project Manager
Hughes Aircraft Co.
P.O. Box 90515
Los Angeles, Calif. 90009

I have from time to time read Computers and People and have appreciated the articles that have been presented. Since my line of work is deeply involved with computers and their associated software, I feel that my associates and I may have something to offer.

I would appreciate it if you would send me your author's guide that pertains to the specific requirements for submitting an article for publication.

2. From the Editor

We desire to publish in Computers and People articles related to computers and data processing, and their design, applications, uses, systems, and implications, both near at hand implications for the machine user and his customers and broad implications for society. The level we try to maintain is intermediate (between elementary and difficult). We like articles that are factual, useful, understandable, and interesting to many different kinds of people. We desire to print news, letters to the editor, discussions, arguments, disagreements, con-

THE PURPOSE OF FORUM

- To give you, our readers, an opportunity to discuss ideas that seem to you important.
- To express criticisms or comments on what you find published in our magazine.
- To help computer people and other people discuss significant problems related to computers, data processing, and their applications and implications, including information engineering, professional behavior, and the pursuit of truth in input, output, and processing.

Your participation is cordially invited.

troversies, announcements, etc., anything, if it is likely to be of significant interest to people engaged in computers and data processing and/or if it is of importance to the profession of information engineering and the pursuit of truth (especially suppressed truth).

We follow the rule: never underestimate a man's intelligence — never overestimate his information. Consequently, any term which may be new to the reader should be defined when it is first used, with about 5 to 20 words, to make sure that the reader can follow the article and does not have to guess. We believe that our readers are people who are seriously interested in many subjects, but who may not have any specific background that the author may hope that they have — and so the author has to orient and help his readers. He should use examples, details, comparisons, analogies, etc., whenever they may help readers to understand a difficult point. He should give data supporting his argument and evidence for his assertions. An article may certainly be controversial if the subject is discussed reasonably.

Some of the questions that an article might answer are these: What is this article about? What does the article show or prove? What was the problem? What is an example of the problem? How were computers used to solve the problem? How long was

(please turn to page 33)

Quotation from the introduction of a recent book on data processing —

The computer has been blamed for many mishaps, such as a failure to deduct enough income tax or a deduction of too much income tax, a one-dollar check that is issued as a million dollars, an incorrect monthly statement from a charge account, or snafus within a registration system. Actually, it is not the computer that is the culprit, but the humans who are responsible for the direction, control, and operation of the computer. To understand why these errors occur, people must get to know the computer better.

The computer is nothing more than an electronic piece of equipment that can be manipulated by man to achieve his goals. Like the telephone, it is an electrical instrument that stands ready to serve. Without the proper commands, it is useless. The telephone can be used to call your next-door neighbor by dialing the correct telephone number. If, however, even one digit of the number is dialed incorrectly, your goal will not be achieved. You may get results — speak to someone — but your aim has not been realized. In this instance, who is wrong — the human or the machine? Surely, the blame must be put on the human.

The computer has a similar relationship to humans. When people (programmers) give it the wrong instructions, it has no way of knowing this; therefore, like an obedient slave, it carries out the incorrect orders. When the wrong telephone number (input) was dialed, it connected you with the correct party based on the information that it received, although it was not the party you wanted. Similarly, when incorrect data (information) is fed into a computer, the results (output), although technically correct, may be invalid.

To help to eliminate as many errors as possible and to train this slave to function correctly, one must develop an understanding of the computer and how it works.

The functions of a computer can be broken down into three major areas: input, processing, and output. . . .

— From *RPG: Language and Techniques*, p. 1, by Marvin Kushner and Cynthia Zucker, published by John Wiley & Sons, Inc., New York, 1974, 482 pp.

STEP-WIDE MANAGEMENT CONTROLS

William E. McMillen, Director
Management Information Services
Questor Corporation
1801 Spielbusch Ave.
Toledo, Ohio 43691

"The planning of a project is . . . similar to the 'explosion' of a production schedule into material and manpower requirements — that is, the determination of what parts must be assembled or manufactured, how many man-hours will be required at each step of the process and what kinds of equipment and skills will be required."

Most of us have been involved in or observed numbers of projects both large and small which have resulted in systems that produce results not really relevant to the need, or in solutions for which there are no suitable problems; and we have seen projects which die somewhere between initiation and completion for any number of reasons. We have also seen projects which were initiated, executed, and completed on schedule and within the budget, and, what's more, produced results which solved the real problem or satisfied the real need.

Failure to Produce Results

If we analyze the differences between these successes and failures, the probability is that the difference can be attributed to methods of planning, follow-up, and control of the project itself, with the greatest likelihood that the problem is in follow-up and adherence to rather well-defined and well-known project control techniques. In many cases, however, the failure to produce results, which both meet schedule and budget and satisfy a need, can be directly attributed to changes in requirements on the part of the system user.

These changes may be real requirements brought on by a change in the operation to be served by the system, or, as is true in many cases, they may be due to change either in management personnel or in the thinking of user management. Regardless of the reason it is still quite possible to restructure, redirect or kill the project in a timely and orderly fashion when these conditions occur. The methods for accomplishing successful completion, orderly restructuring or timely abandonment of projects make up the subject we've labeled "Step-Wise Management Controls," and I'd like to discuss these with an emphasis on planning and control from the viewpoint of upper management.

Based on a talk at a conference sponsored by The Conference Board, New York, N.Y., November 26-27, 1973.

Resource Allocation

We'll start with a look at resource allocation and priority setting, for these two subjects frequently lead to or contribute to delays and failures. By "resource allocation" I mean the determination of how available manpower and equipment will be allocated to the various projects. This becomes particularly important in the normal case where demands exceed available resources and where we must plan for unknown contingencies such as hardware failure, personnel turnover or emergency requirements for project resources.

I'd like to use the term "single service" for those systems functions which serve a single company, division, or other organization which is entirely under the direction of a single chief operating executive, and "multi-service" if the function serves more than one such entity; for instance, a centralized corporate group serving several divisions or subsidiaries which are independent profit and loss centers and operate on a decentralized management basis.

Single Service Environment

In the single service environment, an operating philosophy must be established which will govern commitment of available resources to several short-range projects, with the possibility of adding long-term projects using outside sources or committing resources to a few long-term projects and using outside sources for adding required short-term work. To attempt to satisfy all requirements as they arise, using the internal staff will cause one of two undesirable situations — either the staff and equipment resources must be padded to absorb these unknown requirements or project delays and overruns will be created as a result of shifting priorities and schedules. But this is the real world, and we might as well plan for the inevitable. This means we must be willing to pay the price unless we are

mature enough to recognize that some work simply won't get done.

Once this basic operating philosophy is established, then priorities must be assigned, based on rate of return on investment, competitive pressures in the marketplace, political expedience or whatever criteria seem appropriate. It is important that the top executive officer either set the priority or approve it and then communicate that priority to all parties and establish credibility in the assignment so that no one can change the priority without formal approval. This may appear to have such strict procedures inherent in it that it will be difficult to adjust to rapid changes in requirements caused by changes in the business. But I am a firm believer that in the long run there will be greater productivity and greater benefits gained if these procedures are enforced. Without such enforcement, the systems function may be flexible, but it cannot be productive.

Once the available resources are assigned to projects on the basis of this priority ranking, new systems requirements should be handled just as any new facilities, via appropriations approval procedures. The established schedules would be changed only when a new requirement pre-empts an existing priority. All other requirements would be satisfied by using outside sources if there is economic justification.

Multi-Service Environment

In the case of multi-service environments such as centralized corporate facilities serving more than one division or subsidiary, resources should be allocated for the future budgeting period on some equitable basis determined by the top executive officer. Once this has been done, each division can handle its priorities and requirements as though it were a single service user. Again, it is very important that priorities be communicated and enforced.

Project Management

Now let's turn to the subject of project management — the second half of Step-Wise Management Controls.

Project planning and control techniques have been quite successful in other industries — construction, manufacturing, aerospace, etc. — but less than successful in many data processing applications, presumably because data processing projects are "unstructured" or, at least, vary widely in form and content and, therefore, don't yield readily to any given standard control procedure.

A closer inspection, however, disproves this theory. The basic structure of systems projects is the same regardless of the application. The procedural steps for development of a system can be standardized into specific "unit projects" in much the same fashion as a product is assembled from parts into components into subassemblies and, finally, into a finished product. The planning of a project is, therefore, similar to the "explosion" of a production schedule into material and manpower requirements — that is, the determination of what parts must be assembled or manufactured, how many man-hours will be required at each step of the process and what kinds of equipment and skills will be required.

A Methodology: "PRIDE"

In this planning process the number of subassemblies to be developed or, in our case, the number

of unit projects to be completed is somewhat arbitrary; it may consist of many small subprojects or of a few larger such units. In our company we have adopted a methodology developed by M. Bryce and Associates, Inc., labeled "PRIDE". This is the registered trademark of a very sophisticated project planning and control methodology, and most of my remarks will be based on concepts used in PRIDE.

In our "process flow" for a systems project are nine major components or unit projects which correspond to nine stages in a manufacturing process. Although each of these unit projects may consist of many activities, the completion of a unit project itself provides the checkpoint for management audit and control.

Once the total project is planned and scheduled by defining the elements of work which make up each of the nine unit projects, the execution of the project then corresponds to the assembly or manufacture of a product, and all normal provisions for cost control, quality assurance, delivery schedules and fitness of the end product to satisfy its intended purpose must prevail.

Unit Projects

I will not attempt here to go into detail in describing these nine unit projects, since their labels are somewhat descriptive and also because they are, to a degree, arbitrary in composition. The important point is that they provide distinct benchmarks and control points for management review and decision-making. The nine are:

1. Systems study and evaluation: this phase includes the analysis of the existing system or definition of the problem, an evaluation of needs, development of a system or problem-solving approach and preparation of an economic feasibility report, project schedule, and proposal.
2. General system design.
3. Subsystem design.
4. Administrative and computer procedure design: this phase includes both administrative or clerical procedure design and computer or program procedure design.
5. Program development.
6. Computer procedure test.
7. System test.
8. System operation.
9. System audit.

Each of these nine unit projects is managed independently but is time-dependent in that no one unit project can be started until the preceding one is completed. Since each of the nine must be completely documented, reviewed by systems and user management and approved before it is classified as complete, any tendency for the total project to stray from original objectives can be detected very early in the process. This also enables the detection of changed requirements early in the process, so that the project objectives can be changed if this is required.

Time Estimating

An important feature of the methodology is that time estimating and target dates are treated realistically. In the first phase, a firm estimate of re-

(please turn to page 17)

"All this activity illustrates the second economic law in operation in computing in higher education. . . . 'If you know exactly what computing you want, you can get it wholesale.'"

Computing Facilities at Stanford University: Their Development and Direction

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"Blessed is he who expects nothing, for he shall not be disappointed."

The relevance of this text to those who have been involved in the computer decisions in higher education over the last decade, will be readily apparent.

I propose here to describe briefly the background and then the outline of recent significant decisions affecting computing at Stanford, and to express what I take to be the generalizations which may be learned from this particular experience.

Background of Service Computing

Two years ago Stanford had three computer organizations and five computer facilities. Now here I am talking about general purpose service machines which supported the administrative, instruction and research programs of the University in distinction from the special purpose facilities such as the large computer installation at the Artificial Intelligence Laboratory directed by Professor McCarthy of the Department of Computer Science where studies of computers, per se, were (and still are) being conducted. But in this service area we had five major facilities.

For example, Stanford University owns and operates a 600-bed hospital in conjunction with our Medical School. For patient billing, general accounts, and other administrative functions the hospital had a Data Processing Department reporting to the Financial Officer. The machine was an IBM 360/40, soon replaced by a 370/135 operating under IBM's D.O.S. with a special monitor called Shared Hospital Accounting System, or SHAS. This facility did negligible system programming, but had a sizeable applications programming and data control section. They ran census up-dates, and posted chargeable items from the various hospital services daily, for example. The machine was tuned to this special function.

University Administration Facility

In an analogous fashion, the University Office of Business and Finance had computer support via a

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370/145, also a D.O.S. shop and running many COBOL programs in support of finance and accounting, student services, such as registration and student aid and loans, the Development Office and Alumni Affairs, Sponsored Projects, and Academic Planning; and also, incidentally, ran a sizeable billing service for the physicians on the faculty of the Medical School who operated the Stanford University Medical Clinics. Again, this was a facility tuned to a group of user requirements. Somewhat unusual in this context was the fact that a significant advanced development in computer support for University Administration was being conducted by this group with partial support from the Ford Foundation. . . .

Stanford Computation Center

Meanwhile, in the area of academic computing in support of research and instruction, there was an organization known as the Stanford Computation Center (SCC) which reported to the Provost, our chief academic officer, and which operated three facilities. Most specialized of these was the ACME facility, a 360/50 installed with substantial support from the U.S. government through N.I.H., as a research tool on computer support for Medical research. The philosophy of design, implemented by Gio Wiederhold and his staff about five years ago, was a single language, terminal oriented facility aimed to be so easy to use and so broad in support that the physician-researcher would do most of his own programming and always maintain control over his own data files. The facility had extensive provision for data collection and plotting including centralized A/D conversion facilities and common graphics support for a variety of devices including drum plotters and CRT displays. The machine configuration was rather specialized, having a minimum of high speed memory, but 2 million bytes of low speed core. The language processor, PL/ACME, was a re-entrant core resident variant of PL/1, running under IBM's standard OS-MVT. The processor, being locally designed, was locally maintained and enhanced by a small systems staff.

SLAC Operated for AEC

Also managed by SCC was the computer facility of the high energy linear accelerator, SLAC, operated

by Stanford for the AEC as a national research facility. The computer was a 360/91 operating mainly FORTRAN in a number crunching mode for a relatively few sophisticated users. They operated an extensive tape library for user data, and also had a substantial systems staff to maintain their charter to be at the forefront of the art of scientific computing support. The SLAC facility had brought up the text editor and remote job entry system, WYLBUR, originally written at Stanford.

General Academic Facility

The last of our five computer facilities of two years ago was called the CAMPUS facility and did the computing for anyone who did not qualify for the other four. If you asked a random student or staff member where to find the "Comp Center", you would be directed to Pine Hall. There you would find a 360/67 operating under OS-MFT being dynamically switched from real to virtual and back to real storage under system modifications designed at Stanford 6 years ago when IBM's announced time-sharing system failed to be efficient enough for us to be able to afford it. This system served about 5,000 users and ran about 10,000 jobs per week. The charter of the CAMPUS facility was to provide the greatest variety of services with maximum flexibility and fast turn around, while also aiming to be reliable and cost effective. A special service, HISPEED, was introduced primarily for short jobs you would expect from student projects and homework. Although the time-sharing system was available, pricing policy and machine effectiveness were such that the majority of jobs were submitted via the card readers. The facility had a large staff of systems programmers dedicated to system maintenance, and enhancement, and a large user services staff who provided a wide range of courses and consulting to help the customers make the best use of the system.

Pressures Determine Direction

This is a brief picture of service computing at Stanford 2 years ago. Five facilities at the hospital, University Administration, Medical School, SLAC and General Academic, each tuned to a particular user community with really only one having a widely diverse user group. This was the position; what was the direction of motion? For surely computing is a dynamic field and to predict the path we need the derivative. Some of the forces influencing this derivative were technological and programmatic, some were financial, and some were managerial. Let us go back and look at the facilities and see some of the pressures they were under.

Let us go back to the hospital; the standard DOS shop doing patient billing. In the first place, the Hospital Data Processing noticed that many hospital patients were also clinic patients, and moved to design a unified patient accounting system to handle all bills and records. On the other hand, many of the physicians in the school were developing systems on the ACME computer, and casting about for a vehicle to support them in production as opposed to research and development mode. The Hospital Data Processing Department felt these should be part of the centralized services and viewed with dismay the initiation of independent systems in Pathology (they got a Sigma 3) and Pharmacology (they got two PDP-11's). Also of concern was the obvious trend towards on-line Hospital Information Systems (H.I.S.) and although it was far from clear what kind of system Stanford would introduce, it was at least evident that a 370/135 operating under the financial officer

was a most unlikely place for it to happen in a university hospital. In any event, Stanford University Hospital Data Processing Department began to acquire on-line experience with the IBM program product CICS for on-line access to census data, and to think about an on-line admissions system. The hospital projected the need for a 370/145 within two years, and, if a centralized H.I.S. was to be introduced, conversion from DOS to an OS environment.

Many of these same pressures were in operation at ACME, of course. The pathology and drug interaction programs were developed on the ACME system and yet the '50 was not a suitable facility for production both because of its design and inherent unreliability and also because of the charter of the ACME research project. The final irresistible force was the fact that NIH informed the principal investigator that further support of ACME in the form then in effect would be impossible.

Medical Community Findings

Thus it came about that the medical community — hospital and school — began an intensive study of computing needs and opportunities in the Medical Center. They proposed a central facility to serve all the centers and in which patient care data could be made available to physicians interested in primary care, those interested in research questions, and those interested in the smooth administration of the hospital. Administratively, these proposals were accorded a receptive hearing by Dr. Clayton Rich, the new Dean of the Medical School and Vice-President for Medical Affairs of the University. However, there were some substantial difficulties with the funding of such a center. As perceived at the time, the computer service priorities would be:

Reliability

On-line interactive computing, including PL/ACME
Extensive file management and data base support services

Provision for entering and interacting with laboratory and other time oriented data, both in research and patient care functions.

SLAC Facility Expands Duties

Things were also moving at SLAC. The AEC had begun a major computer procurement cycle some time before and, with several false starts, it happened that SLAC was to receive two 370/168's in the fall of 1973 to augment the 91. In the procurement negotiations, SLAC had taken the position that computing is central to effective physics and that the required facility was to collect data directly from the experiment, spool it immediately into digital form, and allow interaction between the experimenter and his data in sufficiently short time to allow the experiment to be modified while in progress based on selected data analysis. The implications of this policy were that SLAC ordered a dual system for reliability since the computer had to be up when the accelerator was up, and otherwise wrote a set of priorities entirely like those of the Medical School. Also, the SLAC facility was moving out of the exclusive business of physics; at the request of the Director, various administrative functions, including payroll and inventory control, were moved to the /91. Many features of a production mode were to be imposed on /91 operation.

Impact of Project INFO Developments

At Encina Hall, where the university administration 145 was, the impact being felt was that of the

Project INFO developments. The On-line Administrative System for Information Service (OASIS) was being introduced for Student Services and Alumni Records. Although designed as a general purpose system for support of university administration in a simple environment, it was apparent that continued systems development for such an on-line data base management facility would be expensive, would have to be supported in-house, and pointed to the same priorities of reliability, production schedules, data base management services, and on-line computing described earlier.

