September, 1974
Vol. 23, No. 9

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September, 1974

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CORRECTIONS

In the August, 1974, issue of *Computers and People:*

Page 3, left column, second paragraph from the bottom, the statement M4. should read:

M4. Add up column 2, this is item 4.

Front cover, line 2 from bottom, replace "Part 8" by "Part 7".

Front Cover Picture

This air compressor is one of several huge machines under computer control at TRW's Equipment Group plant and corporate offices in Cleveland. TRW engineer Norm Vicha (right) and IBM's Mordy Pelleg talk over TRW's energy management system. (See page 35.)

Departments

Key

[A] – **Article**
[C] – **Monthly Column**
[E] – **Editorial**
[F] – **Forum**

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.

EDITORIAL

The Almost Invisible Mountain

The harm from computers is often visible.

Computers have been used to invade the privacy of people; wrong records have gotten into data bases; and wrong decisions have been rendered. This has led to widespread concern, even from the Federal government. Before he became president, Gerald Ford was chairman of a governmental committee on privacy.

Computers have sent wrong bills. When a computer repeatedly sends a wrong bill, the recipient often writes and writes and writes, to no effect. Finally he writes the company president, the local newspaper, and his congressman, and makes an earthquake, so as to correct the computer system. It took me four years to persuade the computer used by Xerox Corp. to change our address from 813 Washington St. to 815 Washington St.

But the best story I know is of an employee of the City of New York who failed for three weeks after the computer was installed to get his computerized weekly pay check. So he started to sue the City and the computerized system. Finally, the program bug was found and removed: this employee's last name was "Void".

But the great mountain of benefits from computers is largely inconspicuous and invisible.

A handbag of a certain kind is available in a local store for Mrs. Joe Doakes to buy – because a computer has determined that this particular model is selling rapidly and should be restocked. Repeat this kind of small clerical discovery for millions of items of stock in thousands of businesses, – and think of the improvement of service and the reduction of waste.

A car rolls off an assembly line adjusted to just what Mr. Joe Doakes wanted and ordered – because a computer has noted the special choices that Joe Doakes made when he ordered his car, and the computer has inserted his specifications at just the right moments into the converging streams of parts entering the assembly line.

Long distance telephone calls are timed to the minute and second, recorded as to the time when made, and computed far more correctly – because a computer instead of a human clerk has performed the billing.

Joe Doakes calls up in Iowa City to reconfirm an airplane flight at 12:35 out of Cedar Rapids. He made the reservation in Boston two weeks previously. "Oh yes," says the young lady in the local airline office, "Mr. Doakes, that's right. And you are going on from O'Hare to Boston on the 2:30 flight. All is OK." Joe does not feel any more like a nobody, but like a somebody; and some of the time he even feels a little like a VIP – because the computer is putting back personality and individuality into the operation of complex systems. And, in addition, he can rely on the plans he has made, and that is satisfying, and gives him more efficiency.

In hospitals, intensive medical care facilities depend vitally on the computer. It can remember what should be done when. It can discover early conditions that are going wrong, and report them. It can query nurse or doctor decisions to prevent sad mistakes. The role of the computer has been phenomenal.

It is reasonable to estimate that the cost of nearly everything where clerical labor used to be largely involved is going down and staying down from 10 to 30 percent and more over what it would otherwise have to be. This is the result of the tireless, speedy, and reliable functioning of computers.

There is an almost invisible mountain of benefits from computers.

It is dangerous to lose sight of it. There are portions of society who want to go back to farming from morning to night, and better still the wilderness. This sort of response may prevent sensible and well rounded judgements of computers, and their role in a modern world of persons striving to be human in modern ways.

Edmund C. Berkeley

Edmund C. Berkeley
Editor

MULTI-ACCESS FORUM

THE PURPOSE OF FORUM

- To give you, our readers, an opportunity to discuss ideas that seem to you important.
- To express criticism 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.

GOVERNMENT

USE OF COMPUTERS IN GOVERNMENT

1. From Thomas J. Downey, Legislator
County Legislature
County of Suffolk
Long Island, N.Y.

4 Udall Road
West Islip, N.Y. 11795

Recently I became aware of your magazine and subsequently I have spent some time reading past issues of "Computers and People."

I am involved with government as an elected official and am trying to be as effective and knowledgeable as possible. Having been made more aware of computers by reading your magazine than I was previously, I now feel that without more knowledge of computers in this day and age, I may not be as effective and knowledgeable as possible; and so, this letter.

I am hoping that you might be able to detail for me your thoughts on creative use of computer technology at the government level. Now we at Suffolk County do make use of computers for bookkeeping and data storage, but I am beginning to believe that there might be further currently usable roles available for computers in government. If possible, please list for me the governmental units — local, state, regional, national or international — that are making the best current use of computer technology.

As important to me, I would be most anxious to know if any individual, elected officials are making direct use of computers in the course of their work. As I stated earlier, I am aware that our county makes extensive but limited use of computers. It is obvious that the state and national governments do, but I have not heard of elected representatives making direct use of computers. It seems as though there might be a place for a computer terminal in the legislator's office. I would like to have your views on that, and once again ask you to make mention of any such current use of which you are aware.

On the other hand, citizens need to be protected from possible tyrannical use of computer-stored data. What type of legislation and other legal protections would you like to see enacted to prevent the misuse of computer data? What needs to be done to protect the rights, freedom and privacy of the individual in a computerized society? And finally, how would you respond to the pessimistic view voiced by Dr. Stafford Beer, University Professor of Cybernetics, Manchester University, in his article which appeared in your magazine?

Your editorials would certainly seem to indicate that you are knowledgeable in all areas of computer technology, and your editorials, "The Nine Most Important Problems in the World and Their Relation to Computers," and "Pressure to Conform," have led me to believe that you are interested in government involvement in computer use. If you don't feel that you can adequately respond to my inquiries, please direct either me or my letter to other individuals or groups who might be knowledgeable in these areas.

Congratulations on a fine magazine.

2. From the Editor

We appreciate very much your letter, and wish that the editors of our magazine could adequately answer your letter.