CAMPUS Facility Facing Similar Issues

Finally, at the CAMPUS facility, many of the same issues presented themselves. Here the driving force was an on-line information retrieval system called SPIRES developed with support from NSF. Using SPIRES services, another project in library automation (BALLOTS) had been initiated and was being developed on the 360/67. At about this time, ... the BALLOTS system was taken as the production system of the university library. This meant going to a situation where the Library Catalog Department will be down if the computer is down. The priority is reliability. Also, BALLOTS is an on-line system using the MARC file generated by the Library of Congress as a major data base with other files being generated of books on order, books catalogued, books in a particular collection.

Facilities Seen Converging

It thus appeared that directions of motion at all five facilities were converging. The more conservative management support centers in the hospital and university administration saw on-line interactive computing as a major feature of their future. Meanwhile, our research and instruction facilities were not only being expected to be more reliable, more stable in their primary roles, but they were also being pushed into administrative functions themselves. SLAC was doing the payroll, ACME was running production patient care data base systems, and the hospital was experimenting with on-line admissions and looking toward a comprehensive Hospital Information System.

At this point, two factors came into play. First, we had new top management in the University with a Provost who was a computer scientist, and Vice-presidents of Business and Finance and of Medicine who were open to different ways of doing things. Also, as I mentioned earlier, the best proposals from the Medical Center ad hoc committee on computer problems had serious funding uncertainties. The second factor, after receptive management, then, was Grosch's Law, or Cheaper by the Dozen. Twice the investment gets four times the power.

Facilities Merge

In April of 1973 there was established the Stanford Center for Information Processing (SCIP) under the directorship of Charles Dickens, with a charter to manage all five service facilities, and to achieve such economies of scale, both in manpower and hardware, as would be consistent with continued support of University programs. At the same time, the University Policy Committee structure had been broadened to include more explicitly university administration Computing Policy and Hospital Data Processing services. We have thus regularized several ad hoc groups of uncertain authority.

SCIP, in its few months of existence, has done several things. A central location for CPU file hardware has been established near the University Library with a university commitment to provide space for all staff and SCIP management nearby within two years. Consolidation in a shorter time is sadly too expensive and I only hope the expense on an organization spread about in several locations is not too high. This is my personal greatest concern at this time on the decision recently made. Building on the studies already done in the Medical Center, SCIP has installed a 370/158, co-located with the 370/145 and released the /50 and, soon, the /135 from the Medical Center. Being co-located with the /145, certain sharing of peripherals is already underway. For the first time, system operations for all five facilities are under one management and the priorities of operations are being uniformly set.

Systems Programming Staff Integrated

In a second major reorganization of Stanford computing, the systems programming staff are now integrated into a single organization, using the experience on the /158 and the resources of the dual /168 installation. This group, under Ed Williams, is undertaking a single program of development for operating system, interactive services, data base management, and real-time services for all SCIP facilities. An immediate impact of this policy is that some enhancements that would have been undertaken on the /67 and on the /145 will, of necessity, be deferred, but we feel the longer range payoff will more than compensate for the immediate discomfort. This group is studying the conversion of the Hospital SHAS, the CAMPUS BALLOTS, and the University OASIS systems to a consistent environment. Their time scale is to accomplish this by the end of calendar 1974.

Other Computer Centers

Of course, there was before, and there is now, more to computing at Stanford than those services which are the responsibility of SCIP. I referred earlier to the research computer of Professor McCarthy and there are many other CPU's on the campus. Also, in special cases, there are basically service machines. The Graduate School of Business has an HP 2000 providing computing in H-P BASIC for their students. The machine is run with one operator and a faculty director and left running unattended nights and weekends. It is very cost effective. Also in the Electronics Laboratories there is an XDS Sigma 5 which supports dedicated high speed real-time services for radioscience and patient monitoring projects, among others. Finally, and especially, there are many mini machines of the PDP-8, 11 and HP 2100 class on campus in laboratories and other unique environments where SCIP services are either unavailable, or uneconomical. During my tenure as Associate Provost for Computing, I have approved acquisitions of about three and a half million dollars worth of computing outside the SCIP "franchise". All this activity illustrates the second economic law in operation in computing in higher education. I first read it applied to computing in a paper by Professor Cox of Washington University. It goes, "If you know exactly what computing you want, you can get it wholesale". Wholesale computing today in medium speed data acquisition and manipulation comes in small packages. In large data base storage and retrieval, centralized facilities now seem to be indicated for all facets of University computing services. The trick is for us all to get our computing by the dozen, wholesale. □

Behavioral Factors in Information Systems

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"The decade of the 1970's should witness the development of sophisticated man/machine planning systems. The development of these systems, however, must await a better understanding of human problem-solving behavior."

The need for better understanding of human behavior in information systems is becoming increasingly apparent. A recent report [1] by the Association for Computing Machinery (ACM) curriculum committee on computer education in management offered recommendations for graduate professional programs in information systems and stated, "If the program turns out practitioners who ignore or only pay lip service to the people problems, it will not have realized its aims ..."¹

Traditionally, information specialists have concentrated their efforts on hardware/software problems. As a result, sophisticated information systems were often developed, but people experienced difficulty in interacting with these complex systems. Since information systems are used, operated, and maintained by people, the design of effective information systems will only result if man's behavioral capabilities are taken into consideration. In this article, man's perceptual and cognitive capabilities will be examined as important determinants of the design of information systems.

The Process of Perception and Perceptual Style

Perception is a selective process which tends to give structure to the complicated situations encountered in experience [2]. In order to fully understand the process of perception recent investigators [3] have emphasized the need to examine the total psychological organization of the individual.

Witkin and his associates [4] have conducted numerous studies to determine if an individual actively contributes to the progress and outcome of the act of perceiving. They concluded that a person's manner of perceiving does not easily change

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and represents an ingrained feature of his psychological being — his perceptual style. Individuals can be classified on a field dependent-field independent continuum contingent upon their ability to extract a figure from an embedding context. In perceiving a situation humans distinguish between prominent elements referred to as the "figure" and suppressed background referred to as the "ground". Field independent people are better able to separate "figure" from "ground" and as a consequence, attempt to overcome social and other environmental factors affecting perception. On the other hand, field dependent people passively conform to the influence of the embedding context.

A Test for Measuring Perceptual Style

The embedded figures test (EFT) developed by Witkin examines the manner in which a part is perceived within a larger field. It requires an individual to locate a simple figure which is perceptually obscured in a larger complex figure. The test utilized eight simple figures and twelve complex figures as shown in Figure 1. Also included are the simple and complex figures used for a practice trial before actual testing. To further obscure the simple figures, complex figures are colored using a design described in Figure 1. The score for the test is the average time taken to locate each figure. This test score provides a measure of perceptual style.

By demonstrating that perception cannot be understood without reference to personal factors, Witkin et al. have provided a basis for a comprehensive theory of human psychological functioning. The authors claim that an individual's performance in the perceptual test (EFT) represents the nature of his personality functioning in other areas of life.

The Process of Cognition and Cognitive Style

Information enters short term memory through the sense organs by the process of perception or from long term memory by the process of cognition. Cognition refers to the processes of thinking, reasoning, remembering, and conceptualizing used to elaborate, combine, and explore what has been perceived [2]. Humans can consciously process only a small portion of sensory inputs because of their limited span of memory. As a result, cognitive activity is also limited to a small number of items (between five and nine) at any one time. If more items are present, humans respond by grouping, sequencing, or neglecting items.

The organization of received sensory data into information is based upon an individual's perceptual habits or the degree of conceptualization used to organize what has been perceived. Perception is strongly influenced by cognition or "what you know is what you see". Individuals demonstrate a consistent mode of perceiving and organizing sensory data which has been termed their cognitive style. Cognitive development is a process of increasing differentiation which is part of and indistinguishable from personality growth as a whole [5].

Personality Classification

A classification scheme developed by Jung and described by Campbell [6] characterizes personality as consisting of four major psychological functions. Two of the functions pertain to perception (sensation and intuition) and two to judgment (thinking and feeling). Every individual tends to develop one style of perceiving and one style of judging while the alternate styles remain in an inferior state of differentiation or unconscious. Thus, the most differentiated or superior functions characterize behavior. An individual's adoption of sensation as a manner of perceiving indicates a heavy reliance upon sensory processes while the intuition type cannot identify the factors on which he bases perception. For the sensation type reality is derived from facts which can be collected and verified by the senses and imagination has little effect on his experiences. On the other hand, the intuition type considers future possibilities and his perception of reality is often via the unconscious, i.e. he is not aware of what aspects of a situation his perceptual processes have selected.

When an individual relies mainly on cognitive processes and bases judgments on systematic, rational, and logical reasoning he can be classified as a thinking type who represses emotion and feeling in discriminating between true and false. A feeling type on the other hand, is characterized by reliance upon emotional processes and judgments based on subjective standards. This latter type is more discerning in attaching value to objects or things.

Since the functions for perception and judgment are assumed to be independent, psychological types can be classified using the Myers-Briggs Type Indicator (MBTI) into one of the following categories: sensation-thinking (ST); intuition-thinking (NT); sensation-feeling (SF); intuition-feeling (NF). It would be rare indeed to find individuals who were exact types. However, this fact does not detract from the utility of this classification scheme as an aid in characterizing personality. For example, each category is characterized by a dominant personality trait as shown in Table 1.

TABLE 1
Personality Traits of Psychological Types

Type	Personality Trait
ST	practical
NT	ingenious
SF	sociable
NF	insightful

Studies conducted by MacKinnon [7] have demonstrated that a high percentage of creative people are characterized by a preference for perception (intuition), according to scores on the MBTI. In ad-

dition, they indicated a tendency towards introversion. Hence, creative people tend to be open to experiences, alert to future possibilities, and independent in thought and action. Since they observed in a highly differentiated manner, and focus perception and judgment upon concepts and ideas rather than upon the environment, it can be hypothesized that creative people are field independent.

A Symbiotic Relationship Between Man and Computer

In a seminal paper on man-computer symbiosis, Licklider [8] described the expected development of a cooperative interaction between men and computers. He viewed this symbiosis as occurring somewhere on a continuum between mechanically extended man and artificial intelligence. A major objective of his argument was to have man and computer closely interact in the problem solving or decision-making sequence. In this manner man's slow, parallel, and associative thinking would combine with the computer's fast, sequential logic capability to improve performance. Human factors handbooks list various capabilities which make humans essential in the problem-solving environment. These include the ability to: project missing information from experience; perceive pattern in a situation; develop hypotheses about cause-effect relationships; make probability estimates of conditions; optimize on uncertain criteria and objectives; and generalize from one context of events to another. Thus, man is uniquely suited to set goals, formulate hypotheses, develop models, define criteria, and evaluate results. On the other hand, computers can be used to convert hypotheses into models for testing, perform simulations, and display results. The integration of these capabilities should lead to better system performance.

Advancement of this symbiotic concept has been limited by a lack of knowledge about personal styles of decision making or problem solving. To examine personal differences in human problem-solving style Sackman and Gold [9] conducted a factor analytic study in which they investigated fifty-three variables related to computer programming. Some of the main factors identified were the following: problem solving speed; exploitation of the computer system; exploration of alternatives; conceptualization ability; and problem strategy. Thus, the psychological variables of cognitive style, decision style, and personality were clearly expressed in the factors which influence programmer performance. These results indicate that individual differences could be better understood if cognitive capabilities could be determined.

In recent years the concept of man-computer interaction has almost been synonymous with online, time-sharing computer systems. For purposes of the discussion which follows, an online system is defined as one with direct access to the central processing unit of the computer. This capability permits managers to query the system for "immediate" responses to questions.

A current topic of investigation is the use of online systems to support human problem solving or decision making. To perform this support function the system must aid the individual's conceptual development. The online mode of operation facilitates extensive exploration of problems and testing of hypotheses. Thus, it assists the creative and intuitive abilities of users which are essential in solving ill-structured problems. In essence the online mode can adapt to the problem solving style of the individual.

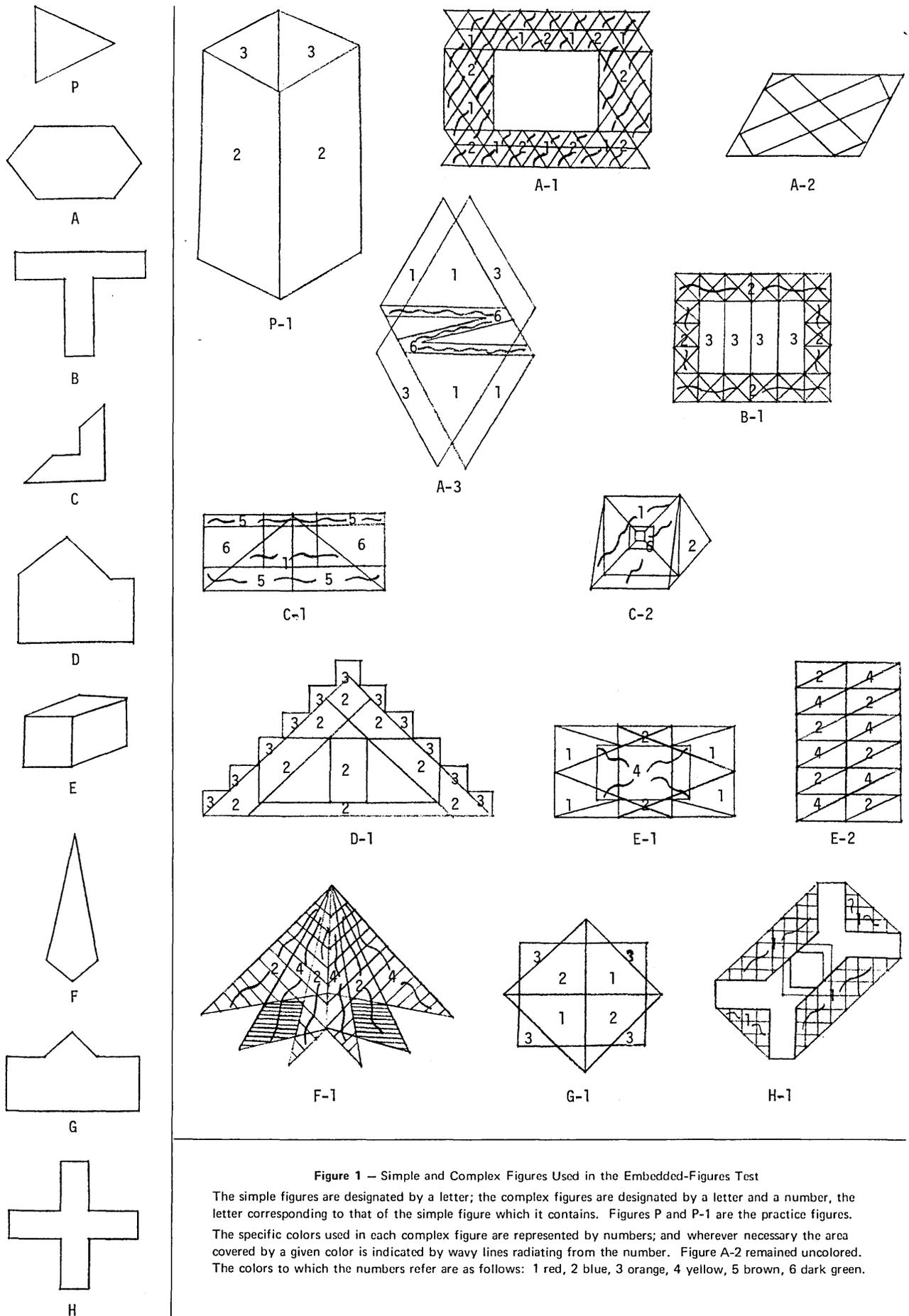


Figure 1 — Simple and Complex Figures Used in the Embedded-Figures Test

The simple figures are designated by a letter; the complex figures are designated by a letter and a number, the letter corresponding to that of the simple figure which it contains. Figures P and P-1 are the practice figures. The specific colors used in each complex figure are represented by numbers; and wherever necessary the area covered by a given color is indicated by wavy lines radiating from the number. Figure A-2 remained uncolored. The colors to which the numbers refer are as follows: 1 red, 2 blue, 3 orange, 4 yellow, 5 brown, 6 dark green.

An examination of these time-sharing systems, however, reveals a pervasive failure to consider human behavioral capabilities. For example, the frequent occurrence of response delays in time-sharing systems can be disruptive to problem solving. Miller [10] estimated that delays of approximately 15 seconds cause deteriorated performance in problem-solving situations. As stated by Miller, "If delays of more than fifteen seconds will occur, the system had better be designed to free the user from physical and mental captivity, so that he can turn to other activities and get his answer when it is convenient to him to do so ..."² In fact, for complex problem-solving activities which are dependent upon short-term memory capability with its rapid decay rate and small capacity, response times of less than 2 seconds are recommended.

Management Information Systems

Management information systems (MIS) are designed to provide information to assist managers in the decision making process. Since decisions differ at various levels in the organization a classification scheme for managerial activity would be helpful in determining specific information requirements. A taxonomy developed by Anthony [11] describes three categories of activity. The first category is strategic planning: "Strategic planning is the process of deciding on objectives of the organization, on changes in these objectives, on the resources used to attain these objectives, and on the policies that are to govern the acquisition, use, and disposition of these resources. ..."³ The determination of policies and long range objectives for the organization is highly dependent upon the creative and intuitive ability of the manager. The second category is management control: "... the process by which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organizations's objectives ..."⁴ At this level the administrative, persuasive, and evaluative capabilities of the manager are most important. Anthony's third category is called operational control: "the process of assuring that specific tasks are carried out effectively and efficiently ..."⁵ At this lowest level the manager need only be able to follow instructions and display a certain degree of persistence.

From these definitions one can conclude that the three activities are sufficiently diverse so as to require different forms of information. This is further illustrated in Table 2 where the characteristics of information in each activity are compared.

TABLE 2
Information Characteristics at Three Levels of Management

Level	Characteristics
Strategic Planning	External predictive data Accuracy not critical Custom-tailored
Management Control	Internal historical data Fairly accurate Financial
Operational Control	Internal logistic data High degree of accuracy Nonfinancial

Another useful classification scheme for managerial activity is the one developed by Simon [12] which distinguishes between programmed and nonprogrammed decisions. "Decisions are programmed to the

extent that they are repetitive and routine, to the extent that a definite procedure has been worked out for handling them so that they don't have to be treated de novo each time they occur. Decisions are nonprogrammed to the extent that they are novel, unstructured, and consequential. There is no cut-and-dried method for handling the problem because it hasn't arisen before, or because its precise nature and structure are elusive or complex, or because it is so important that it deserves a custom-tailored treatment ..."⁶ The problems encountered by the president and vice president of an organization are typically ill-structured (nonprogrammed) and depend upon judgment, intuition, and creativity for solution. On the other hand, the problems of lower level managers are normally well-structured (programmed) and can be solved by following standard operating procedures. Once again the form of information required depends upon the classification, i.e., whether or not the problem is programmable. Decision situations which can be classified as programmable can often be handled by an existing operations research type model. The model allows an empirical or experimental determination to be made of the best operating condition. Nonprogrammable situations, however, often require the development of models which may be nonquantitative in nature. As a result, these models tend to be more useful for the insights gained by the manager rather than for actual model output. The relationship between these two decision types and Anthony's levels of management is depicted in Table 3. Anthony and Simon have described two alternative, yet compatible views of managerial activity in organizations which in combination provide a useful framework within which to examine problems in the design of MIS.

TABLE 3
Degree of Structure in Decisions
at Three Levels of Management

Level	Degree of Structure
Strategic Planning	Low
Management Control	Medium
Operational Control	High

Implications for Future MIS Design

Research in the design of information systems requires an appreciation of the future development of technology, the economic factors involved, and the future attitudes of managers toward various system alternatives. It can be argued that the grandiose plans developed for MIS have accomplished very little to date. This is not to imply that they are unnecessary, but rather that small action steps towards specific goals should also be taken. Some of the immediate goals should include research on: the perceptual and cognitive styles of managers and alternative modes of information presentation.

The first goal seems particularly important since every corporation has different psychological types each of whom require different kinds of information. Past design of MIS has been oriented almost exclusively to individuals who could be classified as sensation-thinking.

It can be noted from Anthony's classification that top management is primarily concerned with planning functions while middle and lower managers primarily attend to control functions. Since the procedures for control systems can be precisely specified, design problems are trivial compared to

those for planning systems. As a result, the decade of the 1960's witnessed the development of many control oriented applications, i.e. payroll, inventory, etc. but experienced very little in the way of planning systems for top management. The decade of the 1970's should witness the development of sophisticated man/machine planning systems. The development of these systems, however, must await a better understanding of human problem-solving behavior. Only then can models or computer aids be developed to assist in certain aspects of human decision making.

Another major assumption of current MIS design is that the best mode of information presentation is computer printout. Once again the direct and well-structured stimuli presented by this form of information fit the needs of a sensation-oriented person. The utilization of more personalistic approaches to information presentation will be warranted, however, if the needs of feeling and intuition types are taken into consideration. For these types, role playing and group discussions may be more useful than traditional methods of presentation.

In both instances the impact of alternative information systems design can only be determined if more is known about the perceptual and cognitive capabilities of managers.

Footnotes

1. ACM [1], p. 381.
2. Miller [10], p. 125.
3. Anthony [11], p. 24.
4. Anthony [11], p. 27.
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McMILLEN — Continued from page 9

quirements to complete the second phase is established along with an order of magnitude estimate for the total project. Upon completion of the second phase, a firm estimate is established for the third phase, and the order of magnitude estimate for the total project is revised. This process continues throughout. At first glance these frequent revisions to the overall project estimate might appear unacceptable to the system user. But, interestingly enough, we have found that in general operating managers prefer this realistic approach to scheduling over the "ballpark" estimating usually done with little or no provision to assure that the estimate is the best possible.

One of the most frustrating and challenging responsibilities of the MIS manager is to make sure that systems are adequately documented, the basic design, program detail, operating instructions, file descriptions, and even the project itself must be described in sufficient detail to allow reconstruction of the system at any point in the future. Again, the PRIDE methodology provides that systems and user management must approve each phase of the project and its documentation before the next phase can begin. As a result, programs are documented before the actual computer instructions are written; manual procedures are written before a system test can be conducted, and the data base or data files are completely described before subsystems are designed.

Time Saved

A seemingly negative aspect of this approach to project management is that all the documentation, estimating, and reporting of actual time in order to revise the estimates take valuable time away from the actual task at hand, which is to produce results. Our experience has shown, however, that the additional time spent in planning and documenting is more than recovered during programming and testing stages and, even more important, that the increased assurance that the results satisfy the needs makes this additional effort almost imperative.

A more serious, seemingly negative aspect is that user management must, in many cases for the first time, take the time to analyze user needs, review the project as it develops, and commit themselves to the project's objectives. Our approach has enabled us to convince the functional manager that he cannot afford to devote all his efforts to running the business today, while some systems analyst is developing the system that will determine how he runs the business tomorrow.

My subject has been priority-setting, resource allocation, and project management as it pertains to system development. But in the final analysis, the successful control of projects depends on management dedication — the same dedication given to a successful start-up of a new production facility or introduction of a new product. With this dedication and a common-sense approach to planning and control, we can assure a much higher success rate. We feel the approach outline here will:

- Provide a better method of reaching and revising agreements.
- Minimize the degree to which management is taken by surprise.
- Optimize performance in a changing environment.
- Cause things to happen.

Managing Modern Complexity --

Dr. Stafford Beer
 Visiting Professor of Cybernetics
 Business School of Manchester University
 Manchester, Great Britain

From the Editor

Every now and then your editor comes across something that is interesting, important, and apparently far away from the main stream in the field of computers and data processing.

This is the case for the following 130 page paperback book available from the Superintendent of Documents, Washington, D.C. (for 60 cents) and which is entitled: *The Management of Information and Knowledge: a Compilation of Papers prepared for the Eleventh Meeting, 1970, of the Panel on Science and Technology of the Committee on Science and Astronautics, U.S. House of Representatives.*

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Former Chief Justice Earl Warren, as reported in this book, says nothing of significance, as can be predicted because of his relation to the field of computers and data processing, about which he admits he knows nothing.

But Stafford Beer's paper is so interesting and so important, even three years after he gave it, that it is worth reprinting currently in *Computers and People*.

I believe that any reader of *Computers and People* who buys this book will find his money well spent.

Edmund C. Berkeley

1. THREAT SYSTEMS

The business of forecasting is fraught with many traps; it often seems ascientific. But the perspicuous detection of inexorable trends can be a matter of good science. There is a reality to observe and to measure, a reality in which a dead man is a corpse and not a statistic. There is a reality, too, with which to experiment; a reality that does not come in parcels labelled for the attention of appropriate officials. The very stuff of this reality is complexity. The elements of our society ever more richly interact: the more this happens, the more participation is invoked, the more the streams of data flow ... the more complex does society become.

Handling complexity seems to be the major problem of the age, in the way that handling material sub-

Reprinted from *The Management of Information and Knowledge* (a compilation of papers prepared for the eleventh meeting, 1970, of the Panel on Science and Technology), published by the Committee on Science and Astronautics, U.S. House of Representatives.

stance offered challenge to our forefathers. Computers are the tools we have to use, and their effective use must be directed by a science competent to handle the organization of large, complex, probabilistic systems. This is the science of cybernetics, the science of communications and control.

Large Interactive Systems

The central thesis of cybernetics might be expressed thus: that there are natural laws governing the behaviour of large interactive systems — in the flesh, in the metal, in the social and economic fabric. These laws have to do with self-regulation and self-organization. They constitute the "management principle" by which systems grow and are stable, learn and adjust, adapt and evolve. These seemingly diverse systems are one, in cybernetic eyes, because they manifest viable behaviour — which is to say behaviour conducive to survival.

In my opinion, the most important fact which a quarter of a century's worth of cybernetics has re-

Part I

*"OUR CULTURE DOES NOT TAKE KINDLY TO THE NOTION
THAT IT NURTURES THE SEEDS OF ITS OWN DESTRUCTION."*

vealed is that this behaviour is governed by the dynamic structure of the system, rather than by special events occurring within it or by the particular values taken up by even its major variables. "Structure" means the way in which the parts of a whole are inter-related; and here it includes both the feedback loops by which systems regulate themselves and also the conditional probability mechanisms by which systems learn and organize themselves. "Dynamic" relates to the speeds at which communication is effected within the system, and especially to the relative lags with which messages are promulgated, overtake each other, and combine to form new patterns. Dynamic structure generates outcomes.

Therefore I say that what will happen to mankind in its battle with complexity will be determined neither by particular innovation nor by isolated achievement at some unknown future date. Hence the attempted prediction of such things is not to the point. Outcomes are latent in the dynamic structure of the systems we have or may adopt: they will inexorably emerge.

Gross Instability

At present, the most obtrusive outcome of the system we have is a gross instability of institutional relationships and of the economy. This cannot last. The society we have known will either collapse, or it will be overthrown. In either case a new kind of society will emerge, with new modes of control; and the risk is that it will be a society which no one actually chose, and which we probably will not like. I shall argue that we must use our science to detect the latent outcomes which will one day characterize the future of mankind. And let us so engineer our systems that their latent outcomes suit our social purpose. It is true that the outcomes cannot be fully determined, because there is noise (or shall we call it free will?) in the system. But a systemic design taking due account of cybernetic laws may be expected to produce behaviour which is predictable in terms of the overriding social need for stability.

Thanks to the growth of complexity, which is very much a function of the growth in data-handling capacity and of the information explosion, society has outgrown the dynamic regulating capacity of its own hallowed structure. History did not design that structure to cope with such complexity, and a cybernetically grotesque machinery is a result. It is

from this standpoint that I ask you to look again at the environmental crises from which our view of the future must necessarily start.

Societary Crises

The thermonuclear threat is a computable threat, and one which computably grows — although we act as if we were inured to it. The various pollution threats — by pesticides, by noise, by sewage, by carcinogenic urban air — were and remain systemically predictable. None of these things happened by chance, by accident, or by the wrath of God. We have run ourselves into these problems by failing to calculate the predictable consequences of the systems civilization has underwritten. The same seems to me to be true, though less obviously so, of the various forms of societal crisis which run alongside the environmental crises. Problems of race, problems of poverty, problems of over-population: all these are quantifiable aspects of computable systems. It has taken social upheaval and threatening violence to draw them to our proper attention; it has taken a major revolt of the young to motivate any kind of rethinking.

The risk which faces us today is the probability that society will yet refuse to study the systemic generators of human doom, and will disregard the cybernetic capability which already exists competent to bring these many but inter-related forms of crisis under governance.

Seeds of Social Destruction

There are two reasons for this fear. First of all, our culture does not take kindly to the notion that it nurtures the seeds of its own destruction. Instead of studying the systemic reality in which outcomes are latent, it prefers the technique of prognostication. Small wonder: by using such wholly non-systemic devices as the Delphi technique, we may predict a possible millennium for our comfort. But the Delphi technique is aptly named: its pronouncements are shrouded in ambiguity — because they take no account of the systemic context. Meanwhile, the systems we have already started, which we nourish and foster, are grinding society to powder. It might sound macabre to suggest that computers will finish the job of turning this planet into a paradise after human life has been extinguished. But that vision is little more macabre than the situation we already have, when we sit in the comfort of affluent homes and cause satellites to transmit to us live pictures

of children starving to death and human beings being blown to pieces.

The second reason for my pessimism is that technology now seems to be leading humanity by the nose. We appear to have no sense of priorities where our problems are concerned; we do what is technologically easy — and we do it regardless of cost. For example, the problem people have of transporting themselves from one remote place to another really exists between homes or offices and international airports. But the problem we continuously solve is the non-existent problem of moving between those airports. It is easier to go from Mach 1 to Mach 2 than to tackle the genuine problem. Perhaps it was also easier to go to the moon than to face up to what is happening in the street outside.

Cybernation is about the Regulation of Society

Thus I direct myself and you to the claim that cybernation is about the regulation of society, and that this is what computers are for. Perhaps this opening is a surprise. Would it not have been easier for all of us to plunge into the technology of computation, to prattle on happily about nanoseconds and massive data banks, to wonder at the explosion of knowledge and the impending marvels of data storage and retrieval by holograms and photochromic tubes, rather than to tell the truth about cybernation? What did you really expect? The fact is that most of the problems we stand ready to consider are bogus problems. They are generated by theories about technological progress, and theories about the way society works. Theory is often the only reality countenanced by our culture.

The reality is that we are elements in a vast and almost ungovernable social system generating outcomes that happen to us. We come sprightly to conference, dragging lead-heavy bones, to talk about machines that matter only if they can help us men. Our fat is suffused with insecticide, but we are averse to decide what it will be like to take our newspaper out of the back of the television set. The expansion of knowledge will yet save the world, shall I not tell you, coughing through the carcinogens — and assuming that my plane was not hijacked and that I was not "mugged" on the way ***.

Information is What Changes Us

I am fighting for a way through to your real ears. That is exactly to say that I am trying to differentiate, in you, between data and information. Data are a whole lot of meaningful patterns. We can generate data indefinitely; we can exchange data forever; we can store data, retrieve data, and file them away. All this is great fun, maybe useful, maybe lucrative. But we have to ask why. The purpose is regulation. And that means translating data into information. Information is what changes us. My purpose too is to effect change — to impart information, not data.

Data are an excrescence. Data are the very latest kind of pollution. We are not going to do anything at all about the management of information and knowledge towards the regulation of society as long as we think in data-processing terms. That is technologically easy. It is what the computer companies and the tele-communication interests would like us to do. Data are assuredly the great new marketable commodities of the nineteen-seventies. But, let me repeat, data of themselves have no value.

What has value is the machinery to transform data into information, and the machinery by which that

information may be used to innervate society. Society has become a complex organism, and it needs a nervous system. Managing the development of informational science and technology is all about this task. There is no other message than this.

2. BASES OF ARGUMENT

The technological capabilities on the availability of which my arguments will be based already exist. There is not really a significant element of prognosis about them. There is however one proviso to this: it derives from a logical trap to which I will shortly draw attention. But first, here are some fundamental propositions.

First Proposition. We can now automate whatever we can exactly specify.

Second Proposition. Most (possibly all) ostensibly human prerogatives for inferential, judgmental, learned and adaptive behaviour can be exactly specified — at least with respect to finite contexts.

Third Proposition. Within specified frameworks, much ostensibly intuitional and creative human behaviour can be indistinguishably imitated by machine.

Fourth Proposition. Distance is technically irrelevant.

Any Purposive System Can Now Be Created

All this means that purposive systems can now be created to undertake any kind of purpose at all. We know how to design those systems, and how to innervate them with data streams. And so society would appear to be confronted by a problem of choice: what activities should actually be automated? But I shall argue that this question is largely illusory.

First of all, there is the logical trap. This is of the sort called by logicians a fallacy of addition. We may do any of the things we can do; it does not follow that we may do all the things we can do. In the present state of the art, that is to say, we shall rapidly exhaust our reserves of skill. So here is the proviso about technological capability. My own belief is that we shall have to embody a great deal of basic software in special purpose hardware, and that we shall need to automate the creation of special software itself. I think that computer science will break through the barrier of human programming, and move to an era when programs are written by machines under general human surveillance. This will in turn lead to programs which modify themselves in the light of experience. Then we shall be near the realization of the machine being more intelligent than its designer, which von Neumann envisaged and showed mathematically possible more than twenty years ago. There is no need for more than this one paragraph of such modest guesswork — because after that it may well be too late to do what ought to be done right now. At any rate, this is the only technological barrier which I can identify.

Lack of Concentration of Power to Choose

Then we revert to the spurious problem of choice. Why should not responsible authorities choose between desirable and undesirable systems for handling knowledge and information? The answer is that in neither the private nor the public sector of a free society is there a sufficient concentration of power to do so. If, for example, mammoth publishing interests decide (as they may) not to mobilize the resources of electronics adequately in the dissemina-

tion of knowledge, then it is open to electronic interests to become the publishers of the future. It is also open to the information handling community itself to embark on entrepreneurial activity at the expense of both these industries. In the public sector, it is certainly open to central government, through its grant-awarding agencies in particular, to encourage or discourage particular applications of cybernation. But it will be very difficult to inhibit developments which are of themselves economically viable in the way that (for example) space exploration would be inhibited without central funding.

Old Problem: Getting Enough Information

And here we perhaps identify the basic nature of the problem which cybernetic systems set out to solve. Throughout history until this time the problem was to acquire sufficient information to generate effective change. The individual wishing to become expert in some field of knowledge had to buy information expensively; the government wishing to understand even the rudiments of the structure of its society had to buy information through the census. And so we have gone on, paying more and more money for data acquisition — on the assumption that data constitute information. But we have already said that data become information only at the point when we ourselves are changed. It is self-evident that our capacity to be changed, whether we are an individual seeking private knowledge or a government seeking understanding of society, is strictly finite. In conditions of data paucity, almost all data acquired can be transformed into information — and data far outruns this metabolic capability, most data are literally worthless. Yet we pay more and more for these worthless data because that is the established order of things.

New Problem: Information Overload

The fact is that quite recently the sign of the informational problem changed from plus to minus. The problem is no longer about acquiring data, which are generated as a by-product of every modern undertaking. The problem is about informational overload. The private citizen seeking knowledge is inundated by information which is virtually free. Yet the publishing industry responds in the old mode — by selling him yet more. The firm continues to buy expensive market research, because that is what it has always done, oblivious of the fact that transactions of every kind can now be electronically monitored, so that data are in glut. Its problem too is one of procuring adaptive behaviour, and no longer at all one of "finding the facts". As for government, there is really no dearth of societary information either; there is instead a problem of organizing information — across departmental boundaries and in time.

Institutions, firms and (thanks to television) private citizens today receive critical information very quickly indeed; the aggregate picture at federal level is slow by comparison to materialize. To put the point the other way round, then, the body politic has wildly overactive reflexes. In the body physiologic this is the condition of clonus — it is a symptom of spasticity. If we live, as I suspect, in a spastic society it is because of clonic response. And by the expectations of these arguments, the clonus will get worse.

Thus I argue that the problem of information management is now a problem of filtering and refining a massive overload — for all of us, whether citizens,

firms, institutions or governments. We might well say that it is a problem not so much of data acquisition as of right storage; not so much of storage as of fast retrieval; not so much of retrieval as of proper selection; not so much of selection as of identifying wants; not so much of knowing wants as of recognizing needs — and the needs are precisely the requirements of systemic equilibria.

An Array of Subsystems

This almost tabular account of the matter ostensibly defines another cybernetic truth. In any controlled system, there must be an hierarchic array of sub-systems, in which both the values and the structure of any one sub-system are set by a logically superior system. That is to say that one cannot discuss the purposive nature of a system in its own language, but only in a higher order language. There are potent reasons for this in theoretical logic, just as there are potent practical issues in terms of the need systematically to reduce the informational overload by a system of filters. These filters are necessarily arranged hierarchically, in a way which matches the hierarchy of logical systems.

The Concept of Metasystem

Thus I introduce the concept of metasystem: a system which stands over and beyond a logically inferior system, and one which is competent to handle that lower system's logic. Please note that metasystems are logically superior, and not necessarily more senior or more highly endowed with status or privilege. Please note also that in an hierarchy of systems there will be several orders of "metal". Let us take a moment of time to illustrate these points, since the concept of metasystem plays an important role in what I have to say.

Consider for example a school, in which each of a hundred teachers adequately controls and instructs a roomful of pupils. The roomful is in each case made up of several sets of pupils. Now each set of pupils is in fact pursuing a course of instruction which takes it from one room, one association of sets, and one teacher, to another room, another set of sets, and another teacher. If we consider the totality of rooms, holding their pupils and teachers, as sub-systems of the school (for this is indeed the organizational format we observe on a visit) there is no way of knowing or discussing in such terms the educative process as it affects all the pupils. To do this we shall need to find the metasystem which organizes all the groupings and ensures that they mesh together. This metasystem is the timetable, in terms of which the course followed by a particular pupil stands revealed. This is a logically superior system; but we do not expect the teacher in his room to treat the timetable as some kind of ju-ju. On the contrary; but if he wishes the timetable altered, he will perforce raise the issue in metasystemic terms. It is simply no good to say "this is my class, and I will take it at another time".