I am not sure that any one person in the computer field knows enough to answer all the questions in your letter. The field of computers and data processing is still expanding rapidly; it is hard to find all the information about new applications. For example, I do not know the governmental units — local, state, regional, national and international — that are making the best use of computer technology. Probably, such a question can only be answered by an expensive and time-consuming survey — and even then the situation would change materially in the course of a year.

I hope that by publication of your interesting letter in "Computers and People" many of our readers and their associates may be persuaded to write to you, with a copy to us.

PROBLEMS OF MAN

COMPUTERS, SOCIAL RESPONSIBILITY, AND WAR

Grace C. Hertlein, Assoc. Prof.
Dept. of Computer Science
California State Univ., Chico
Chico, Calif. 95926

Readers of "Computers and People" may be interested to know that a great many issues of "Computers and People" (formerly "Computers and Automation") are used as background references in a course I teach at California State University-Chico, entitled

(please turn to page 32)

Computer Science and Its Relation to Mathematics

Dr. Donald E. Knuth
Computer Science Dept.
Stanford University
Stanford, CA 94305

"RECENT TRENDS HAVE MADE IT POSSIBLE TO ENVISION A DAY WHEN COMPUTER SCIENCE AND MATHEMATICS WILL BOTH EXIST AS RESPECTED DISCIPLINES, SERVING ANALOGOUS BUT DIFFERENT ROLES IN A PERSON'S EDUCATION."

A new discipline called Computer Science has recently arrived on the scene at most of the world's universities. The present article gives a personal view of how this subject interacts with Mathematics, by discussing the similarities and differences between the two fields, and by examining some of the ways in which they help each other. A typical nontrivial problem is worked out in order to illustrate these interactions.

WHAT IS COMPUTER SCIENCE?

Since Computer Science is relatively new, I must begin by explaining what it is all about. At least, my wife tells me that she has to explain it whenever anyone asks her what I do, and I suppose most people today have a somewhat different perception of the field than mine. In fact, no two computer scientists will probably give the same definition; this is not surprising, since it is just as hard to find two mathematicians who give the same definition of Mathematics. Fortunately it has been fashionable in recent years to have an "identity crisis," so computer scientists have been right in style.

My favorite way to describe computer science is to say that it is the study of algorithms. An algorithm is a precisely-defined sequence of rules telling how to produce specified output information from given input information in a finite number of steps. A particular representation of an algorithm is called a program, just as we use the word "data" to stand for a particular representation of "information" [14]. Perhaps the most significant discovery generated by the advent of computers will turn out to be that algorithms, as objects of study, are extraordinarily rich in interesting properties; and furthermore, that an algorithmic point of view is a useful way to organize knowledge in general. G. E. Forsythe has observed that "the question 'What can be automated?' is one of the most inspiring philosophical and practical questions of contemporary civilization" [8].

From these remarks we might conclude that Computer Science should have existed long before the advent of computers. In a sense, it did; the subject is deeply rooted in history. For example, I recently found it interesting to study ancient manuscripts, learning to what extent the Babylonians of 3500 years ago were computer scientists [16]. But computers are really necessary before we can learn much about the general properties of algorithms; human beings are not precise enough nor fast enough to carry out any but the simplest procedures. Therefore the potential richness of algorithmic studies was not fully realized until general-purpose computing machines became available.

I should point out that computing machines (and algorithms) do not only compute with numbers; they can deal with information of any kind, once it is represented in a precise way. We used to say that a sequence of symbols, such as a name, is represented inside a computer as if it were a number; but it is really more correct to say that a number is represented inside a computer as a sequence of symbols.

The French word for computer science is Informatique; the German is Informatik; and in Danish, the word is Datalogi [21]. All of these terms wisely imply that computer science deals with many things besides the solution to numerical equations. However, these names emphasize the "stuff" that algorithms manipulate (the information or data), instead of the algorithms themselves. The Norwegians at the University of Oslo have chosen a somewhat more appropriate designation for computer science, namely Databehandling; its English equivalent, "Data Processing" has unfortunately been used in America only in connection with business applications, while "Information Processing" tends to connote library applications. Several people have suggested the term "Computing Science" as superior to "Computer Science."

Of course, the search for a perfect name is somewhat pointless, since the underlying concepts are much more important than the name. It is perhaps significant, however, that these other names for computer science all de-emphasize the role of computing machines themselves, apparently in order to make the field more "legitimate" and respectable. Many people's opinion of a computing machine is, at best, that it is a necessary evil: a difficult tool to be used if other methods fail. Why should we give so much emphasis to teaching how to use computers, if they are merely valuable tools like (say) electron microscopes?

Computer scientists, knowing that computers are more than this, instinctively underplay the machine aspect when they are defending their new discipline. However, it is not necessary to be so self-conscious

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about machines; this has been aptly pointed out by Newell, Perlis, and Simon [22], who define computer science simply as the study of computers, just as botany is the study of plants, astronomy the study of stars, and so on. The phenomena surrounding computers are immensely varied and complex, requiring description and explanation; and, like electricity, these phenomena belong both to engineering and to science.

When I say that computer science is the study of algorithms, I am singling out only one of the "phenomena surrounding computers," so computer science actually includes more. I have emphasized algorithms because they are really the central core of the subject, the common denominator which underlies and unifies the different branches. It might happen that technology someday settles down, so that in say 25 years computing machines will be changing very little. There are no indications of such a stable technology in the near future, quite the contrary; but I believe that the study of algorithms will remain challenging and important even if the other phenomena of computers might someday be fully explored.

The reader interested in further discussions of the nature of computer science is referred to [17] and [29], in addition to the references cited above.

IS COMPUTER SCIENCE PART OF MATHEMATICS?

Certainly there are phenomena about computers which are now being actively studied by computer scientists, and which are hardly mathematical. But if we restrict our attention to the study of algorithms, isn't this merely a branch of mathematics? After all, algorithms were studied primarily by mathematicians, if by anyone, before the days of computer science. Therefore one could argue that this central aspect of computer science is really part of mathematics.

However, I believe that a similar argument can be made for the proposition that mathematics is a part of computer science! Thus, by the definition of set equality, the subjects would be proved equal; or at least, by the Schroder-Bernstein theorem, they would be equipotent.