Furthermore: if the state wished to discuss the total process of education for all its high schools in relation to nursery schooling on the one hand and to university education on the other, then a new metasystem logically beyond the first metasystem would be required. And in this case the question whether the second metasystem is not only logically but also constitutionally superior would arise. It would be discussed in those familiar terms about autonomy, about professional integrity, about bureaucratic interference, about sub-optimization, about synergy.

... Such discussions would be less boring if we could get the logic right first.

The Concept of the Esoteric Box: an "Establishment"

Let us now retrieve the argument that the development of purposive automated systems involves a spurious problem of choice. For, we argued, there is no method in a free society whereby such choice could be implemented. I would like to examine this argument in more detail, with a view to uncovering certain mechanisms which are germane to the issue before us. The objective now is to try, like good scientists, to determine the basic parameters of the problem at some level of abstraction which facilitates understanding. Were we to fail in this endeavor to stand back and to generalize, we should conclude with long lists of possible systems, in hundreds of possible contexts, with long lists of possible dangers attaching to each. Then we should achieve no useful insights at all.

Firstly, what is the entity which will in practice develop systems of knowledge and information? It is some kind of social institution: perhaps a firm, perhaps a profession, perhaps a social service Whatever it is, it is surely an identifiable entity, with certain recognizable characteristics. I call it an esoteric box. What is going on inside this box is an established order of things: things accepted as mores of the box, things professional, things historical, and so on. There is a complex arrangement of sub-systems, a strange set of relationships between people of standing inside the box, and a recondite way of behaving. These features — their complexity and unintelligibility to the outsider — justify the box's adjective "esoteric". Admission to the box's activity cannot be gained without the appropriate passport. But the box is not a closed system, it is part of society; it certainly has inputs and outputs. Even so it is internally and autonomously self-organizing and self-regulating. And although the box processes whatever it exists to affect (and this is often people), that which is processed does not change the box at all. The box goes on; it is very powerfully organized to maintain its own internal stability, and therefore its survival as an integral institution.

An Identifiable Social Institution

I have elsewhere sought to show that the esoteric box, the identifiable social institution, is a strongly robust system in equilibrium. If we try to influence its behaviour by changing variables which apparently affect it, it responds neither by collapsing nor by a violent reaction. It simply shifts the internal position of equilibrium very slightly, thereby offsetting the environmental change that has occurred. (In the model from physical chemistry that I have used to study these boxes, this behaviour would be an instance of the operation of Le Chatelier's principle.)

... Which Acts to Keep Itself Going

Now if it is an esoteric box which is going to develop an information system directed to cybernetic ends, its primary objective will be to enhance its own performance and chance of survival — it will not attend first to the performance and survival of society at large. Equally, the box will be highly resistant to efforts made to constrain its freedom to do so. There seem to be only two mechanisms available to a free society seeking to influence an autonomous institution in any case. The first is to facilitate some modes of development and to inhibit

others by the provision of incentives and inhibitors from outside. I mean by this the awarding or withholding of grants, tax concessions, public campaigns, and so on. Every esoteric box has its own feedback mechanisms; what the state can do is to change the gain on the relevant amplifiers. But because of the high internal stability of the box, we must expect this kind of control device to operate in a cumbersome and generally inefficient way. The other device available is legislative. The main trouble here lies in the identification of what is antisocial. Most advances in human welfare have paid a price in the infringement of personal liberty: whether that price is seen as reasonable or as a fundamental deprivation of human rights will often be a matter of interpretation. But I shall in any case assume that wise government will interact with the authorities in any esoteric box to achieve acceptable codes of behaviour. What really concerns us in this situation is what happens at the metasystemic level.

Interaction

The fact is that esoteric boxes interact. Any major facet of public policy, such as health, education, the manipulation of credit, security, and balance of payments and so forth, involves at least a string and possibly a complex network of interacting esoteric boxes. Now just as the esoteric box itself is seen as something extremely stable and survival-worthy, so the system which links the boxes is typically tenuous and unstable. It is not itself an institution, not itself a higher order esoteric box. It is simply an assemblage of esoteric boxes, and it does not constitute a proper metasystem at all. It is in this fact that the threat to society really lies; it is here that we shall seek the important scientific generalizations.

Consider education, for example. There are, to speak arbitrarily, four major esoteric boxes involved in this facet of society. There is the system of compulsory schooling; there is the university system; there is the post-experience career-oriented system sponsored by industry; there is the free market in adult education. All four of these esoteric boxes may be sub-divided, almost endlessly; but we are seeking to move our thoughts in the opposite direction — to identify the commonality of these systems and to examine their interactions. If we take health as our example, we shall find a similar situation. There is an esoteric box labelled general medical practice, and another called hospitals; there is a public health box labelled sanitation; there is a market-oriented box dealing in pharmaceuticals; there is a market-place for medical information which belongs to publishing.

In short, we may take any facet of social policy and find the strings and networks of highly stable esoteric boxes which between them make a composite but not integrated impact on the individual citizen. We may do this for security, discovering esoteric boxes for the police, esoteric boxes for fire protection, and esoteric boxes for insurance — not to mention the esoteric boxes which are the armed services themselves. We may do the same thing for the movement of goods, discovering esoteric boxes for every method of transport. We may do it for the movement of money, detecting esoteric boxes for emolument and social benefit, for taxation, for credit

Unstable Networks

Then the question arises, why are those strings and networks as unstable as they appear to be? If
(please turn to page 32)

MAGPOINTS — Two New Symbols for Space Age Mathematics

Article 1. MAGPOINTS by Myron J. Brown, 16 Hawthorne Rd., Pittsburgh, Pa. 15221

Article 2. REVIEW BY THE NATIONAL BUREAU OF STANDARDS by Ms. Betsy Ancker-Johnson, Assistant Secretary for Science and Technology, National Bureau of Standards, Washington, D.C. 20234

Article 3. REPLY TO COMMENTS BY Ms. BETSY ANCKER-JOHNSON from Myron J. Brown

"The system is so simple that it can be taught in grade schools as part of the numbering system. It is a logical extension of the decimal system and simplifies calculations when very large or very small numbers are involved, in the same way that scientific notation does, but is symbolically simpler."

Article 1. Magpoints by Myron J. Brown

In our modern numbering system we typically write a number such as 1234.567, which is the whole number 1234, separated from the decimal fraction .567, by the decimal point. If the present method of numerical exhibition is extended to include a new symbol followed by a figure for the order of magnitude of the number being written, then very large or very small numbers can be written much more efficiently.

The present method of exhibiting the order of magnitude is to imply that there is a multiplier of one, or to employ the system of scientific notation. Scientific notation uses the conventional decimal system number followed by the algebraic expression " $\times 10^m$ " - for example, 2.998×10^8 .

The Basic Concepts of the Magpoint System

An improved system has been developed having the two following basic concepts:

1. Two magpoint symbols are used, one the mag symbol (\blacktriangleright), the other the gam symbol (\blacktriangleleft). Either of these symbols may be followed by a numerical exponent, m . The combinations of magpoints and numbers have the following meanings:

$\blacktriangleright m$ means the same as $\times 10^m$

$\blacktriangleleft m$ means the same as $\times 10^{-m}$

A complete number would take a form such as

$$2.997925 \blacktriangleright 8 = 2.997925 \times 10^8$$

$$6.6256 \blacktriangleleft 34 = 6.6256 \times 10^{-34}$$

The expressions are verbalized as "two point nine nine seven nine two five mag eight" and "six point six two five six gam thirty four".

The directional arrow has mnemonic value in that it indicates in what direction the decimal point is to be moved. The exponent indicates how many places it is to be moved.

2. No number will be complete without the decimal point being located either explicitly or implicitly and a magpoint with an exponent being expressed either explicitly or implicitly.

The implied position of a decimal point — that is, its location when the decimal point is omitted — is to the right of the last digit. There can be no other valid implication. Likewise, the implied magpoint and exponent will be a mag with a zero exponent — rendering a multiplier of one for the significant figures used. For example, 3.1416 means $3.1416 \blacktriangleright 0$ or, in scientific notation, 3.1416×10^0 . Since 10^0 is equal to 1, the multiplier is simply one. There can be no other valid implication.

Advantages of the Magpoint System

These advantages are pointed out for the proposed system:

1. For the first time, a number can be written on a single line to express an integer, a decimal fraction, and an order of magnitude.
2. Because of the convenience and completeness of a number so written, any parameter may conveniently be specified in basic units — that is, those units such as meters, grams, seconds, farads, hertz, etc., which are called for in basic formulas.
3. The numbering system is compact and thereby suitable for marking small devices and inclusion in limited space on drawings. The decimal point, which is an easily obliterated mark, can always be eliminated and the parameter will always be

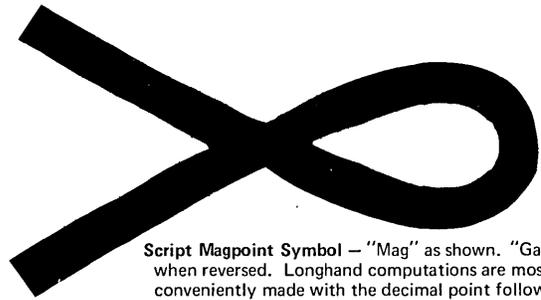
expressed in basic units. For example, a .25 mfd capacitor can be designated as a 25◀8 capacitor. Note that the proposed method uses only four characters in this example, whereas the conventional method uses six. Further, the decimal point is eliminated by implying its location after the last significant figure.

4. A similar saving of space is possible in the display of numbers in the readout of computers, particularly pocket size models. Two decades of readout devoted to the exponent lying behind the magpoint will replace 99 decades of readout in the present method of fully displaying a conventional number.
5. Named orders of magnitude can be avoided. There are presently fourteen named orders of magnitude covering thirty exponential decades. The system taxes the memory of users, particularly occasional users. There is a hodge podge of abbreviations containing lower case letters, capitals, one Greek letter, one double letter and confusing names such as deci and deka. Note the following table and the simplification provided by the magpoint system.

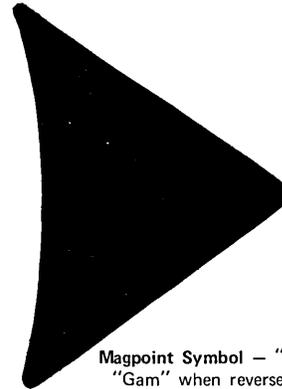
Symbol	Name of the Order of Magnitude	Scientific Notation	Magpoint and Exponent
a	atto	$x 10^{-18}$	◀18
f	femto	$x 10^{-15}$	◀15
p	pico	$x 10^{-12}$	◀12
n	nano	$x 10^{-9}$	◀9
μ	micro	$x 10^{-6}$	◀6
m	milli	$x 10^{-3}$	◀3
c	centi	$x 10^{-2}$	◀2
d	deci	$x 10^{-1}$	◀1
da	deka	$x 10$	▶1
h	hecto	$x 10^2$	▶2
k	kilo	$x 10^3$	▶3
M	mega	$x 10^6$	▶6
G	giga	$x 10^9$	▶9
T	tera	$x 10^{12}$	▶12

By the choice of the proper exponent, the significant figures will read directly in the basic parameter or one of the named orders of magnitude. For example, a capacitor marked 470◀12 can be read either as "four hundred seventy gam twelve farads" or as "four hundred seventy pico-farads".

6. The system is so simple that it can be taught in grade schools as part of the numbering system. It is a logical extension of the decimal system. For more advanced calculations, it is a convenient way of keeping track of the decimal point when using a slide rule. Further, the magpoint system simplifies calculations when very large or very small numbers are involved, in the same way that scientific notation does, but is symbolically simpler. The same rules apply as when calculating by scientific notation, viz.: decimal numbers are manipulated as in common arithmetic; exponents are added when multiplying, subtracted when dividing, multiplied by the power when raising to powers and divided by the power when extracting roots.



Script Magpoint Symbol — "Mag" as shown. "Gam" when reversed. Longhand computations are most conveniently made with the decimal point following the first significant figure.



Magpoint Symbol — "Mag" as shown. "Gam" when reversed. To match typewriter pica reduce to 2.8 mm high.

Conclusion

In this age of nuclear physics and interplanetary space travel, atomic clocks and pocket computers, there is a need to provide the scientific and non-scientific worker with an improved method of writing numbers such that there is a smooth and simple continuum from the very small numbers to the very large numbers. Two symbols, a mag symbol (▶) and a gam symbol (◀), used with an exponent to disclose an order of magnitude, is proposed as a satisfaction of this need. With such a system, a very small number such as Planck's constant would be written as 6.625◀34 joule-sec., and a very large number, such as the speed of light, would be written as 2.998▶8 meters per second.

Article 2. Review by the National Bureau of Standards by Ms. Betsy Ancker-Johnson

Mr. Myron J. Brown has made a new proposal for a convenient notation of decimal numbers. This proposal is indeed a very interesting one and I appreciate his thinking of the National Bureau of Standards as the natural place in the Federal Government that should review and promote a proposal such as his.

The staff at the Bureau of Standards has reviewed Mr. Brown's proposal and reports to me that the computer community has had to cope with this problem for the last 20 years, namely to avoid the cumbersome raised exponential notation such as 7.3×10^{-3} .

At this time there are three systems in use already which are competitive to Mr. Brown's:

- (1) The computer notation with the exponent E, viz. 1.234 E-5, where E indicates exponent to base 10. The American Standard FORTRAN uses this notation, though with two positions reserved in the exponent field.

(2) A variant of (1), which is widely used in published mathematical tables, omits the E altogether: e.g., 1.234(-5).

(3) The Algol notation (Algol is a computer language that is widely used in Europe, but is mostly of academic interest here in the U.S.) employs one special symbol, something like a lower-case 10, in the same sense as the E in American Standard FORTRAN: 1.234₁₀-5.

All these schemes suffer in comparison to Mr. Brown's in that they use more symbols as compared to what he proposes. However, the American National Standards Institute has the difficult task of standardizing the meaning of the 128 different symbols that can be represented by a 7-bit code such as is used in telecommunications today. Mr. Brown's symbols mag and gam could be possibly represented by \leftarrow and \rightarrow , but a good number of already existing conventions about these symbols would have to be scuttled in the process.

With respect to Mr. Brown's comment No. 4 on saving space on small calculators, he is, I am sure, aware of the fact that a good many of these (such as the Hewlett-Packard HP35, or the Compucorp Scientist and Statistician models) use the exponent notation such as 1.234 -77, or 2.623 03 in their display.

On the international scale, the matter is even worse where we have to observe not only our own American National Standards but also those of the General Conference on Weights and Measures (CGPM) which is responsible by international treaty for the symbols and notation of the decimal powers from atto (10^{-18}) to tera (10^{12}). These were developed not only for notational ease (which might be debated when confronted with d and da) but also for conversational purposes. Since such an international standard involves the signatures of all the member states, you might imagine the uphill battle any country faces to gain acceptance on any such proposal.

Article 3. Reply to Comments by Ms. Betsy Ancker-Johnson from Myron J. Brown

The comments by Ms. Betsy Ancker-Johnson, are greatly appreciated since the viewpoint of her office and the review of the National Bureau of Standards reflect experience with commercial interests and the ensuing problems of national and international standardization.

When the problem of avoiding the cumbersome raised exponential power such as 7.3×10^{-3} became real to the computer industry in the last twenty years, solutions followed the usual pattern of expediency and, as a result, at least three practices evolved, namely, the FORTRAN notation, 1.234 E-5; the Algol notation, 1.234₁₀-5; and the small calculator practice, 1.234 -05. These three practices, plus the basic method of scientific notation, 1.234×10^{-5} ; and the method used in mathematical tables, 1.234(-5), are all expedients for surmounting an inefficiency of the decimal system of numeration when handling very small or very large numbers. The magpoint system, by correcting this inefficiency, provides a simple method that can readily supersede these other five methods. Because of its efficiency and rigorous accuracy, it is a method that would make it a candidate for standardization.

It is interesting to note that all of these traditional methods are tied to the concept of negative and positive exponents. In contrast, the magpoint system, which is suitable for teaching in grade

schools, avoids the negative (-) and positive (+) symbols and the exponential concept by indicating simply that the decimal point is moved in one of two directions a certain number of places as indicated by the magpoint symbol and the number which follows it. That this is equivalent to introducing a multiplier equal to a negative or positive power of ten becomes of interest as the student reaches studies in higher mathematics. Not only do the new symbols make early usage of magpoints possible but in the more erudite applications the expressions use fewer symbols and are strictly accurate, avoiding the possibility of ambiguity inherent with some of the five other methods reviewed.

Another pair of symbols in the already extensive lexicon of scientific symbols poses certain mechanical problems of typography, reproduction, and encoding, the latter being for telecommunications and tape storage. The symbol mag (\blacktriangleright) and gam (\blacktriangleleft) are derived in shape and form by a simple modification and rotation of the capital letter "A" of a conventional typewriter font. Modern typewriters, in many cases, have keys for changeable type; another device for typewriters is a plastic accessory which bears an embossed replica of the symbol — this accessory is hand held when making the typed impression. A third device is a sheet plastic stencil that is used as a guide when drawing the symbol with a pencil. In telecommunications it is suggested that the words "mag" and "gam" be transmitted as words until some code for the symbol is accepted. For tape encoding the present combination of E+ and E- would respectively represent mag and gam. In facsimile and television no special provisions need be made since these media are self-encoding.

As to the international scene, it can be envisioned that our delegates to an international convention, armed with a proposal that the decimal system of numeration be expanded to include a magpoint and an exponent (1.234 \blacktriangleright 5 or 6.789 \blacktriangleleft 2) could win a standardization that would make the European designations of the lifted dot (3.1416) and the comma (3,1416) obsolete. That is, the magpoint system would be standardized as a package, including the numeration when the magpoint is implicit, thereby making 3.1416 correct and 3.1416 and 3,1416 obsolete.

In summary, after integrating the National Bureau of Standards comments into the original concept, the proposed magpoint system and its use in numeration are based on these concepts:

1. The decimal system of numeration is inefficient when handling very small or very large numbers.
2. The form and location of the decimal point in the decimal system of numeration is not internationally standardized.
3. The expression of the order of magnitude of numbers is not standardized and follows at least six systems, the decimal system using zeros, the scientific notation system, three computer conventions and a mathematical table convention.
4. The names of fourteen orders of magnitude from atto (10^{-18}) to tera (10^{12}) have been standardized.
5. The magpoint system is an efficient means of expressing a decimal number and its order of magnitude. As such, the magpoint system is a worthy candidate for standardization. It will supplement and support the already standardized named orders of magnitude without conflict. □

GAMES AND PUZZLES for Nimble Minds – and Computers

Edmund C. Berkeley
Editor

COMPMEANO

The following was “picked up from the floor of a computer laboratory”. The characters were printed by a computer output device.

Is it a random number sequence? or does it have meaning? If so, what does it say?

The answers to these questions will be published next month.

COMPMEANO PUZZLE 744

760708340750158125782930078791
590375873578607583172742929216
788687073591492601507085982853
172808707539879118507381407039
160852734075427368735081887076
070834075015170729150662737508
691630678687075831727429292172
010159176070831675985074075960
985072216608293007879159032728
543069540707671540847607082348
278791327541769

NAYMANDIJ

A “naymandij” puzzle is a problem in which an array of random or pseudorandom digits (“produced by Nature”) has been subjected to a “definite systematic operation” (“chosen by Nature”) and the problem (“which Man is faced with”) is to figure out what was that operation.

A “definite systematic operation” meets the following requirements: the operation must be performed on all the digits of a definite class which can be designated; the result displays some kind of evident, systematic, rational order and completely removes some kind of randomness; the operation must change at least six digits from their original random value; all other digits must remain unchanged in value and position; and the operation must be expressible in not more than four English words. (But Man can use more words to express it and still win.)

NAYMANDIJ PUZZLE 744

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

The solution for Naymandij Puzzle 743 in the March issue is: Sequence half row 9.

NUMBLES

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

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

NUMBLE 744

$$\begin{array}{r} \text{L A Y} \\ + \text{T H E} \\ \hline = \text{Y K H} \\ \times \text{E G G} \\ \hline \text{A H C E} \\ \text{A H C E} \\ \hline \text{H L N T} \\ = \text{E E N N E E} \\ \hline 223450 \quad 070164 \end{array}$$

The solution for Numble Puzzle 743 in the March issue is: D = 0; E = 1; G = 2; C = 3; N = 4; R = 5; S, Z = 6; I, Y = 7; A = 8; F = 9.

The message is: Rain times icy equals freezing and it all increases the skidding.

SIXWORDO

In the March issue of *Computers and People*, we said in substance:

The day is coming when words will be understandable by computers not only in limited contexts but more widely. In the meantime it will be good to practice with several kinds of exercises. . . . One kind of exercise is persuading people to translate from more difficult English sentences with many words into shorter and easier sentences with fewer words, for there is a great deal of English written or spoken which is hard to understand for a variety of reasons.

Some of the questions we raised were:

- Is it possible to express any desired meaning as a sequence of short sentences?
- Can each such sentence be no longer than n words?
- What is the best value of n for a computer? for a person?

One of the exercises or puzzles proposed was to paraphrase a passage (a series of sentences), making every new sentence no longer than six words, the meaning to be just the same. According to the dictionary, to paraphrase means to restate a text or passage giving the meaning in another form; in this case there is no requirement to change or alter any word – only the requirement of producing sentences no longer than six words.

SIXWORDO PUZZLE 744

(1) Eastern Illinois University, Charleston, has over 820 faculty members and an enrollment of over 8,600 students. (2) A state university, it provides programs in liberal arts and professional fields, including teacher training and library science. (3) Booth Library holds about 300,000 cataloged volumes. (4) The university has experienced a steadily increasing enrollment, and the library, in consequence, has been adding over 20,000 volumes per year in an attempt to keep pace with enrollment. (5) The number of volumes per student, 35, is about three-fourths of the national average, 45. (6) The collection is being reclassified from the Dewey to the Library of Congress classification system. (7) During 1970-71 about 115,000 volumes were circulated by the Booth Library automated circulation system.

– From page 35, *Case Studies in Library Computer Systems*, by Richard Phillips Palmer, published by R. R. Bowker Co., New York and London, 1973, 214 pp.

SIXWORDO PUZZLE 743 – A SOLUTION

(If better solutions are received, we plan to publish them.)

(1) It was a fascinating place. Especially for working, it was fascinating. (2) There was the graceful old hacienda. It was now falling into disrepair. The disrepair was picturesque. (3) There was the cone of Popocatepetl. It was volcanic, immense, close by. It dominated the western sky line. (4) The orchard was really many orchards. Throughout were old avocados. They were in long straight rows. (5) The family was the Rodiles family. They had been interested in avocados. Their interest endured through several generations. (6) For years they brought home avocados. They brought the best ones. These came from the local markets. They sprouted the seeds. They planted the seedlings. These grew in their orchard. (7) The resulting collection is a paradise. It is a botany professor's paradise. It contains literally several thousand avocados. They have been grown to maturity. No two are exactly alike. (8) Suppose one wants to study variation. This variation is among avocados. Here is the place for study.

Comment. Such a series of short sentences has an obnoxious style, and reminds one of the silly reading books in kindergarten. Such books are so boring that they seem likely to discourage many children from ever wanting to read, especially when they can watch television.

But a computer of course will input anything that is given to it, and usually without complaining. And it ought to be the case that the frameworks of sentences occurring in sentences of up to 6 words might make it rather easy for almost all such sentences to be “understood” by a suitably programmed computer.

This proposed solution however does clearly lose some of the meaning of the original passage. I would estimate that not more than 90 to 95% of the original meaning is successfully expressed in this SIXWORDO proposed solution. Therefore, my tentative conclusion is that 6 is too small a number of words, and is an unsatisfactory lower limit of n .

Other solutions of this puzzle sent in by readers of *Computers and People* will be most helpful.

PICTORIAL REASONING

The following pictorial reasoning test is a test to see how carefully you can observe and reason. It is not timed.

1. In each row find the four pictures that are alike in some way and find the one that is *not like* all the others and write its letter, A, B, C, D, or E as your answer.

2. If you become convinced that no picture is essentially unlike the others, write F for “fatally ambiguous” as your answer.

“A solution with reasons” will be published in the next issue.

PICTORIAL REASONING TEST 744

	A	B	C	D	E
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					

(please turn to page 42)

The Assassination of the Reverend Martin Luther King, Jr., and Possible Links With the Kennedy Murders — Part 3

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"Assassinating King would be analogous to assassinating Ho Chi Minh in the Vietnamese situation, with added fallout benefits in the U.S. situation . . ."

Was the murder of the Reverend Martin Luther King, Jr., the result of a conspiracy?

Parts 1 and 2 of this series of articles introduced the "eggs and sausage" man, a mysterious person who appeared on the scene the day of the murder.*

Wayne Chastain has also examined the theory of a larger conspiracy — left-wing radicals or black militants, or the Federal Government, or right-wing racists — and disqualified each of these as a realistic possibility. But he continues to investigate, "Who really killed Dr. King, and does this relate to the murders of the Kennedys and other political assassinations in America?"

Conspiracy by Paramilitary Organizations

The paramilitary right, as the third possibility, presents many very persuasive arguments. The Minutemen was one of the more visible paramilitary right-wing organizations in early 1965, but by 1968, when King was killed, the FBI had penetrated the organization, split its ranks, and forced it to go underground. Thus it was doubtful that this particular paramilitary organization had the power to carry off a successful conspiracy and effective cover-up. Although some elements of the organization had marked King and Senator Fulbright¹ for assassination, it was DePugh himself who defused the plots. The objectives of the Minutemen were the same as the black militants — namely, to trigger violent urban warfare in the nation. Their ultimate objective was to step in and take over the government when it proved inadequate to cope with rising lawlessness in the street, in much the same fashion as Hitler and the Nazi Party did in Germany in the late 1920's and early 1930's.

It is doubtful, however, that the minutemen had the cohesive organization and sufficient allies inside the Federal Government to have achieved a successful cover-up.² There was no evidence to link James Earl Ray (assuming for argument's sake that Ray did indeed kill King) with the Minutemen, although one report this writer investigated contended the Minutemen — headquartered in Independence, Mo. — had its largest membership in that state and had penetrated the ranks of the State Police and the Prison System. Thus, "the Minutemen arranged for Ray's escape in 1967". This writer could not confirm the substance of that report. Note, Ray was linked indirectly to the National States Rights Party as his brother, Jerry Ray, was an active member.

* Parts 1 and 2 were published in the February and March issues of *Computers and People*, which are available from the publisher as back copies at \$2 each.

Ray's attorney, J. C. Stoner, is also the attorney for both the KKK and the National States Rights Party.³ As discussed above, neither one of these parties or organizations have the clout to carry off a successful cover-up because they are heavily penetrated by the FBI.

The Military-Industrial Complex

If one uses the term "paramilitary right" in a broader sense, rather than one or two organizations such as the Minutemen or the American Nazi Party, then one could conceive of a select group that could carry off a successful assassination and a subsequent cover-up. Such a select group of paramilitarists would of necessity come from within the enclaves of the powerful military-industrial complex. They could include military persons, civilians within governments and wealthy private citizens. The latter would be members of the respectable right, those who kept a low profile on the issues, and were not visible on the landscape of anti-communist activities.

The matrix of anti-King feeling in the nation contained a dimension that has often been overlooked when speculating on motives that may have lay behind a murder conspiracy. This dimension imperceptibly grew between 1965-68 because it was obscured by Dr. King's escalation of domestic civil rights issues — such as housing in Chicago, voting rights in Selma, and decent wages for black sanitation workers in Memphis — during this same period. This dimension is reflected by the escalation of Dr. King's anti-Vietnam War rhetoric and his increasing participation in anti-war protest demonstrations. Dr. Abernathy and other SCLC leaders had in private urged Dr. King to stick to black civil rights issues, for both tactical reasons⁴ and because some feared Dr. King might meet the fate of Malcolm X.

Dr. King's Anti-War Activities

On the day before he was killed, Dr. King made one of the most vehement anti-war speeches of his career. It was made in the courtyard of the Centenary Methodist Church (FBI agents — with movie cameras — sat in parked cars across the street). The church's pastor, Rev. James Lawson, an articulate and black intellectual, represented the dove faction of the SCLC, which had always urged Dr. King to sound out loud and clear against the war. Lawson had organized the first anti-war, peace demonstrations in Memphis two years before. Lawson's anti-war activities had also aroused the ire of the white majority. Rev. Lawson's pacifism dated back to the early 1950's when he preferred to go to Federal

prison rather than register as a conscientious objector at his draft board. Lawson had shrewdly detected that there were groups who hated King — and himself — but who were not "overt racists". Lawson had described these groups as "paranoid patriots" at a foreign policy seminar on United Nations Day the year before, becoming the target of the local John Birch Society and the American Legion's watch dog committee on subversion. Lawson said the "neurotic preoccupation with anti-Communism had blinded many whites to the racist ramifications of the Vietnam policy". He pointed out a higher percentage of black soldiers dying in Vietnam than white soldiers, to "sate the white man's anti-Communist fetish". The net effect, Rev. Lawson said, was a "racist war" against the interests of blacks in America and destructive of the lives of the yellow-skinned Vietnamese.

Writers⁵ reflecting the view of the "paranoid patriots" and paramilitary professionals expressed the view that Dr. King loomed as a "national security threat to the nation," but these writers did not necessarily criticize his role in pure civil rights activities for blacks. "King is today the most dangerous man in America," lamented one writer.⁶ This was because King was about to lead his Poor People's March to Washington beginning in June, 1968.

Five Events in Early 1968

Five events occurred in early 1968 that had a traumatic effect on those who viewed the winning of the Vietnam War as an imperative to "stopping worldwide Communism".

1. The Tet Offensive occurred in late February and early March. The event shattered the confidence of Americans — both within the official and private sectors — in the South Vietnamese Government's ability to represent the South Vietnam populace and survive the assault of a phenomenon that now appeared to be a "civil war" after all. (The earlier assumption was that North Vietnam had invaded the South through infiltration tactics). For the first time, a thin majority of American public opinion favored pulling out. Many newspapers changed their long-time, hawkish and super-patriotic editorial policies. Inside government, long-time, hardened hawks became fledgling doves (Secretary of Defense Clark Clifford; U.S. Senator Stuart Symington, one-time Secretary of the Air Force under the late President Harry Truman).
2. The virtual abdication of President Lyndon Johnson on the Sunday night before the Thursday slaying of Dr. King. This event opened the floodgates for dovish Democrats to vie for the Democratic nomination. Eugene McCarthy had just barely lost the New Hampshire primary six weeks before, and Robert F. Kennedy had already announced his candidacy.
3. The announcement accompanying President Johnson's abdication that he was going to call a bombing halt for the extreme portion of North Vietnam and was immediately launching peace negotiations with the North Vietnamese in Paris.
4. The riot in Memphis in March. This event was described by Time magazine as the "beginning of a long, hot, bloody summer of 1968". Dr. King was enroute to start peace marches in North Mississippi when he returned to Memphis, where he was killed, to attempt a peaceful demonstration.
5. The announcement that Dr. King would lead a "Poor People's March" from Mississippi to Washington, D.C., in June. According to many writers reflecting the paramilitarist viewpoint, this explosive event may have been the spark that would bring to the nation's capital the massive rioting of Detroit and Newark of the summer before. The powder keg in Washington, however, would contain the potential of a much more devastating detonation because it would occur in a Presidential election year. The march might climax a coup of the peace protesters. Many of the "paranoid paramilitarists" might even analogize Dr. King to Ho Chi Minh, and describe the peace coalition as Dr. King's National Liberation Front (The National Liberation Front in South Vietnam almost toppled the South Vietnam regime in 1963).

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 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 latter event might also be analogized to the third and final phase of Mao Tse Tung's formula for the War of Liberation's encirclement tactic. This was the phase which had almost cut Saigon off from the rest of South Vietnam in late 1964 and early 1965 before the U.S. stepped up its commitment and sent American combat troops to prop up the regime.

Washington and Vietnam Parallels

The solution to the problem in Washington, D.C., in 1968, however, could be dealt with more expeditiously than the geopolitical cancer which began growing in Saigon in the fall of 1963. The latter event called for a long shot — assassination of a longtime ally, who had outlived his usefulness to the U.S. and who could no longer hold the line effectively against encroaching Communism. This would create a vacuum that could be quickly filled with an active military junta that would brook no opposition from the insurgents.

In the U.S. situation in 1968, the solution was more simple: assassinate the leader of the insurgents — a feat that could not have been done in Vietnam in 1963. The irony of Diem's oppression was that it was so massive and complete that it prevented the visibility of any one strong personality in the South that could symbolize the leadership of the National Liberation Front and its military arm, the Viet Cong. Instead, the Southern revolutionaries had to look to the North for a personality to symbolize their struggle — Ho Chi Minh. Assassinating Ho Chi Minh was almost next to impossible as neither the U.S. nor the South Vietnamese had any roots or guerilla infrastructure in the North to get close to the aging nationalist leader.

King and Vietnam Parallels

Assassinating King would be analogous to assassinating Ho Chi Minh in the Vietnamese situation, with added fallout benefits in the U.S. situation: death of King would leave a vacuum of leadership in the SCLC (Rev. Jesse Jackson of Chicago was in competition for the top post with Rev. Ralph Abernathy shortly after King's death). This would defuse the power of the SCLC and perhaps prevent the Poor People's March in June. (The event did not forestall the march, but King's absence in Washington during the month of June will always be an unknown factor in whether the march would have been more effective in terms of concrete concessions from Congress).

The plotters may have assumed that the assassination could easily be blamed on black militarists or some "white nut," or both, without the public ever perceiving the national security implications. King's death would also trigger the black militants into action and they would temporarily create chaos in the cities, but the mighty forces of urban⁷ police forces — many of them trained at paramilitary and riot controls in secret camps in Georgia under the aegis of the CIA during the late 1950's and early 1960's — with the help of National Guard units could swiftly crush the dissidents. The broad white middle class, relieved and grateful to the martial forces because of the effective repression of the rebel forces, would be conditioned and predisposed to accept a "man on a white horse" in the forthcoming Presidential election less than six months away. This could mean the election of Governor George Wallace of Alabama (note the concession Wallace made to the paramilitary right: selection of retired Air Force General Curtis LeMay, former chairman of the joint chiefs-of-staff, and vocal hawk, as his Vice Presidential running mate.⁸)

"Man on a White Horse" Fever

Or, if a Wallace election was too much to be hoped for, would not a vigorous Wallace candidacy alienate the blue collar workers of the North and Eastern cities from their traditional loyalties to the Democratic Party, and assure a victory of Richard Nixon? And even if the Democrats should win, wouldn't a Humphrey victory be preferable to one by Robert F. Kennedy (still alive at the time)? Wasn't it Humphrey who made the caustic criticism of RFK, when the latter called for a coalition government with the National Liberation Front and the Ky Government in 1966? Humphrey had said that this would be like "putting the fox in the chicken coop". With a "man on a white horse" fever in the air, would not Humphrey be amenable to the paramilitary right, in much the same way he was to the hawkish taskmaster

he had served for four years? And after all, if RFK's popularity were to still survive the shift to the right, could not he be dealt with in another way?

Two Strange Visits

Five days after the eggs and sausage man left Jim's Cafe, two other strange visits — perhaps by the same man — occurred in Memphis. They seem to make the eggs and sausage man's visit seem more significant.

One visit was made by a mysterious blond Latin. The second visit was by a dark-haired man, strangely resembling the blond Latin except for his hair and lack of stylistic clothing. The blond Latin visited an attorney. The dark-haired man visited two ministers. The visits occurred at different times of the day, leaving the possibility that they were by one and the same man. Both visitors gave their next destination as Brownsville, Tenn., for purposes of visiting a well-known member of the Ku Klux Klan. Neither the Klan leader, nor local citizens, ever received a visit from either of the two men.

Thus, the purported visit to Brownsville may have been an attempt to drag a red herring across the investigative trail — a ploy to cast suspicion on a racist or racist organization and divert investigations away from the "national security" motive.

Last but not least, both men exhibited multi-linguistic aptitudes — either to dazzle or to confuse their listeners. They both gave Latin sounding aliases to their listeners. Both purported to have known the man who killed King, his motive and his modus operandi. Both stories coincided in most respects. Both said the killer had impersonated a Negro in setting the scene for Dr. King's assassination (remember the supposed SCLC advance man who convinced Mrs. Bailey to switch Dr. King's suite to the second floor?).

The two ministers and the attorney have tentatively identified their visitors from photographs provided by — Renfro Hays, a Memphis private detective; and Bernard Fensterwald, executive director of The Committee to Investigate Assassinations and a Washington, D.C., attorney.

The evidence suggests that the eggs and sausage man, and the two visitors, are all one and the same man. For the time being, we will call him by the code name Jack Armstrong.

A Soldier of Fortune

Jack Armstrong is a code name for a dark, handsome soldier of fortune. He excels both as a guerilla fighter and confidence man par excellence. An erstwhile licensed pilot, Armstrong participated in at least three South American revolutions during the decade of the 1950's. Thus, he exploited — and exported — a seller's market for skills provided him by Uncle Sam during the Korean War. Trained by the U.S. Army as a ranger-commando, Armstrong was commissioned directly from the ranks as a second lieutenant. This was a remarkable feat for a 20-year-old youth who had only been in the army a few weeks and had no combat experience, did not have a college degree, had not attended Officers Candidate School, had not taken Army ROTC during the two years of college he attended before enlisting. Perhaps it was because he demonstrated an unusual proficiency for physical agility, firearms, and explosives,

as well as an aptitude for inexhaustible rough and tumble combat. He registered a score of 142 on the Army General Classification Test — a score roughly comparable to an IQ score earned by less than a fraction of one per cent of those tested in the Armed Services at that time. Other tests reflected an aptitude for languages and verbal fluency as well as high mechanical insight. He later fought behind the lines in North Korea. After the war, he would brag to close friends at college that he once rescued a contingent of downed B-29 crews across the Yalu River in Manchuria near that nation's industrial complex.