My own feeling is that neither of these set inclusions is valid. It is always difficult to establish precise boundary lines between disciplines (compare, for example, the subjects of "physical chemistry" and "chemical physics"); but it is possible to distinguish essentially different points of view between mathematics and computer science.

The following true story is perhaps the best way to explain the distinction I have in mind. Some years ago I had just learned a mathematical theorem which implied that any two n x n matrices A and B of integers have a "greatest common right divisor" D. This means that D is a right divisor of A and of B, i.e., A = A'D and B = B'D for some integer matrices A' and B'; and that every common right divisor of A and B is a right divisor of D. So I wondered how to calculate the greatest common right divisor of two given matrices. A few days later I happened to be attending a conference where I met the mathematician H. B. Mann, and I felt that he would know how to solve this problem. I asked him, and he did indeed know the correct answer; but it was a mathematician's answer, not a computer scientist's answer! He said, "Let R be the ring of n x n integer matrices; in this ring, the sum of two principal left ideals is principal, so let D be such that

$$RA + RB = RD.$$

Then D is the greatest common right divisor of A and B." This formula is certainly the simplest possible one, we need only eight symbols to write it down; and it relies on rigorously-proved theorems of mathematical algebra. But from the standpoint of a computer scientist, it is worthless, since it involves constructing the infinite sets RA and RB, taking their sum, then searching through infinitely many matrices D such that this sum matches the infinite set RD. I could not determine the greatest common divisor of $\begin{smallmatrix}1&2\\3&4\end{smallmatrix}$ and $\begin{smallmatrix}4&3\\2&1\end{smallmatrix}$ by doing such infinite operations. (Incidentally, a computer scientist's answer to this question was later supplied by my student Michael Fredman; see [15, p. 380].)

One of my mathematician friends told me he would be willing to recognize computer science as a worthwhile field of study, as soon as it contains 1000 deep theorems. This criterion should obviously be changed to include algorithms as well as theorems, say 500 deep theorems and 500 deep algorithms. But even so it is clear that computer science today does not measure up to such a test, if "deep" means that a brilliant person would need many months to discover the theorem or the algorithm. Computer science is still too young for this; I can claim youth as a handicap. We still do not know the best way to describe algorithms, to understand them or to prove them correct, to invent them, or to analyze their behavior, although considerable progress is being made on all these fronts. The potential for "1000 deep results" is there, but only perhaps 50 have been discovered so far.

In order to describe the mutual impact of computer science and mathematics on each other, and their relative roles, I am therefore looking somewhat to the future, to the time when computer science is a bit more mature and sure of itself. Recent trends have made it possible to envision a day when computer science and mathematics will both exist as respected disciplines, serving analogous but different roles in a person's education. To quote George Forsythe again, "The most valuable acquisitions in a scientific or technical education are the general-purpose mental tools which remain serviceable for a lifetime. I rate natural language and mathematics as the most important of these tools, and computer science as a third" [9].

Like mathematics computer science will be a subject which is considered basic to a general education. Like mathematics and other sciences, computer science will continue to be vaguely divided into two areas, which might be called "theoretical" and "applied". Like mathematics, computer science will be somewhat different from the other sciences, in that it deals with man-made laws which can be proved, instead of natural laws which are never known with certainty. Thus, the two subjects will be like each other in many ways. The difference is in the subject matter and approach — mathematics dealing more or less with theorems, infinite processes, static relationships, and computer science dealing more or less with algorithms, finitary constructions, dynamic relationships.

Many computer scientists have been doing mathematics, but many more mathematicians have been doing computer science in disguise. I have been impressed by numerous instances of mathematical theories which are really about particular algorithms; these theories are typically formulated in mathematical terms that are much more cumbersome and less natural than the equivalent algorithmic formulation today's computer scientist would use. For example, most of the content of a 35-page paper by Abraham Wald can be presented in about two pages when it is recast into algorithmic terms [15, pp. 142-144]; and numerous other examples can be given. But that is a subject for another paper.

EDUCATIONAL SIDE-EFFECTS

A person well-trained in computer science knows how to deal with algorithms; how to construct them, manipulate them, understand them, analyze them. This knowledge prepares him for much more than writing good computer programs; it is a general-purpose mental tool which will be a definite aid to his understanding of other subjects, whether they be chemistry, linguistics, or music, etc. The reason for this may be understood in the following way: It has often been said that a person does not really understand something until he teaches it to someone else. Actually a person does not really understand something until he can teach it to a computer, i.e., express it as an algorithm. "The automatic computer really forces that precision of thinking which is alleged to be a product of any study of mathematics" [7]. The attempt to formalize things as algorithms leads to a much deeper understanding than if we simply try to comprehend things in the traditional way.

Linguists thought they understood languages, until they tried to explain languages to computers; they soon discovered how much more remains to be learned. Many people have set up computer models of things, and have discovered that they learned more while setting up the model than while actually looking at the output of the eventual program.

For three years I taught a sophomore course in abstract algebra, for mathematics majors at Caltech, and the most difficult topic was always the study of "Jordan canonical form" for matrices. The third year I tried a new approach, by looking at the subject algorithmically, and suddenly it became quite clear. The same thing happened with the discussion of finite groups defined by generators and relations; and in another course, with the reduction theory of binary quadratic forms. By presenting the subject in terms of algorithms, the purpose and meaning of the mathematical theorems became transparent.

Later, while writing a book on computer arithmetic [15], I found that virtually every theorem in elementary number theory arises in a natural, motivated way in connection with the problem of making computers do high-speed numerical calculations. Therefore I believe that the traditional courses in elementary number theory might well be changed to adopt this point of view, adding a practical motivation to the already beautiful theory.

These examples and many more have convinced me of the pedagogic value of an algorithmic approach; it aids in the understanding of concepts of all kinds. I believe that a student who is properly trained in computer science is learning something which will implicitly help him cope with many other subjects; and therefore there will soon be good reason for saying that undergraduate computer science majors have received a good general education, just as we now believe this of undergraduate math majors. On the other hand, the present-day undergraduate courses in computer science are not yet fulfilling this goal; at least, I find that many beginning graduate students with an undergraduate degree in computer science have been more narrowly educated than I would like. Computer scientists are of course working to correct this present deficiency, which I believe is probably due to an over-emphasis on computer languages instead of algorithms.