A Natural Born Fighter

Slightly less than six feet tall, Armstrong possessed in his youth a lean — but deceptively muscular — physique. He acquired a reputation as a "murderous in-fighter" in hand-to-hand combat, both among his army buddies and his college friends. He employed a unique style that combined the best of boxing, judo, karate, and "dirty football tactics," comments an old college chum, who described how Armstrong whipped a college football teammate outweighing Armstrong by 40 pounds and having a longer reach.

"His victim," the college teammate said, "went on later to become a famous professional football player, but in a slugfest with Jack, he would always be a hopeless amateur outmatched by a relentless pro."

Another college acquaintance — not necessarily a close friend — witnessed the same fight. He said: "Jack had the instincts of a natural born street fighter alright. He loved fighting and if he had less intelligence, he probably would have gone into the ring. When you first met Jack, you would say to yourself ... 'this is a nice guy ... quiet, unassuming, very modest, very friendly with a sly grin and almost a wink in his eye as if you and him shared some private joke' I later learned his friendliness was a facade — behind it was a come-on. He wanted some one to attack him so he could retaliate. He would set up his victims — always bigger than himself — by inviting friendly responses and then turning them into aggressive acts that would justify a retaliatory response."

Armstrong's affinity for violence and danger approached "pathological proportions," the college acquaintance said. He added: "I believe that Jack is a true psychopath ... or a sociopath as psychiatrists use the term today"

Armstrong's physical prowess, however, has caused him trouble. Rap sheets from metropolitan police departments in several cities show he has been arrested on charges of assault and battery on several occasions. However, those same rap sheets show no convictions.

Right Out of James Bond Fiction

A skeptic would be justified in believing that the above character sketch was taken out of a James Bond plot if there were not ample documentation for the above listed facts. Reading Armstrong's dossier further, his life begins to sound even more like the script of a contemporary espionage thriller.

His real name, however, is known to Bernard Fensterwald, executive director of The Committee to Investigate Assassinations. It is also known to the

FBI, and the Memphis Police Department investigators who handled the Martin Luther King assassination.

Link to Kennedy Assassination?

Armstrong's real name appears at least once in the appendix of the prolix Warren Commission report. Critics of the Commission have described this section as the "throw-away bin" — any material that did not fit the pre-conceived "lone assassin, two bullet" frame of reference projected by the Commission members found itself in the appendix, rather than the narrative body of the report.

Commission staff investigators collected a welter of reports about plots and counter-plots that the Commissioners later deemed irrelevant.

One included an interview with a witness who related the details of a gun running scheme planned in a Dallas, Tex., apartment in late 1961. The scenario included one other soldier of fortune — later murdered in New Orleans by arsenic poisoning — and an unidentified Army Colonel. The plot called for smuggling a cache of weapons into Cuba for the benefit of anti-Castro guerrillas, who were building an underground for a second attempt to overthrow Premier Fidel Castro.

Although the witness had apparently never seen Armstrong, the witness knew Armstrong by name. The witness linked Armstrong with none other than Jack Ruby — the Dallas nightclub owner who shot Lee Harvey Oswald to death in the basement of the Dallas police station in front of the eyes of the entire world via television cameras.

Armstrong and the other soldier of fortune were supposed to be the ones to smuggle a cache of weapons (apparently stolen from military bases by the right-wing colonel) into Cuba. Ruby, who was present at the meeting with several other persons whom the witness did not know by name, was the "bag man" for the operations — that is, he provided the funds for the operation at the same meeting. Investigative reports in later years indicated Ruby was not the actual "Sugar Daddy" for the operation, but merely a financial conduit of a wealthy Houston, Texas, man.

Not knowing Armstrong by sight, the witness described a "young, mysterious Cuban" who was present. The purported Cuban never said anything. The witness was not sure what the Cuban's role in the venture was supposed to be.

The purported Cuban, however, was neither young nor Cuban. He was Jack Armstrong himself. (In the next installment, an in-depth portrayal of Jack Armstrong.)

Footnotes

1. William Turner. Power on the Right (New York: Ramparts Press), pp. 77-78.
2. In a series of letters to Robert Collins, staff writer for The St. Louis Post-Dispatch, DePugh maintained that he did have sufficient allies inside the Federal government that enabled him to elude capture by the FBI for almost 18 months. Ironically enough, DePugh went into hiding shortly after his indictment and that was only a few weeks before King's murder. One hideout the FBI raided contained documents that included the list containing four Americans marked for assassination. DePugh, however, said this was an FBI planted document. DePugh said he some-

times received tips from Minutemen inside the Federal government that the FBI had discovered his new hideout and were going to raid it. DePugh said he escaped several times only minutes ahead of the raiding agents. When he was captured near Truth Or Consequences, New Mexico; reporters asked him if the Minutemen were responsible for King's death. DePugh vigorously denied it and said when asked if he had any knowledge of those behind the murder: "The CIA or some other Federal agency". In another interview, DePugh said the Minutemen had a much more massive membership than the FBI realized, and that the paramilitary organization had penetrated the higher levels of the Federal government.

3. William Bradford Huie. He Slew the Dreamer (New York: Delacourt Press), pp. 176-177.
4. Jim Bishop. The Days of Martin Luther King, Jr. (New York: G. P. Putnam & Sons), pp. 2, 402, 409, 415, 449. Bayard Rustin advised King to stay away from anti-Vietnam peace demonstrations and to lay off anti-war sloganeering in 1965 because of tactical reasons. Tying in the black civil rights movement with the peace movement would erode the vast bargaining power King had with a friendly, pro-civil rights administration. Rustin later changed his views when the war fever mounted and Johnson had escalated the bombing raids over North Vietnam in 1966-1967.
5. William Schulz. "Safety of America at Stake," Reader's Digest (April, 1968). Ironically, the issue containing the article reached Memphis newstands only a few days before King was killed.
6. Ibid.
7. Colonel Fletcher Prouty. The Secret Team (Englewood Cliffs, N.J.: Prentice-Hall, pp. 2, 394-395. If one has read David Halberstam's The Best and the Brightest (New York: Random House) one must read Prouty's book to understand the depth of regimented deception, bureaucratic myopia, and military duplicity that led America into the quagmire of Vietnam. Halberstam reported the war first-hand, and documents his thesis by extrinsic sources. Col. Prouty, however, a retired Air Force officer, played a key role inside the Pentagon and was once a focal control officer for many clandestine CIA operations. His conclusions, surprisingly, confirm those of Halberstam. Prouty strongly suggests (page 2) that the assassinations of both Kennedys and Dr. King (as well as Diem, Nhu, Hammar-skjöld, Trujillo) were perpetrated by a "Secret Team" — an inner establishmentarian clique that cuts across military, State Department, CIA, and financial leadership of the nation. "The power of the team is enhanced by the 'cult of the gun' and by its sometimes brutal and arbitrary anti-Communist flag-waving, even when Communism has nothing to do with the matter at hand. The Secret Team does not like criticism, investigation, or history, and is always prone to see the world in two divided camps — 'them' and 'us'."
8. LeMay's famous advice to President Johnson in 1964 before Johnson launched massive bombing of North Vietnam was that "two weeks of massive bombing of Vietnam" would force the abdication of Ho Chi Minh and the surrender of all North Vietnam forces in South Vietnam. LeMay apparently believed in the Rusk theory prevalent at that time — namely, that all of the guerilla fighting in the South at that time was due to North Vietnamese infiltrators, rather than disaffected South Vietnamese engaged in a civil war against the Saigon regime. □

BEER — Continued from page 22

there is no genuine metasystem, why has one not grown up? Was there never a stabilizing structure of any kind? I think that there was a metasystemic structure of a very remarkable kind, but that it has been abandoned. We have thereby lost the meta-controls which made the composite systems of esoteric boxes viable. If this be true, no wonder we need assiduously to design replacements.

First, there was the structure of society's "external skeleton": the religious, legal and moral framework. Into this hooked the structure of the "internal skeleton"; there were indeed formal bonds linking social institutions themselves. Younger people seem to be systematically abandoning the values of the external system, so that it ceases to be relevant to any control process dependent on negative feedback. Given that almost fifty per cent of the population of the United States is now under twenty-five years of age, the revolt of youth is destroying metasystems whose stabilizing value they do not understand is a serious matter indeed. The young have more power in society than even before: purchasing power, and the power that derives from not being afraid of inherited norms. Most of them are not taking technology for granted. Many of them are questioning established values in terms which their elders do not understand. Some have already begun smashing up computer installations. As to the internal system, changes in technology are moving the interfaces between the esoteric boxes representing established institutions — and they are not responding. Instead of evolving by adaptation, these boxes are putting up the shutters and seeking to maintain themselves as integral systems while the context changes around them. This will not work.

Thus the strings and networks are unstable, and the metasystems are missing. Rather than attempt the exhaustive enumeration of these composite systems let us try to state the features they share in terms of knowledge, information and control. They seem to me to be the following:

Characteristics of Strings and Networks of Esoteric Boxes

1. In all cases some esoteric boxes in the system are part of the public sector and some part of the private sector.
2. In all cases the esoteric boxes are generating, and (inefficiently) passing between themselves, knowledge about the world in which they operate.
3. In all cases they are also generating, either as primary or as spin-off data, knowledge about the individual citizen which they rarely interchange.
4. In all cases the very forces which produce stability within the esoteric boxes themselves conduce to instability between the boxes.
5. In all cases, what constitutes the improved management of knowledge within the esoteric box has to do with the rapid matching of sets of possible courses to sets of actual conditions, and the rapid correction of mismatches by feedback governors.
6. In all cases what would count as an improvement in the management of information between esoteric boxes, and therefore an embodiment of the metasystem concerned, would be an integral information network and a mutual trade-off in knowledge — both of the world and of the citizen.

If this list of six points correctly states the position, it behooves us to elucidate them further.

(To be continued in the next issue)

the program (in operation steps, and in time on the machine)? What was the input? example? What was the output? example? What were the tests used to make sure that the answer or solution given by the computer was correct? What are the limitations of the answer or solution? How can the answer or solution be used additionally in the future? What surprises turned up in the course of working on the problem? Any remarks or comments interesting to the reader or useful to the next investigator?

The usual length of an article is 2000 to 3000 words. Charts, pictures, and drawings that help to clarify the ideas in the article are very desirable if they contribute materially to the explanation. To be considered for any particular issue, the manuscript should be in our hands by the second day of the preceding month.

All suggestions for articles, manuscripts, inquiries about editorial material, and letters should be addressed and mailed to the Editor:

Edmund C. Berkeley
Editor, Computers and People
815 Washington St.
Newtonville, MA 02160

The Contents of Computers and People

A. Orsava
145 Marlee Ave.
Toronto, Ontario, Canada

I wish to compliment you on the excellence of your February issue, which I enjoyed thoroughly.

Below are my solutions:

Solution to Naymandij Puzzle 742: "Couple 8's with 9's".

Solution to Numble 742: "I want you to be my Valentine."

Editorial Note: All suggestions for making Computers and People more interesting, more entertaining, and more useful will be welcomed.

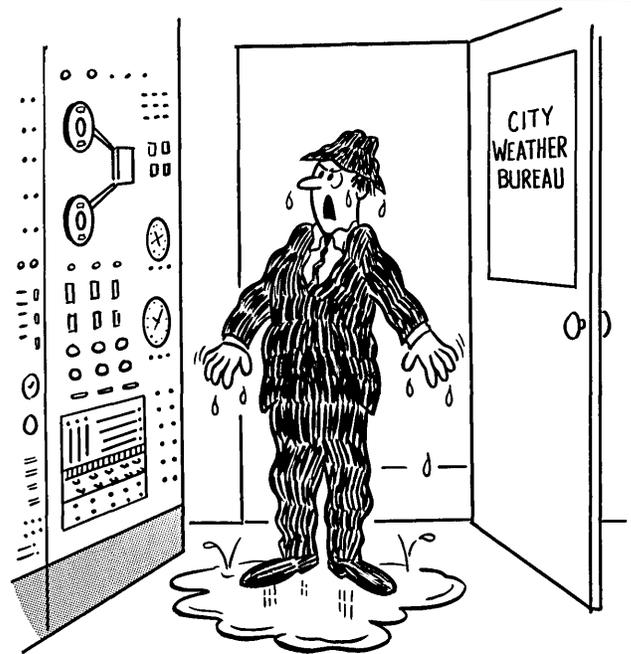
Digital Processes — A New International Journal on the Theory and Design of Digital Systems

Heinz Georgi
Managing Director
Delta Publishing Co. Ltd.
P.O. Box 20
CH-1800 Vevey 2, Switzerland

We are pleased to inform you that we plan to launch a new international journal entitled "Digital Processes". The first issue will be published towards the end of 1974.

"Digital Processes" will cover all aspects of theory and design of digital systems, such as: computer and systems architecture; memory and peripheral devices; evaluation and testing procedures; techniques of computer-assisted documentation; logic design techniques; switching and automata theory; coding theory; computational methods; etc. The journal will include: original research work, short technical communications; critical survey and review papers, etc. The editor-in-chief of "Digital Processes" is Prof. Douglas Lewin (Chair of Digital Processes, Dept. of Electrical Engineering and Electronics, Brunel University, Uxbridge, U.K.); he is assisted by an international editorial board of 22 members.

We hope this new project will be of interest to your readers. Any person desiring more information should write to me.



Hal Moseley

" — and you predicted POSITIVELY no chance of precipitation for today!"

The Fox of Mt. Etna and the Grapes

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

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

From *Ride the East Wind: Parables of Yesterday and Today* by Edmund C. Berkeley: see more information on page 3.

ACROSS THE EDITOR'S DESK

Computing and Data Processing Newsletter

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APPLICATIONS

ADVANCED RESEARCH INTO BRAIN PHYSIOLOGY WITH A LOW-COST COMPUTER SYSTEM

*Dr. Peter Henning
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Palo Alto, Calif. 94303*

Researchers at the University of Arkansas Medical Center, Little Rock, Ark., are using a small, low-cost computer to investigate brain dysfunction in slow-learning children. ADAPTS, as the system is called, was created by Varian Data Machines, a subsidiary of Varian Associates. The central element of ADAPTS is a Varian Model 620/f-100, a compact but powerful high-speed machine weighing only 35 pounds.

Dr. Roscoe Dykman, a professor in the University's Department of Psychiatry, says that the new system will be used first to study brain function in children who have normal or superior IQ's but whose learning is impaired by difficulties with reading, spelling, writing or arithmetic.

Dr. Dykman looks for minimal brain dysfunction (MBD) in such children by measuring their responses to light flashes, sounds and spoken words. The speed and nature of a child's reaction will be assessed through monitoring of his electroencephalogram (EEG), galvanic skin response (GSR) and other indicators of his neurophysiological state. In his research, Dr. Dykman hopes to develop reliable indicators for MBD, so that physicians will be able to tell quickly and easily whether a child's learning problems are chiefly psychological or whether they stem from a brain anomaly.

In a related study, Dr. Dykman and his colleagues will use the ADAPTS system to investigate brain wave frequency patterns in normal and learning-impaired

children and to analyze the effects of medication on brain wave activity. A human brain generates several distinct types of waves. Alpha waves (with frequencies of about 10 Hz) usually predominate when a person is awake and relaxed. During peak alertness, beta waves (at 15-30 Hz) predominate. In drowsiness or sleep, the slow delta and theta waves — with frequencies less than 7 Hz — take over. "We suspect now that slow-learning children have more slow wave activity than normal children," Dr. Dykman observes. "We want to find out if this is so, and see whether medication will move them into a normal range of brain wave activity."

In analyzing the frequency recordings that this research will generate, the Varian 610/f-100 computer will use Fourier transformation, a technique for fitting a mathematical series to observed data points.

The same computer system will help scientists learn how the brain works, and help teach hypertensive patients to moderate their blood pressure by controlling their own brain activity.

COMPUTER PRINTS BOOK EACH NIGHT TO HELP RESEARCHERS FIND JOURNALS

*Al Hicks
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A computer at the UCLA Health Sciences Center, Los Angeles, Calif., prints out an updated 550-page "book" every night to help researchers keep up with the 40,000 copies of scientific journals that arrive each year at the school's biomedical library. The nightly printing is done by an IBM System/360 Model 91. It lists all publications on file, including those received earlier that day.

The biomedical library, which serves one of the largest teaching and research complexes of its kind in the country, subscribes to more than 6,500 scientific journals. Its stacks contain 175,000 bound volumes of periodicals.

The computer also provides a daily rundown of those publications not received on time. If staff members see urgent need for a particular issue, they can direct the IBM system to write a follow-up letter to the publisher. In addition, the system displays lists of journals as volumes are complete and ready for binding, gives their location in the stacks and prints identifying slips for an average of 800 volumes of journals the library sends to the bindery each month.

The logging of journals, tracking of missed issues and printing of bindery reports are the main tasks carried out with the aid of the IBM system. However, the computer is programmed so that library staff members may order special lists for internal use — by title, call number or physical location in the library or by name of the agent through whom particular subscriptions are ordered.

In the library, visual display terminals, which resemble TV sets with typewriter keyboards, are used in the check-in process. When a clerk keys in receipt of a new journal, for example, the system records it automatically and the display on the terminal's screen lists the volume number and date of the next issue to be received and when it is expected.

The 7,000 hardcover scientific books that arrive yearly also are computer processed. After a staff member types one standard catalog card, the computer generates 10 or more others that index the book under a variety of classifications.

The UCLA facility has been a pioneer in the use of data processing in libraries, and the research is continuing. Much of the current work is funded by the National Library of Medicine.

COMPUTER AIDS PHARMACISTS IN FILLING PRESCRIPTIONS

*Eleanor D. Midrack
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A computer at Cleveland Metropolitan General Hospital is programmed to help pharmacists spot potential drug overdoses as they fill prescriptions faster and with less chance of error. It has increased the number of prescriptions that can be filled from 80 to 400 an hour. At the same time, the system provides a safeguard against drug overdoses.

When a prescription is received in the pharmacy, a six number coded abbreviation for the drug is keyed over a TV-like terminal into an IBM computer, along with coded information on the patient and doctor. The data is then reviewed by the system, and if not challenged in any way, a nearby printer types out a label to be affixed to the prescription. In addition, the system will indicate the shelf life of a drug and track this for the benefit of the patient.

Several of the TV-like units in the pharmacy are linked to the hospital's central IBM computer, a System/370 Model 155, which also supports other hospital medical and administrative programs. Once the

prescription-filling procedure is complete, the system automatically charges the drug to the patient's account for later billing.

Lee Jackson, operations systems director, who designed and programmed the system, feels that the computer relieves the pharmacist from the chore of typing labels and lets him devote his time to drug selection and preparation. "This also gives the pharmacist additional time to discuss the medication with the patient, a procedure that would not be possible under a manual operation," he said. "In addition, this system goes to the patient's central medical file for further checks, something the pharmacist did not have time to do. It also prints out a label that has more information than most labels do now."

The system also will enable the pharmacy to stock an optimum level of drugs. Based on past usage records, the system will produce a report that highlights those drugs that should be reordered to avoid shortages. Conversely, it will also make it possible to reduce the level of drugs that are infrequently prescribed.

NEW PRODUCTS

M.I.T. LIBRARIES LAUNCH NEW INFORMATION SERVICE

*News Office
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Cambridge, Mass. 02139*

The Massachusetts Institute of Technology's five divisional libraries have launched a new information service that provides rapid and economical access to large bibliographic data bases through computer search techniques. The service is available through NASIC — Northeast Academic Science Information Center — a National Science Foundation-supported program of the New England Board of Higher Education.

Natalie N. Nicholson, director of libraries, said the three major interdisciplinary data bases initially available through NASIC are: (1) CA-Condensates (Chemical Abstracts Condensates) covering chemistry, chemical engineering and related physical sciences; (2) ERIC (Education Resources Information Center) covering education, linguistics and information sciences; and (3) INFORM covering selected areas of business, management, economics and related subjects. In addition, MEDLINE (Medicine, Online) covering biomedical sciences and applications, is being provided through cooperation between M.I.T. and the National Library of Medicine. Together, the four data bases contain reference to more than two million documents.

Search results can be obtained immediately from on-line terminals by using an interactive dialog with the appropriate computer to interrogate the data bases. Users also can have a profile of their research interests filed with the computer. New literature in their field will be searched and search results will be mailed to them.

The libraries, the Electronic Systems Laboratory and the Information Processing Services are cooperating on the program at the Institute. Each divisional library has at least one information specialist to assist the user in translating his problem statement into the languages of the particular computer systems that are pertinent to that problem.

Miss Nicholson said the new service is a national "first" in that it will be a test of the NASIC concept of a regional organization that provides access to a large variety of digital data bases on a fee basis. Fees vary with the amount of service provided by the information specialist, the data base searched and the time spent at the terminal. Since MEDLINE is substantially subsidized by the National Library of Medicine, the cost of searching it is less than for the other data bases. There is a charge of \$8 per hour for the information specialist's time with a minimum charge of \$5. Additional fee details are explained in separate brochures describing each data base.

The NASIC service eventually will include data for all major fields of research interest at M.I.T., Miss Nicholson said. New data bases will be added soon to cover interests in government research, engineering and physics. Based on the experience gained at M.I.T., NASIC plans to expand to cover New York, New Jersey, Pennsylvania and Delaware as well as New England.

SIM ONE ENTERING COMMERCIAL PRODUCTION

*Jean Vandenberg
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SIM ONE, the computer-controlled, plastic-skinned, simulated patient, is entering commercial production. An agreement signed by the University of Southern California (USC) and CapTech Inc., a public OTC (over the counter) corporation of Long Beach, gives CapTech's Division, Sierra Engineering Company of Sierra Madre, exclusive license to fabricate the patient simulator according to a model developed by USC.

SIM ONE is a six-foot manikin with a "skin" of resilient plastic which has been used for anesthesiology training at the USC School of Medicine since 1968. It does not talk — yet. But it breathes, chokes, blinks, coughs, and regurgitates. Anesthesiology residents can become skillful in the delicate and potentially dangerous technique of endotracheal intubation before approaching a human patient.

Intubation, a technique frequently used in anesthesiology, requires insertion of a semi-rigid tube down a patient's throat and upper chest, between the vocal cords, for artificial lung ventilation. SIM ONE will respond to errors in procedure just as a patient would — even to the point of "dying".

SIM ONE can also present symptoms of a patient in shock, such as lowered blood pressure, vanishing pulse, and gasping for breath. Unless an emergency room attendant does the right things quickly, SIM ONE will "die". But unlike a human patient, a flick of the switch will bring SIM ONE back to "life". Computer programs have been carefully designed to simulate exactly the reflexes of a patient so that students may practice the same techniques repeatedly until they reach a professional level of skill.

When SIM ONE became operational in 1968, it created considerable attention for the possibilities it opened for use of simulated patients to teach difficult medical and dental procedures without risk. SIM ONE's versatility and that of its future descendants is limited only by the data fed into its computer system.

RESEARCH FRONTIER

MACHINE EXTENDS COMPUTER GRAPHICS INTO THE DIMENSION OF TOUCH

*Fred Myers
Polytechnic Institute of New York
333 Jay Street
Brooklyn, N.Y. 11201*

Three-dimensional movies that people can touch as well as see may be just around the corner.

Edging mankind one step closer to the "feelies" of Aldous Huxley's "Brave New World," a computer scientist working on his Ph.D. at Polytechnic Institute of New York (PINY) has invented a "tactile simulation device". About the size of a large television set, the machine lets its user feel the form, contours and textures of programmed objects that do not really exist. At the same time, these objects are visualized in three dimensions.

Dr. Michael Noll perfected this device as part of his work on a doctoral dissertation in electrical engineering at Polytechnic. He built his machine at Bell Laboratories in Murray Hill, N.J., where he has been a research scientist for the past 12 years. From 1970 until recently he was on leave to serve as a technical assistant for computers in the Office of Science and Technology of the Executive Office of the President in Washington, D.C.

His invention is a square box with an upright rod projecting through a hole in its cover. Atop the rod is a featherlight knob about the size of a billiard ball. In an "off" or unprogrammed condition, the knob is free to move anywhere within a one-foot cube of empty space above the machine — responding lightly to the touch of a finger in any direction. But when a solid object is programmed into the computer that controls the box, the knob "collides" with the object, scrapes along its surface or bounces off.

With eyes closed, an operator whose fingers are resting on the knob can thus feel a potentially infinite variety of shapes as he moves his hand at random through the empty space.

"I envision a number of education, research and training applications — perhaps most important a sort of computer 'graphic' for the blind," says Dr. Noll. "But what is more, the device could be developed and refined for sighted persons, resulting in an independent, improved and altogether new approach to man-machine communications."

Dr. Noll has coordinated three-dimensional visual simulation with tactile simulation, using a computerized stereoscopic device in concert with his "feelie" machine. He estimates that within two years it would be possible to build a more complex device that will bring tactile sensation to the palm and fingertips as well as the hand and arm.

The present machine — the pioneer, perhaps, of a new communication medium — is mounted on three sliding axes: one for each of the three dimensions. Its movement along each axis is controlled by a small electric motor with a potentiometer to measure the constantly varying distance from the central point to the side of the box. Calculating these three distances, the computer always knows the precise position of the "feelie" knob — and can trigger resistance from the three electric motors just where it is needed to simulate the object being modeled.

MISCELLANEOUS

NEW LANGUAGE FOR COMPUTER FIRM FEATURES GROWL AND 'HO, HO, HO'

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

The Jolly Green Giant has been cut down to size. He now stands 29 inches tall and is dressed in green transistors. And Lincoln-Mercury's snarling cougar has been reduced to a mere 17 pounds, with a trace of a smile softening his snarl.

The transformations have taken place in an art studio in Boston (Mass.) where designer Joe Veno has been laboring to create Honeywell's 1974 computer advertising campaign.

Veno is the man who builds Honeywell's computer animals, a menagerie constructed of diodes, transistors, wires, switches and integrated circuits, that has been featured in the company's advertising for a decade. The latest additions to Veno's gallery are the famed trademark of the Green Giant Co. and the popular symbol of Lincoln-Mercury's sporty mid-size car. Making each sculpture took about two weeks after Veno had prepared illustrations for approval by Honeywell's ad agency. He carved the designs out of urethane foam and then attached parts to the carvings with a special adhesive.

Why is Honeywell using the symbols of other companies in its advertising? Key element of the campaign is letting users describe how Honeywell computers have been successfully applied to their business operations. The Green Giant sculpture, for example, is used in an ad which says, "Here's how Honeywell helps keep the Green Giant jolly." The ad describes how computer terminals are used to process data at 57 locations around the country. A direct quotation from a Green Giant vice president tells how Honeywell "helps us secure a maximum return". Honeywell uses the cougar sculpture in an ad outlining the successful computer applications supplied for Ford Motor Co. "At the Sign of the Cat, we're adding to their kitty," proclaims the Honeywell ad.



— Lincoln-Mercury's live cougar (background) shows feline interest during presentation of late-model cougar made of computer parts. Willard A. Little (left) Midwest regional sales mgr., accepts "cougar" from Kenneth G. Fisher, regional VP of Honeywell's computer operations.

Veno built the sculptures from a collection of computer parts he gathered on "shopping trips" to Honeywell manufacturing plants in the Boston area. "I look for color and interesting designs," he says. "If a part has the right shape and size to fit the concept I'm trying to develop, I try to get it." Veno says he used about 1,000 computer parts to construct the cougar and 600 to build the Green Giant.

NSF MAKES AWARDS TO IMPROVE COMPUTER USE IN RESEARCH

Walter H. Dodd
National Science Foundation
1800 G Street
Washington, D.C. 20550

Nine awards, totaling \$280,400, designed to improve the effectiveness of computers for scientific research recently were announced by the National Science Foundation (NSF). The awards support a cooperative program to develop accurate, consistent, and well-documented mathematical computer programs for researchers.

One of the biggest problems in the computer field is the need to improve the quality of computer programs, called computer software as opposed to computer hardware which consists of computers and other physical equipment. Computer software for scientific research, as well as those for other applications, have developed chaotically over the last decade, the NSF said. NSF is making a special effort to improve the quality of scientific computer programs because of their importance to research.

Errors in scientific computer programs are frequently subtle and may escape detection for months or years. They differ from errors in business computations, for example, when a surprised recipient receives a check for \$99,999.99 when no check was due. An important part of the NSF computer software research is to validate mathematical computer programs for scientific research.

In a collection of scientific computer programs developed with NSF support, no errors in the program were found in the past 14 months with the programs being used by over 200 computer installations. Furthermore, in one specific application the computer running time was reduced to five per cent of that previously required and the accuracy of the computations doubled.

NSF awards were made to: Argonne National Laboratory (Dr. Wayne Cowell); University of Kentucky (Dr. Henry C. Thacher, Jr.); Jet Propulsion Laboratory, California Institute of Technology (Dr. Edward W. Ng); University of Southern California (Dr. Robert F. Tooper); Purdue University (Dr. David S. Dodson); Northwestern University (Prof. Benjamin Mittman); University of Wisconsin (Prof. Larry E. Travis); University of Texas (Dr. David Young); and University of Toronto (Dr. Thomas E. Hull). Argonne National Laboratory, University of Kentucky, and the Jet Propulsion Laboratory will develop the new mathematical computer programs while the other institutions will field test them.

The awards, made for a two year period, constitute a concerted and continuing effort by NSF's Office of Computing Activities to increase the effectiveness of computing resources through the Software Quality Research Program. In addition to NSF support, the project for improved computer software is being supported by the Atomic Energy Commission (AEC).

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Recognition Equipment, Inc., Dallas, Texas	The Singer Co., Business Machines Div., San Leandro, Calif.	Up to 50,000 hand-held OCR (optical character recognition) Wands to be used with Singer's electronic point-of-sale terminals	\$7.5 million (approximate)
Computer Sciences Corp. (CSC), El Segundo, Calif.	U.S. Naval Electronic Systems Command	Providing technical support and management assistance to the command's Special Communications Project Office	\$4+ million
Dataproducts Corp., Woodland Hills, Calif.	Four-Phase Systems, Inc., Cupertino, Calif.	Four models of Series 2000 line printers to be used in new System IV/40 and System IV/70 Intelligent Terminals	\$4+ million
Pertec Corp. (ASE), El Segundo, Calif.	Sperry Univac Div., Sperry Rand Corp., Blue Bell, Pa.	Supplying shared processor data entry systems under a three year, non-exclusive purchase agreement; requirements estimated at more than \$15 million over the 3-year period	\$4 million (approximate)
Control Data Corp., Minneapolis, Minn.	Barclays Bank Limited, United Kingdom	Front-end communications processing hardware and software for Barclays Integrated Network System (BINS) consisting of 3 pairs of CYBER 1000 communications processors, each serving one of three main data centers equipped with IBM 360 and 370 computers	\$4 million
GTE Sylvania Inc., subsidiary of General Telephone & Electronics Corp., Mountain View, Calif.	U.S. Army	Design, development, and implementation of a system providing computer-controlled electronic processing, data storage and retrieval	\$3.4 million
Peripheral Equipment Div., Pertec Corp. (ASE), Chatsworth, Calif.	Facit-Addo, Electrolux, AB, Stockholm, Sweden	Digital magnetic tape transports and disk drivers over a two year period; will be used in data entry systems built by Facit-Addo	\$3 million (approximate)
Xonics, Inc., Van Nuys, Calif.	U.S. Air Force	Data services and analyses for the Advanced Ballistic Reentry Systems (ABRES) Program	\$3 million (approximate)
Litton Industries, Sweda International Div., Beverly Hills, Calif.	Au Printemps, S.A., Creteil, France	A minimum of 750 Sweda Series 725 electronic point-of-sale terminals and related processing equipment	\$3 million
GTE Sylvania Inc., subsidiary General Telephone & Electronics Corp., Mountain View, Calif.	U.S. Army	Research contract for tactical jamming system which includes development of ground-based, very-high-frequency communications equipment that uses computer control	\$2.9 million
National Cash Register Co., Dayton, Ohio	Myer Emporium Limited, Sydney, Australia	350 NCR 280 electronic terminals and 22 NCR 723 data collectors; conversion to electronic point-of-sale equipment has already begun	\$1 million
Bunker Ramo Corp., Trumbull, Conn.	Franklin Savings Bank of New York City, Computer Center, Brooklyn, N.Y.	A new computer-based system of BR 2001 teller terminals which will be used to equip its 11 banking offices	\$750,000+
Sperry Univac Div., Sperry Rand Corp., Blue Bell, Pa.	Federal Aviation Administration, Anchorage Air Route Traffic Control Center, Anchorage, Alaska	Installing a modified ARTS III (Automated Radar Terminal System) to process radar data sent over telephone lines from long-range radar atop a mountain known as Murphy Dome	\$750,000
Scientific Technology Inc., Mountain View, Calif.	U.S. Army Corps of Engineers, Huntsville, Ala.	Equipping 19 major U.S. Postoffices with sorter sensor controls for bulk mail handling	\$425,000 (approximate)
Incoterm Corp., Natick, Mass.	United Air Lines, Denver, Colo.	64 "intelligent" computer display terminals, 50 P-100 printers and other auxiliary equipment for United's Food Service Management and Information System; also will develop software programs for a variety of tasks	\$400,000+
Cubic Corp., Western Data Products subsidiary, San Diego, Calif.	Boeing Aerospace Co., Seattle, Wash.	Fully computerized automatic fare collection system to be put into operation in nation's first Personal Rapid Transit system in Morgantown, West Va.	—
Interdata Inc., Oceanport, N. J.	Remote Computing Corp. (RCC), Palo Alto, Calif.	Six Series Model 50 communications processors to be used primarily as regional message concentrators in Automated Mortgage Management Information Network (AMMINET) operated by Federal Home Loan Mortgage Corp. and associated banks, insurance companies, brokerages, savings and loan institutions	—
National Cash Register Co., Dayton, Ohio	J. C. Penney Company, Inc. New York, N.Y.	Up to 15,000 NCR 280 electronic point-of-sale terminals and 300 NCR 725 in-store computers and associated peripheral equipment	—
National Sharedata Corp., Dallas, Texas	First National Bank of Odessa, Odessa, Texas	Five year extension to original contract agreement to manage computer facilities and market automated data processing services	—
Recognition Equipment, Inc., Dallas, Texas	National Cash Register Co., Dayton, Ohio	Up to 50,000 hand-held OCR (Optical character recognition) Wands to be used with NCR data terminals	—
TRW Data Systems, Hawthorne, Calif.	J. C. Penney Company, Inc. New York, N.Y.	Leasing up to 7,000 point-of-sale credit communications terminals and 11 computer-based communication system	—
Computer Sciences Corp. (CSC), El Segundo, Calif.	National Aeronautics & Space Administration (NASA), Langley Research Center, Hampton, Va.	Further improvement and maintenance of NASTRAN, a general-purpose software system for analyzing the behavior of complex structures under a variety of loading conditions	—

NEW INSTALLATIONS

OF	AT	FOR
Basic/Four Model 350 system	Maroun Brothers, Inc., Lawrence, Mass.	Inventory control, a comprehensive order catalogue, order entry invoicing, accounts receivable, payroll and accounts payable
Basic/Four Model 400 system	Sterling Publishing Co., Inc., Irvine, Calif.	Customer invoices, two-step order entry, inventory control, accounts receivable, sales analysis, and authors' royalty accounting
Burroughs B 1700 system	W. L. Jackson Manufacturing Co., Inc., Chattanooga, Tenn.	Accounts receivable and payable, payroll and general ledger; future use includes perpetual inventory, compilation of sales statistics and cost accounting (system valued at \$104,000)
	Unidare, Limited, Dublin, Ireland	Financial accounting, inventory control and production control
Burroughs B 6700 system	Consolidated City of Jacksonville, Florida, Jacksonville, Fla.	A variety of administrative and service functions for Board of Education, Water and Sewer Dept., Tax Collector and Tax Assessor
	Dime Savings Bank of New York, New York, N.Y.	On-line banking services in 8 offices; also mortgage accounting, payroll, general ledger and financial forecasting
	Lomas and Nettleton Company, Houston, Texas	Data communications between computer center and 7 regional service centers across nation; also detailed reports to investors, and mortgage processing and accounting
	New York Clearing House Association (NYCHA), New York, N.Y.	Handling growing volume of interbank money transfers (system valued at \$4.8 million)
Digital Equipment DECsystem 10	University of Washington, Seattle, Wash.	Medical, instructional and administrative data processing; class scheduling and registration
	Engineering Sciences and Technology Building, Brigham Young University, Provo, Utah	Supporting studies in computer science and programming languages and in research, problem solving and application programming in mechanical and electrical engineering, and physical, biological, and social sciences (system valued at \$700,000)
	Pima Community College, Tucson, Ariz.	Administrative and instructional purposes including a complete library inventory and circulation system, multi-campus use for student registration (system valued at \$471,000)
Hewlett-Packard HP-2100 system	Gerber Scientific Instruments Co., Hartford, Conn.	Use in automatic systems
Hewlett-Packard HP-3000 system	ESL, Inc., Sunnyvale, Calif.	Cataloging aerial photos supplied by NASA/Ames Research Center, Moffett Field, Calif., through Earth Resources Aircraft Project; this is a subcontract with Lockheed Aircraft Co.
IBM System/7	Burdine's, Dadeland, Florida	Monitoring and controlling power to conserve electric energy
NCR Century 100 system	Delannoy of Lille, Lille, France	Remote processing of invoices via 8 typewriters; data from invoice preparation produces reports for order control, delivery, payroll, sales and stock management
NCR Century 101 system	The McLane Company, Inc., Temple, Texas	Processing orders, accounts payable and receivable, and also for inventory control
NCR Century 200 system	SKM, Stains, France	Order processing, payroll preparation, and inventory
NCR Century 251 system	Consolidated Computer Systems, Inc., Oklahoma City, Okla.	A broad range of accounting services to various organizations including hospitals
Systems 86 system	The Bendix Research Laboratories, Southfield, Mich.	Research and development for automotive steering, braking and emission controls, earth satellite and aerospace systems (replaces another digital system) (system valued at approximately \$350,000)
Univac 494 system	Northwest Orient Airlines, Minneapolis/St. Paul, Minn.	Upgrading present computer complex; will be tied into existing real-time system, presently composed of two UNIVAC 494's (system valued at approximately \$2 million)
Univac 1106 system	Gustave Roussy Institute (I.G.R.) Villejuif, France	Wide variety of cancer treatment and research applications including patient administration and patient care, and administration of facilities; also real-time updating of medical and administrative patient files; radiotherapy and scintigraphy, calculations and keeping medical research statistics
	Sisters of St. Mary Mother House, Data Center, St. Louis, Mo.	Health care information system to initially serve five Midwest hospitals (system valued at \$1.2 million)
Xerox 530 system	National Accelerator Laboratory, Batavia, Ill. (4 systems)	Control of the 300-billion-electron-volt proton synchrotron (system valued at \$375,000)
	The Research Corporation (TRC) of New England, Boston, Mass.	Environmental impact studies for New England business firms and federal, state and local government agencies
	Sangamon State College, Springfield, Ill.	Computer-supported course work in programming, operations and vocational training (system valued at \$98,000)