SOME INTERACTIONS

Computer science has been affecting mathematics in many ways, and I shall try to list the good ones here. In the first place, of course, computers can be used to compute, and they have frequently been applied in mathematical research when hand computations are too difficult; they generate data which suggests or demolishes conjectures. For example, Gauss said [10] that he first thought of the prime number theorem by looking at a table of the primes less than one million. In my own Ph.D. thesis, I was able to resolve a conjecture concerning infinitely many cases by looking closely at computer calculations of the smallest case [13]. An example of another kind is Marshall Hall's recent progress in the determination of all simple groups of orders up to one million.

Secondly, there are obvious connections between computer science and mathematics in the areas of numerical analysis [30], logic, and number theory; I need not dwell on these here, since they are so widely known. However, I should mention especially the work of D. H. Lehmer, who has combined computing with classical mathematics in several remarkable ways; for example, he has proved that every set of six consecutive integers > 285 contains a multiple of a prime ≥ 43.

Another impact of computer science has been an increased emphasis on constructions in all branches of mathematics. Replacing existence proofs by algorithms which construct mathematical objects has often led to improvements in an abstract theory. For example, E. C. Dade and H. Zassenhaus remarked, at the close of a paper written in 1963, "This concept of genus has already proved of importance in the theory of modules over orders. So a mathematical idea introduced solely with a view to computability has turned out to have an intrinsic theoretical value of its own." Furthermore, as mentioned above, the constructive algorithmic approach often has pedagogic value.

Another way in which the algorithmic approach affects mathematical theories is in the construction of one-to-one correspondences. Quite often there have been indirect proofs that certain types of mathematical objects are equinumerous; then a direct construction of a one-to-one correspondence shows that in fact even more is true.

Discrete mathematics, especially combinatorial theory, has been given an added boost by the rise of computer science, in addition to all the other fields in which discrete mathematics is currently being extensively applied.

For references to these influences of computing on mathematics, and for many more examples, the reader is referred to the following sampling of books, each of which contains quite a few relevant papers: [1], [2], [4], [5], [20], [24], [27]. Peter Lax's article [19] discusses the effect computing has had on mathematical physics.

But actually the most important impact of computer science on mathematics, in my opinion, is somewhat different from all of the above. To me, the most significant thing is that the study of algorithms themselves has opened up a fertile vein of interesting new mathematical problems; it provides a breath of life for many areas of mathematics which had been suffering from a lack of new ideas. Charles Babbage, one of the "fathers" of computing machines, predicted this already in 1864: "As soon as an Analytical Engine [i.e., a general-purpose computer] exists, it will necessarily guide the future course of the science. Whenever any result is sought by its aid, the question will then arise — By what course of calculation can these results be arrived at by the machine in the shortest time?" [3]. And again, George Forsythe in 1958: "The use of practically any computing technique itself raises a number of mathematical problems. There is thus a very considerable impact of computation on mathematics itself, and this may be expected to influence mathematical research to an increasing degree" [26]. Garrett Birkhoff [4, p. 2] has observed that such influences are not a new phenomenon; they were already significant in the early Greek development of mathematics.

I have found that a great many intriguing mathematical problems arise when we try to analyze an algorithm quantitatively, to see how fast it will run on a computer. Another class of problems of great interest concerns the search for best possible algorithms in a given class; see, for example, the recent survey by Reingold [25]. And one of the first mathematical theories to be inspired by computer science is the theory of languages, which by now includes many beautiful results; see [11] and [12]. The excitement of these new theories is the reason I became a computer scientist.

Conversely, mathematics has of course a profound influence on computer science; nearly every branch of mathematical knowledge has been brought to bear somewhere. I recently worked on a problem dealing with discrete objects called "binary trees," which arise frequently in computer representations of things, and the solution to the problem actually involved the complex gamma function times the square of Riemann's zeta function [6]. Thus the results of classical mathematics often turn out to be useful in rather amazing places.

The most surprising thing to me, in my own experiences with applications of mathematics to computer science, has been the fact that so much of the mathematics has been of a particular discrete type. Such mathematics was almost entirely absent from my own training, although I had a reasonably good undergraduate and graduate education in mathematics. Nearly all of my encounters with such techniques during my student days occurred when working problems from the "American Mathematical Monthly". I have naturally been wondering whether or not the traditional curriculum (the calculus courses, etc.) should be revised in order to include more of these discrete mathematical manipulations, or whether computer science is exceptional in its frequent application of them. ....

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The Quality of Working Life in the Computer Industry in Australia

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"THE TIME HAS ARRIVED FOR THE COMPUTER INDUSTRY TO MATCH ITS INNOVATIVE APPROACH IN THE FIELD OF TECHNICAL DEVELOPMENTS WITH A SIMILAR INNOVATIVE APPROACH IN THE FIELDS OF INDIVIDUAL AND SOCIAL DEVELOPMENT."

Introduction

The basic objective of this paper is to stimulate discussion on the quality of working life of people in the computer industry. Firstly, I propose to open up the discussion on three issues which could have an increasingly negative effect on the quality of working life of people in the industry. These issues are industrial relations, the use of the computer to prop up outdated bureaucratic structures and practices, and the concept of corporate dishonesty. These issues will not be new to many of you, but I suggest that with the changing environment in which the industry operates, they could become critical variables for many individuals and organisations in the future.

Secondly, I propose to put forward some suggestions to open up the discussion in relation to technological assessment, continuous learning, and some new reward systems in the industry. I do this in the belief that the time has arrived for the computer industry to match its innovative approach in the field of technical developments with a similar innovative approach in the fields of individual and social development. This is not to suggest that many organisations in the industry do not invest heavily in human resource development. However, I believe the changing values in the community make it imperative to question the appropriateness of much of the current training and education programs and reward systems. The demand for talented people will continue to outstrip the supply in the foreseeable future in Australia. The computer industry can no longer rely on just glamour and money to attract and retain such people.