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 MARCH 15, 1974

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL (\$000)	NUMBER OF INSTALLATIONS			NUMBER OF UNFILED ORDERS	
				In U.S.A.	Outside U.S.A.	In World		
Part 1, United States Manufacturers A-H								
Adage, Inc. Boston, Mass. (A) (Feb. 1974)	AGT 10 Series AGT 100 Series Adage 300 Adage 400	4/68 1/72 3/74 3/74	X 100-300 100-300 30-50	(S) (S) (S) (S)	32 16 0 0	3 12 0 0	35 28 0 0	X 2 3 2
Autonetics Anaheim, Calif. (R) (Jan. 1969)	RECOMP II RECOMP III	11/58 6/61	X X		30 6	0 0	30 6	X X
Bailey Meter Co. Wickliffe, Ohio (R) (Aug. 1972)	Metrotype Bailey 750 Bailey 755 Bailey 756 Bailey 855/15 Bailey 855/25 Bailey 855/50	10/57 6/60 11/61 2/65 12/72 4/68 3/72	40-200 40-250 200-600 60-400 50-400 100-1000 100-1000	(S) (S) (S) (S) (S) (S) (S)	8 37 7 17 2 16 12	0 15 0 12 1 0 0	8 52 7 29 3 16 12	- - - - - - 2
Bunker-Ramo Corp. Westlake Village, Calif. (A) (June 1973)	BR-130 BR-133 BR-230 BR-300 BR-330 BR-340 BR-1018 BR-1018C	10/61 5/64 8/63 3/59 12/60 12/63 6/71 9/72	X X X X X X 23.0 -		160 79 15 18 19 19 -	- - - - - - - -	- - - X - - - -	X X X X X X - -
Burroughs Detroit, Mich. (N) (R) (Mar. 1974)	B100/500 B200 B205/220 B300 Series B700 Series B1700 Series B2500 B2700 B3500 B3700 B4500/4700 B5500 B5700 B6500/6700 B7500 B7700 B8500	7/65 11/61 1/54; 10/58 7/65 3/73 8/72 2/67 8/72 5/67 11/72 10/71 3/63 12/70 2/68; 8/72 4/69 2/72 8/67	2.8-10.0 5.0 X 7.0 1.0-2.3 2-10 4-10 4.5-10.0 5.3-15.0 12.5-30.0 14.0-90.0 23.5-34.0 12-32 18-30 44.0 50-150 200.0		1141 - 42 - 32 78 277 33 569 17 78 152 27 51 - 1 1	677 - 4 - 13 26 123 16 300 6 26 47 8 25 - - -	1818 500 46 - 43 104 400 49 869 23 104 199 35 76 - 1 1	- - X - - - - - - - - - - - - 13 4 -
Computer Automation, Inc. Newport, Calif. (R) (April 1971)	108/208/808 116/216/816	6/68 3/69	5.0 8.0	(S) (S)	165 215	10 20	175 235	110 225
Consultronics, Inc. Dallas, Texas (A) (April 1973)	DCT-132	5/69	0.7		75	65	135	-
Control Data Corp. Minneapolis, Minn. (R) (Mar. 1974)	G15,G20 LGP-21,LGP-30 M1000 RPC4000 636/136/046 Series 160/8090 Series 921/924-A 1604/A/B 1700 Series 3100/3150/3170 3200 3300 3400 3500 3600 3800 6200/6400/6500 6600 6700 7600	7/55; 4/61 12/62; 9/56 - 1/61 - 5/60 8/61 1/60 5/66 5/64-10/70 5/64 9/65 11/64 8/68 6/63 1/66 8/64 8/64 6/67 12/68	X X - X - X X X X 3.8-4.0 3-18 13.0 20-38 18.0 12-30 52.0 53.0 41-66 115.0 130.9 235.0		- 1 - - - - - - - 100 51 106 6 5 23 17 77 56 3 8	- - - - - - - - - 58 42 100 11 15 17 3 63 33 2 4	315 487 - 75 29 610 29 59 479 158 93 206 17 20 40 20 140 89 5 12	X X - X X X X X X - - - - - - - - - - - -

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL (\$ (000))	NUMBER OF INSTALLATIONS			NUMBER OF UNFILED ORDERS
				In U.S.A.	Outside U.S.A.	In World	
Control Data (cont.)	Cyber 70/72	11/71	28-47	6	15	21	-
	Cyber 70/73	3/72	34-49	6	11	17	-
	Cyber 70/74	12/71	41-100	2	3	5	-
	Cyber 70/76	12/71	82-150	2	3	5	-
	Cyber 1000	1/73	250-1,200	(S)	-	-	-
Data General Corp. Southboro, Mass. (A) (Feb. 1974)	Nova	2/69	9.2	(S)	-	C	-
	Supernova	5/70	9.6	(S)	-	C	-
	Nova 1200	12/71	5.4	(S)	-	C	-
	Nova 800	3/71	6.9	(S)	-	C	-
	Nova 820	4/72	6.4	(S)	-	C	-
	Nova 1210/1220	2/72	4.2;5.2	(S)	-	C	-
				Total:			9205
Datacraft Corp. Ft. Lauderdale, Fla. (A) (Feb. 1974)	6024/1	5/69	52-300	(S)	18	18	0
	6024/3	2/70	33-200	(S)	119	26	145
	6024/4	8/73	19.9	(S)	11	3	14
	6024/5	5/72	11-80	(S)	115	2	117
	6024/5R	2/73	30-60	(S)	3	0	3
Datapoint Corp. San Antonio, Texas (A) (Feb. 1974)	Datapoint 2200	2/71	151-292	-	-	4000	-
Digiac Corp. Smithtown, N.Y. (A) (Feb. 1974)	Digiac 3060	1/70	9.0	(S)	80	0	80
	Digiac CT-10	-	9.0	(S)	21	0	21
	Digiac 3090	2/74	4.6	(S)	4	0	4
Digital Computer Controls, Inc. Fairfield, N.J. (A) (Feb. 1974)	D-112	8/70	0.12	-	840	184	1024
	D-116	1/72	0.1	-	1306	119	1425
Digital Equipment Corp. Maynard, Mass. (A) (Sept. 1973)	PDP-1	11/60	X	-	48	2	50
	PDP-4	8/62	X	-	40	5	45
	PDP-5	9/63	X	-	90	10	100
	PDP-6	10/64	X	-	-	-	23
	PDP-7	11/64	X	-	-	-	100
	PDP-8	4/65	X	-	-	-	1402
	PDP-8/I	3/68	X	-	-	-	3127
	PDP-8/S	9/66	X	-	-	-	918
	PDP-8/L	11/68	X	-	-	-	3699
	PDP-8/E,8/M,8/F	5/72	3.9-4.9	(S)	-	-	9150
	PDP-9	12/66	X	-	-	-	436
	PDP-9L	11/68	X	-	-	-	40
	DECSystem-10	12/67	700-3000	(S)	-	-	300
	PDP-11/10,11/20/11R20, 11/40	-	10.8-13.8	(S)	-	-	3280
	PDP-11/05,11/15	-	10.8	(S)	0	0	3170
	PDP-11/45	-	-	-	0	0	650
PDP-12	9/69	-	-	-	-	725	
PDP-15	2/61	17.0	(S)	-	-	625	
LINC-8	9/66	X	-	-	-	200	
Electronic Associates Inc. West Long Branch, N.J. (A) (Sept. 1973)	640	4/67	1.2	110	61	171	0
	8400	7/67	12.0	21	8	29	0
	PACER 100	7/72	1.0	50	45	95	25
General Automation, Inc. Anaheim, Calif. (A) (Mar. 1974)	SPC-12	1/68	-	-	-	2750	-
	SPC-16	5/70	-	-	-	3000	-
	System 18/30	7/69	-	-	-	500	-
General Electric (Process Control Computers) see Honeywell							
Hewlett Packard Cupertino, Calif. (A) (Mar. 1974)	2114A, 2114B	10/68	X	-	-	1210	-
	2115A	11/67	X	-	-	342	-
	2116A, 2116B, 2116C	11/66	X	-	-	1446	-
	2100A, 2100S	9/71	-	-	-	6000	-
	3000	11/72	-	-	-	50	-
Honeywell Information Systems Wellesley Hills, Mass. (R) (Mar. 1974)	Series 50: G53,G55	-	-	-	-	-	-
	c58	3/71	0.7-6.0	6	1	7	-
	Series 100: G105	6/69	0.9-1.4	6	-	6	-
	G115	4/66	2.2	400	680	1080	-
	G118/A,/B	-	-	-	-	-	-
	G120	3/69	2.9	-	2	2	-
	G128	-	-	-	-	-	-
	G130	12/68	4.5	-	-	-	-
	G138	-	-	-	-	-	-
	5	4/69	1.5	-	-	-	-
	10	4/66	3.3	-	-	-	-
	15	4/69	6.9	-	-	-	-
	Series 200: 105	4/69	1.7	-	-	-	-
	110	8/68	2.7	180	93	273	-
	115,/2	6/70	3.5	30	-	30	-
	120	1/66	4.8	800	160	960	-
	125	12/67	7.0	150	220	370	-
	200	3/64	7.5	803	275	1078	-
	1015	2/71	8.5	-	-	-	-
	1200	2/66	9.8	230	90	320	-
	1250	7/68	12.0	129	55	184	-
	2015	1/71	13.4	4	-	4	-
	2200	1/66	18.0	125	59	184	-
	3200	2/70	24.0	40	25	65	-
	4200	8/68	32.5	18	2	20	-
	8200	12/68	50.0	12	3	15	-
	Series 2000: 2020	2/73	2.1	49	6	55	-
	2030,/A	1/73	2.1	11	3	14	-
	2040,/A	4/72	3.1	86	23	109	-
	2050,/A	4/72	4.3	50	20	70	-
	2060	4/72	7.0-66.0	25	8	33	-
	2070	5/72	12.0-66.0	20	1	21	-
	2088	4/72	27.0-55.0	2	1	3	-
	Series 6000: 6025	3/71	20.0	-	-	-	-
	6030/6040	7/71	20.0-60.0	1	11	12	-

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL \$ (000)	NUMBER OF INSTALLATIONS			NUMBER OF UNFILLED ORDERS
				In U.S.A.	Outside U.S.A.	In World	
Honeywell (cont.)	6050/6060	7/71	20.0-60.0	6	44	50	-
	6070/6080/6180	7/71	20.0-100.0	2	1	3	-
	G405/410	2/68	5.5-10.0	38	5	43	-
	G415/420	5/64	7.3-23.0	148	300	448	-
	G425/430	6/64	9.6-17.0	93	75	168	-
	G435/440	9/65	14.0-25.0	55	31	86	-
	G615	3/69	32.0	3	11	14	-
	G625	4/65	X	23	3	26	X
	G635	5/65	47.0-100.0	41	3	44	-
	400/600	12/60	X	103	55	138	X
	G205/210/215	9/63-6/64	X	101	26	127	X
	G225-275	4/61-11/68	X	288	62	350	X
	1400/1800	1/64	X	19	11	30	X
	DDP19, 21, 24	5/61	X	89	14	93	X
	DDP112, 116, 124	4/65	X	376	124	500	X
	DDP224, 290	3/65	X	57	7	64	X
	DDP316	6/69	0.6	408	45	453	-
	DDP324	7/68	4.0	7	0	7	-
	DDP416	6/67	X	182	168	350	X
	DDP516	9/66	1.2	769	131	900	-
	632	12/68	3.2	8	4	12	-
	716	6/72	0.8	3	0	3	-
	1602	-	-	-	-	-	-
	1642	-	-	-	-	-	-
	1644	-	-	-	-	-	-
	1646	-	-	-	-	-	-
	1648, /A	11/68	12.0	-	-	20	-
	GE-PAC 3010	5/70	X	25	1	26	X
	GE-PAC 4010	10/70	6.0	30	4	34	32
	GE-PAC 4020	2/67	X	200	60	260	X
	GE-PAC 4040	8/64	X	45	20	65	X
	GE-PAC 4050	12/66	X	23	2	25	X
	GE-PAC 4060	6/65	X	18	2	20	X

GAMES AND PUZZLES – Continued from page 27

WUNSILLABO

Another kind of exercise or puzzle in the direction of making words and text understandable by computers is to convert a passage entirely into one-syllable words. There are some exceptions: (1) additional syllables produced by one of the endings “s, es, d, ed, ing, ly” are allowed; (2) figures in digits and symbols such as \$25 are allowed.

This kind of puzzle has been named WUNSILLABO. Here is the current one:

WUNSILLABO PUZZLE 744

(1) According to information reaching me from Jones, he has been engaged in a long continued effort to instruct Smith in culinary arts and activities. (2) No candidate for the position of master of culinary arts, Jones reported to me, has ever been more difficult for Jones to educate. (3) Jones asserted vehemently that he would surely discontinue his efforts at instructing because of certain failure in the future. (4) Jones confirmed that Smith was an excellent dishwasher, but that he (Jones) was convinced that dishwashing represented the outermost limits of Smith's mental powers and practical capabilities.

WUNSILLABO PUZZLE 743 – A SOLUTION

(If better solutions are received, we plan to publish them.)

1. I do not trust rule by a king, and have felt so at all times in the past.
2. In his long boring talk there were lots of thoughts that were wrong.
3. Brown is sending Smith a load of spices and putting them in Smith's care to sell and pay for.
4. Smith said that the earth in Maine was shaking a great deal and in a lot of places.
5. These old Scotch firms that make thick jam from the pulp of fruits have ways of making good jam that

have been handed down for long years, and for all these years they and no one else sell such good jams.

6. The sharp drop down the ice cliff in the great stream of hard yet broken ice was so much in the way for Clark that he could not go past it and go on.
7. Your bill shows that you owe us \$179. Please send us this sum as soon as you can.
8. Please tell me if you are searching in the mail that comes in for any pieces that you want and need fast. As soon as the mail comes in and is slit, I will be glad to look at it and bring you at once any kinds of mail that you tell me of and may wish to see.

Comment. The only reason for success in these efforts to express the given eight sentences in one-syllable words is that no words like “Alabama” (four syllables) and “before” (two syllables) having no one-syllable equivalents were used in the original language to be paraphrased.

This raises an interesting question, and one worth looking into:

What minimum additional vocabulary of words of more than one syllable must be allowed or granted in order that an adequate paraphrase for any sentence may be expressed?

Our thanks to the following individuals for submitting their solutions to – **Naymandij Puzzle 742:** A. Orsava, Toronto, Ontario, Canada – **Naymandij Puzzle 741-1:** Stephen K. Kelleher, Pennfield, N.Y. – **Numble 742:** Edward A. Bruno, Daytona Beach, Fla.; T. P. Finn, Indianapolis, Ind.; A. Orsava, Toronto, Ontario, Canada – **Numble 741:** Harry E. Easton, Richmond, Va.; T. P. Finn, Indianapolis, Ind. – **Numble 7312:** Nihan Lloyd-Thurston, S. Nutfield, Surrey, England

CALENDAR OF COMING EVENTS

- 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 1-3, 1974:** ADAPSO 40th Management Conference, Caesar's Palace, Las Vegas, Nev. / contact: ADAPSO, 551 Fifth Ave., New York, NY 10017
- 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:** 4th Annual Federation of NCR Users' Meeting, Netherlands Hilton Hotel, Cincinnati, Ohio / contact: Federation of NCR Users', The National Cash Register Co., Dayton, OH 45479
- May 6-8, 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 Conference, New York Hilton, New York, N.Y. / contact: Joseph E. Nove, BOCES II, 201 Sunrise Highway, Patchogue, NY 11772
- 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 4-6, 1974:** Symposium: Simulation of Computer Systems, National Bureau of Standards, Gaithersburg, Md. / contact: Paul F. Roth, National Bureau of Standards, U.S. Dept. of Commerce, Room A265—Technology Bldg., Washington, DC 20234
- 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 17-19, 1974:** Design Automation Workshop, Holiday Inn, Denver, Colo. / contact: Nitta P. Dooner, IBM T. J. Watson Research Center, P.O. Box 218, Yorktown Heights, NY 10598
- June 23-26, 1974:** 1974 DPMA INFO/EXPO (22ns Annual Data Processing Conference and Business Exposition), Auditorium & Convention Hall, Minneapolis, Minn. / contact: Data Processing Management Assoc., 505 Busse Highway, Park Ridge, IL 60068
- 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
- June 24-26, 1974:** Society for Industrial and Applied Mathematics 1974 Annual Meeting, California Institute of Technology, Pasadena, Calif. / contact: SIAM, 33 S. 17th St., Philadelphia, PA 19103
- 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
- July 29-Aug. 1, 1974:** 2nd Jerusalem Conference on Information Technology, Jerusalem, Israel / contact: Prof. C. C. Gottlieb, Dept. of Computer Science, University of Toronto, Toronto, Ontario, Canada M5S1A7
- 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. 8-10, 1974:** 6th International Conference on Urban Transportation, Pittsburgh, Penna. / contact: John W. Besancency, Pittsburgh Convention & Visitors Bureau, P.O. Box 2149, Pittsburgh, PA 15230

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