Industrial Relations

The computer industry in Australia developed in the 1960's in the predominantly hermetically sealed, air conditioned, white collar and grey flannel world of the nation's major cities (and Canberra). The bright young men and women who flocked to join the new bandwagon to the pot of gold tended to have a maximum of formal education and a minimum of experiential learning in industry. Most of them had not dirtied their hands or their minds by first hand contact with industrial Australia. If they thought about old established industrial institutions such as unions, it was rarely in terms of their relevance to the new computer world.

The skirmishes with the clerks union over redundancy in the oil industry in the 1960's appeared to have little long term impact on the computer industry. The predominant concerns of the industry were too firmly fixed on marketing, financial and technical issues. The concentration of the unions on the redundancy issue meant that computer companies and their clients were able to ignore or gloss over the changes which the computer brought to our social systems. Such selective inattention to important industrial relations issues has continued as fairly standard corporate behaviour in the computer industry. However, the industrial relations environment and climate has changed dramatically in recent years.

Turbulent Scene of Industrial Relations

I suggest that the second half of the 1970's could see the computer industry moved into the centre of the increasingly turbulent industrial relations scene. The dominant area of conflict will almost certainly shift from the old one of redundancy to the quality of the life of people working in industries affected by computer systems. Yet there is probably no group in Australia who are less equipped to handle industrial conflict than the people at all levels of the computer industry. The average shop steward in the metal trades has infinitely greater experience in industrial relations than even the majority of personnel people in the computer industry.

And in case you think the unions are short on their understanding of computers, let me inform you that Laurie Carmichael, the powerful Assistant National Secretary of the Amalgamated Metal Workers

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did much of the programming for their union's computer systems.

Militant White Collar Workers

The recent disputes in the banking industry clearly indicate that previously non-militant career white collar workers in our community are becoming increasingly militant over issues which affect the quality of their working life. The failure of some systems analysts to understand the culture of branch banking has resulted in the development of inappropriately designed systems which have turned some branch banks into industrial powder kegs. I have heard computer people argue that this is merely a transition problem and that everything will be rosy when they get the bugs out of the system. I am afraid that this may indicate a faith in a technological solution to a social problem and a frighteningly naive view of how industrial relations develop in an organisation or an industry. Unfortunately, industrial relations naiveté pervades both the computer people and their clients in the banking industry. So we can expect to see a lot of buck passing until some executives in the computer and/or banking industry recognise the seriousness of the problem and are willing to do something about it.

The long-talked-of proliferation of computer systems in manufacturing in Australia now seems certain to eventuate in the remainder of the 1970's. The development of minicomputers and the saturation of some previously lucrative markets should provide the necessary incentive for computer organisations to develop major marketing efforts in the manufacturing sector, particularly in the field of process control. But how adequately equipped are Australia's computer organisations to cope with the industrial relations issues they will meet as they come up against the culture of industrial Australia?

An executive of one of the market leaders in the computer industry told me his organisation was totally ill-prepared for this new scene. I suggest he is one step in front of many of his peer group: he has recognised the problem. Of course some computer organisations have had some experience in the manufacturing sector, but a cursory glance at the experience of one of these organisations indicates some practices that could trigger off some long-term industrial conflict. A client with constructive industrial relations policies and practices is unlikely to welcome such a naive group of computer technocrats. In the near future, there is a distinct possibility of seeing plant managers, union delegates and workers lining up together against the computer boys from the city.

Computers and the Preservation of Bureaucratic Conservatives

There is growing concern amongst many socially aware people in the computer industry that ADP systems are often used to prop up outmoded bureaucratic structures and practices which otherwise would have collapsed or been modernised. It has come as a traumatic shock to many computer people to realise that often, instead of modernising our organisational structures, they have been merely prolonging the use of out-dated systems by making them more efficient and thus blocking organisational and other reforms. An example of this was the use of the computer to process the results of the external School Certificate Examinations in New South Wales. Progressive educators for years had advocated the dropping of the School Certificate as an external exam. But by the use of the computer, the educational bureaucracy in New South Wales was able to preserve the external method of examination. It was not till finally the increasing cost of the exam became a problem for the State Treasury, that we were able to achieve the educational reform which had been achieved years before with the old Intermediate Certificate. Progressive educators see this as a classic case of a computer system providing the means by which the bureaucracy were able to turn back the educational clock.

Other examples of the use of computer systems to maintain conservative structures, and even develop reactionary trends, can be found in the field of personnel practices and procedures. This is a particularly significant area because it affects so many people.

At present the use of the computer is tending to reduce the freedom of choice in the design of organisations. For instance, large organisations are tending to be over-influenced by the technical values of systems people and the authoritarian values of the people whom they serve. This is an important reason why many people see the computer as a symbol of authoritarianism, contralism and inflexibility at a time when more and more people are striving for freedom, involvement and flexibility in their working lives.

Narrow View of Marketing

I have heard computer marketing people argue that their job is only to provide a system which meets the client's specifications. I suggest such a narrow view of marketing may be socially irresponsible and against the long term interests of their organisation and the computer industry. There is need to drop such a lap-dog approach to computer marketing and for the systems marketing people to ask new questions of their clients and propose alternative ideas. For instance, in the field of education, instead of propping up archaic examinations, innovative computer people could show their clients how they could assist in developing alternative methods of assessment, particularly methods, such as participative assessment, that are more in line with contemporary values.

The propping up of old institutions by making them more efficient could be adding considerably to our long-term economic and social costs. For as an institution becomes less and less appropriate, there will be demands to make it even more efficient. By the time it eventually collapses, disintegrates, or is abolished, the economic and social costs of creating or developing a more appropriate institution may have been dramatically increased.

Corporate Dishonesty

The quality of life of individuals working for computer marketing organisations and their clients is being affected by the growing concern, particularly among many non-marketing people, over issues which they cluster under the umbrella of "corporate dishonesty". In talking to people in the industry in recent months, I have been surprised by how quickly they raise the spectre of corporate dishonesty. It is not a simple issue, nor is it confined, as many senior managers would like to think, only to people working in other organisations. For instance, I raised the issue recently with two senior executives from organisations who are major clients of ADP organisations. The first executive said he would not have an interview with any person from a computer marketing organisation unless he had a witness present. (This in itself is a pretty damning indictment of the marketing practices in the industry.) In his experience, he felt that he could only trust representatives of one computer organisation. The second executive however, said that from his experience, the indictment of corporate dishonesty applied to only one computer marketing organisation. Yet the firm singled out by the first executive as the only honest one in the industry was in fact the same firm singled out by the second executive as the only dishonest one in the industry.

This is a more complex and fundamental problem than one of the public or corporate client relations. In fact, any managers who hand it over to their PR department either fail to understand the significance of the problem or do not have the courage to tackle it. In either case, they cannot expect to maintain, let alone gain, respect from the concerned ADP employees, their clients or the informed public.

There is inadequate research evidence to analyse fully the complex multi-dimensional and inter-dependent reasons for the concern over corporate dishonesty in the computer industry. However, I will highlight two interdependent factors which underlie the emotional anguish that many computer people feel on this issue.

Simplistic Goals of Profit Growth

Firstly, for many Boards of Directors, the concept of setting corporate goals appears to mean assessing the current year's profit and adding, say, 25% for the next year. This simplistic "annual profit growth" mentality puts pressure on marketing people to view their work in line with narrow short term organizational objectives and values. It positively encourages people to sign up clients before the end of the year, even though it may mean selling a hurriedly-put-together package which will require a considerable amount of patching up by someone else in the new year. This policy of encouraging the development of annual achievers at almost any cost, appears to be building up a ground swell of discontent and disillusionment among employees of computer organisations and their clients.

Underpowered Systems

A second and interdependent factor underlying the concept of corporate dishonesty is the pressure felt by many computer people to sell and develop underpowered or less appropriate systems to meet the increasing price competition in the industry. This is perhaps the prime reason why many systems analysts believe that their integrity, and consequently the quality of their working life, is being eroded by what they regard as dishonest marketing practices.

Meeting Goals at the Expense of Colleagues

The idea of developing corporate policies and practices which encourage individuals to progress by meeting goals at the expense of their colleagues and clients is just not an acceptable value to a dramatically increasing number of people in contemporary Australia. It may have worked in the "growth-at-any-cost" mentality which pervaded this country in the 1960's, but "growth-at-any-cost" is no longer an idea in good currency in the mid 1970's.

Ralph Nader has been encouraging employees in North America to "blow the whistle" if their employers' policies and practices are at odds with community standards. There are many concerned people in the computer industry today who are agonizing over when they should start blowing the whistle. And I would strongly suggest that some of the economic and social pressures which effectively restrained the potential whistle-blowers in the past, may not restrain such people in the future.

Technological Assessment

In North America, and more recently in Japan, there has been growing emphasis on technological assessment. According to the Japanese Government's Science and Technology Agency, technological assessment is "the evaluation of scientific technology to direct it towards better serving the people's welfare. Specifically, it attempts to estimate the effects of science and technology on man, society and nature, weigh their advantages and disadvantages, and find the optimum ways to use and develop them". (Yoshida, 1973/74.)

I suggest that sophisticated purchasers of computer systems in the future will carry out or commission a technological assessment (TA) by a multi-disciplined group before signing any contracts for new systems. The TA would include an assessment of the intended and likely unintended social consequences of adopting the new system. This of course means that computer organisations would need to dramatically change their marketing strategies to include social assessments of their systems. This in turn would mean a drastic change in the orientation of some marketing training programs and the employment of new style researchers in computer organisations. As clients gain more sophistication in their buying of computer systems, they are also likely to favour marketing groups whose track record shows that their systems are designed to create a maximum of socio-technical benefits and a minimum of social dislocation and industrial conflict.

Continuous Learning

It is now becoming more widely accepted that most students in secondary schools and centres of tertiary education should gain at least an elementary understanding of the uses and abuses of computers. This is essential if we are to break down the general fear that hinders much of the discussion of the computer by people outside the computer industry. A democracy works best with populations which are informed about the key issues that affect the quality of their lives. And computers in the future will certainly continue to impact on the lives of an increasing number of people.

However, the narrowness of much of computer education and training at all levels means that few people are capable of informed discussion on the economic, social and political impact of the computer. For instance, the commerce student who learns to punch computer cards for a package program is probably doing little more than learning finger dexterity. There is an urgent need therefore, for people in the fields of social science and computers to combine to develop a range of appropriate learning systems based on an understanding of our changing socio-technical environment.

Sensitivity to Turbulent Social Systems

Perhaps the most urgent need is to develop new education programs for systems analysts and systems engineers so that they can develop socio-technical systems rather than narrow technical systems. At present much of the existing formal engineering education and training is based on a dominant system of technical values, such as efficiency and productivity. In a world of changing social and economic values this tends to dramatically reduce an engineer's sensitivity to the changing and often turbulent social systems within which his technical systems must operate.[1] In the past, many engineers overcame the social deficiencies of their narrow formal education by the experiential learning they gained from on-the-job involvement with rank and file workers. However, computer engineers rarely have this opportunity as they normally work in the isolation of an air conditioned city office. Therefore, I believe that centres of tertiary education and computer organisations which specialize in training systems analysts must aim at developing people who are capable of designing socio-technical systems.[2] And it must be emphasised that this cannot be achieved by studying technical courses in one department of a university with a diversion for one or two hours a week to a humanities course in another department.

In developing these new socio-technical education programs, provision must be made for the existing system analysts to develop an understanding of the significance of the continuously changing economic, social, and educational environment in which their systems must operate. Such learning programs are likely to have a high benefit-to-cost ratio for both the individuals and the organisations for which they work. They could also help bridge the generation gaps which are frustrating many people in the computer industry.

Courses in Marketing that Sow Industrial Discord

Perhaps I should also re-emphasise the need to review the courses for marketing people in the computer industry so that they can understand the socio-technical impact of their work. In a number of case studies, in a variety of industries, I have been able to discern an increasing relationship between marketing and industrial conflict. Frequently the marketing people who complain about industrial conflict are often the cause of it, both inside their clients' and their own organisation.

There is also an urgent need to communicate the idea of changing social systems to the executives in the computer industry so that they can understand the growing frustrations of their staff. For an industry which markets communication systems, it is rather frightening the number of times I am asked by computer people "how do you get through the hierarchial barriers to the men at the top?" Many information systems men of the 70's are feeling increasingly frustrated at their inability to get ideas through the executive iron curtain, or should I say, the teak veneer curtain. I believe the most effective way to break through the teak veneer curtains is to develop appropriate continuous learning systems for executives, so that they too can keep abreast of the changing economic, social and educational scenes from which they are now protected. Before I am drowned out by people muttering "where do we get the time?" let me say I recently heard one of IBM's top technical development men in the United States, tell a group of systems engineers that he religiously devotes two hours a day to reading, or conversing with people, outside the computer scene. Perhaps that is why he is at the top.

The Computer Sub-Culture

The increasing movement of people out of the computer sub-culture into general management and administrative positions in other industries presents another important educational challenge. For unless we develop appropriate retraining, re-education and rehumanising programs for many of these people, they could become a serious threat to the quality of working life of their new work groups.

This threat has already become a reality for some clerical groups in the public sector as ADP people move to promotion positions in general administration. Public Service union delegates have told me of individuals coming from the ADP units who tend to have considerable difficulty relating to their new work situation. Two of the reasons given for this are, firstly, that they tend to treat their new subordinates as if they can be programmed like a computer, and secondly, that they tend to be notorious non-communicators, having been conditioned to expressing themselves in the "garbage in, garbage out" in-group jargon of computer people. This tends to make them both unattractive and incomprehensible to their new work groups. This in turn reinforces the ex-computer person's pre-conceived prejudices about the lesser mortals which they now have to manage. Such vicious circles of animosity are at least partly due to the narrow computer education programs of the past.

Hopefully, new learning systems will be developed to reduce the gap between the computer sub-culture and the outside world. In the meantime however, we should give some thought to the transition problems of people who have spent many years in the almost closed sub-culture of the computer world and who are likely to be moving in increasing numbers into very different and often more open working environments.

Finally, let me strongly counsel against the quick-fix package-education programs or the occasional brief exposure to a behavioural scientist as a solution to your learning problems. What is needed is the development of continuous open learning systems which acknowledge firstly, that many computer people tend to develop tunnel visions by their constant involvement with closed systems, and secondly, that organisations in the future must serve a range of human values. Development of such learning systems will not be easy, but it presents a great challenge for people who are willing and able to develop their sociological imagination.[3]

Reward Systems

After many years in an organisation or industry, there appears to be an increasing number of people who desire to revitalise or renew their personal development, their family relationships or their community involvement. If organisations wish not only to retain, but to revitalise many of these people, then there is a need to understand the changing range of values and goals of individuals and to develop reward systems which are relevant individual as well as corporate goals.

The concept of rewarding people by giving them a trip to a company convention is a hangover from American corporate values of the 1950's and 1960's. These normally all-male junkets are at odds with values of many of the younger generation and are becoming a repetitive bore for many of the older generation. Young wives and girl friends increasingly resent corporate rewards which expose their loved ones to the male chauvinist pressures which many regard as synonymous with the American businessmen's convention. Unless corporations develop reward systems that can be shared by young couples, then increasingly these so-called rewards may prove to be counter productive.

Let me put forward for your discussion, a few alternative ideas which I believe are more in line with the range of human values and individual and group goals of the 1970's.

Leave for the Purpose of Learning

Firstly, a system of learning leave which would allow a person to choose an individual program of study which would give him or her an opportunity for further personal development. The study could be carried out at a centre of tertiary education in Australia or overseas. Or it could be an experiential learning program involving a craft or an art. I know of one computer person who has developed a keen interest and active involvement in archaeology. Such learning leave would allow a family to share in the reward system. This of course, is very similar to the sabbatical leave concept existing in universities and colleges of advanced education in Australia, a concept which has helped universities to retain many people who might otherwise have been tracted to more lucrative jobs in government or in industry.

Secondly, exchange programs could be developed between computer organisations and centres of tertiary education. It would be a valuable two-way exchange. Industry people could be given an opportunity to broaden their circle of friends and open up new areas of interest.

Leave for the Purpose of Social Contribution

Thirdly, social science leave has been developed by organisations such as IBM and Xerox in the United States, but I have not been able to find similar initiatives by local branches of international computer organisations. The idea behind this form of leave is to allow an individual to contribute, without short-term personal financial sacrifice, to community projects which have no connection with their employer's business or industry. For instance, an employee of a computer company may wish to work with a community project involving aborigines, migrants, aged or physically handicapped. He or she could be given leave on full pay for example, for a number of days a week or a month, or for a block period such as three to six months. Such opportunities may provide the type of reward needed to retain the services of the growing number of community and socially minded people.[4] Such leave would also help organisations to develop a continuing source of first hand information on social changes and values which could be vital to their future.

Flexible Working Time

Fourthly, the introduction of systems of flexible working time based on the different organisational needs and life styles and values of their employees is another option open to organisations in the computer industry. There is already a considerable range of flexible time programs being developed in a wide variety of industries and countries. Although many computer organisations in Australia allow their employees some flexibility in daily working times, there appears to be little imaginative development in terms of annual hours. I recently reviewed a project in which the American consulting group involved set an annual total of working hours for each of its consultants; when this was completed, the consultants were free of corporate commitments. This allowed members of the group to have annual learning leave as well as recreation leave. In a period of constant change, annual learning leave may be just as essential as annual recreation leave, particularly for people associated with the computer industry.

I can imagine by now there are a number of people muttering, not necessarily under their breath, that I must think that they are running not-for-profit organisations. In reply, all I can say is, that unless you look for some new options in your corporate goals and reward systems, I believe that your organisation may run the risk of joining the not-for-profit organisations of the future.

Accounting that Recognizes Losses from Social Turbulence

Computer organisations should begin to ask their accountants to develop full cost sytems which take cognizance of, firstly, the turbulence, frustration and losses which result from technical systems which ignore or run counter to the social systems and, secondly, the financial and human costs of an organisation's failure to develop, retain and motivate appropriate human resources. Given the increasing instability of urban industrial society, can corporate leaders still afford the luxury of restricting their decisions to traditional simplistic notions of profit and growth?

Australia's Neighbours

As Australia increasingly becomes a knowledge-based post-industrial society, we will tend to increase our overseas marketing of people with ideas and techniques. Hopefully, these people will be chosen not simply on the basis of their technical skills, but also on their sensitivity to different cultural values and goals and an awareness that appropriate data or skills may not be available for some sophisticated systems. In addition, they should realise that they may need to look at possible alternative systems rather than simply sell software designed for Australian requirements. For instance, the idea of marketing a system, one of the prime objectives of which is to conserve manpower in a fully employed economy, is unlikely to appeal to many neighbouring governments who are faced with large pools of educated and uneducated unemployed.

Thick-Skinned Champion of Data Processing

The exporting of a thick-skinned all-Australian ADP champion may do more long term damage to the quality of life of our Asian or Pacific neighbours than a shipload of Australian football stars on one of their end-of-the-season Asian or Pacific rampages. I raise this issue because recently I participated in a seminar with a group of government officials from Africa, Asia and the Pacific. And one of the key concerns expressed by them was the potential damage that could be caused to their societies by forceful marketing of inappropriate western technology and systems to unsophisticated consumers.

Conclusion

I have raised issues and asked questions which I believe to be important to your future. Again let me stress they are not issues which can be competently handled by PR departments. They are the responsibility of people in management, marketing, systems development and operations. And to use good old Australian non-computer language, I believe that the people and the organisations which can construc-

(please turn to page 41)

The Evolution of Telephone Connecting

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> *"One can't help but wonder how long . . . before voice controlled computers will be saying, 'May I have your credit card number please?' "*

The telephone, like many other commonly accepted inventions, is widely used but little understood. Although most people know how to place a telephone call, relatively few have any conception of how the telephone network operates. The purpose of this article is to briefly acquaint the reader with some of the highlights in the evolution of the telephone network, placing special emphasis on the most recent development — TSPS.

Central Exchanges

When Alexander Graham Bell invented the telephone in the late 1800's the entire telephone network consisted of two telephones directly connected by a pair of wires. As the number of telephone users increased it soon became apparent that it was impractical to attempt to directly connect each pair of telephones. In the case of a small town with one hundred homes, direct connection would have required ninety-nine telephones in each home. To avoid this problem, the central exchange system was developed.

A central exchange was simply a centralized location at which all local telephone lines terminated. Using this system it was possible for an operator, at the central exchange, to connect any two telephones in the exchange by simply splicing the proper wires together. In actual practice, calls were connected via switchboard which consisted of a series of cords, jacks, and plugs. By selectively plugging a pair of wires into the correct jacks, the operator easily connected any two telephones in the exchange.

Inter-City Calls

As transmission capabilities improved, the need arose for a system capable of connecting inter-city and inter-state calls. This need was met through the installation of special telephone lines, called trunks, connecting several small central exchanges to one larger central exchange which, in turn, was connected to other large central exchanges, thereby making inter-city and inter-state calling possible. An example will illustrate the mechanics of this system: a call from Grand Prairie, Texas (a suburb of Dallas) to LaGrange, Illinois (a suburb of Chicago) would have proceeded from the party in Grand Prairie to the operator in the Grand Prairie central exchange, to the Dallas operator, to the Chicago operator, to the LaGrange operator who would ring the desired party in LaGrange. If this system sounds cumbersome by today's standards, it is. Often the most difficult part of completing a long distance call was determining which central exchanges should be linked together. The old saying "You can't get there from here" may have originated as a result of this system.

Dial Offices and Direct Distance Dialing

With the constant increase in calling volume it became more and more time consuming to use operators to establish local calls. The solution to this problem was the development of dial offices. The term "dial office" refers to a telephone office that employed special equipment which, when utilized in conjunction with the dial telephone, enabled customers to directly dial local calls. Although some dial offices were in operation as early as 1930, it was the years immediately following World War II that saw the conversion of most of the country to dialing. in addition to temporarily reducing the large volume of calls requiring operator completion, dial offices also paved the way for the next major breakthrough — toll dialing network.

The toll dialing network is a call routing system which connects a call from dial office to dial office automatically. Using this system our call from Grand Prairie to LaGrange could be completed by the party in Grand Prairie calling the local operator who records the pertinent billing data, then dials the call into the toll dialing network. The call is automatically connected through Dallas, Chicago, and LaGrange to the LaGrange party without requiring the assistance of any additional operators. The Grand Prairie operator need only time the call and disconnect the cords when the call is terminated.

In the 1950's the toll dialing network was combined with automatic message accounting (AMA) to produce direct distance dialing (DDD). Automatic message accounting is a system by which the pertinent billing information of a directly dialed call (i.e. calling phone number, date, called number, connect time, and disconnect time) is automatically recorded. This information is then utilized in either the manual or mechanized preparation of bills. Since the toll dialing network routes and connects calls, and AMA automatically records billing information and times calls, DDD has virtually eliminated the need for operator assistance in connecting long distance station-to-station calls.

The development of these various network improvements has made it possible for the telephone company to keep pace with the public's growing demand for fast, accurate, and efficient completion of calls. Each improvement has reduced the types of calls necessitating operator assistance to the point that, today, the operator need only handle special calls such as collect, person to person, credit card, third number, conference, and coin.

Other Improvements

One of the greatest challenges to the telephone industry has been the development of refinements that streamline the physical mechanics of operating a switchboard. Since the establishment of the toll dialing network, the proper procedure for placing an operator assisted call is to dial "0" and dictate to the operator all of the information necessary for the proper completion and billing of the call. The operator writes down all pertinent data on a call record, places the call, times it, and terminates the connection by disconnecting the cords when the call is completed. Since these manual operations are very time consuming, they have a large impact on the number of calls an operator can handle per hour. Greater efficiency has been obtained through the installation of semi-automatic timing devices, similar to time-clocks, that are used to stamp the start and finish times on the call record.

Finally, in the mid 1950's, the introduction of the computer made possible the use of the mark-sensed card for recording call data. By darkening the proper places on a computer card with a special pencil, the operator can quickly record the necessary billing information in machine readable form. This innovation has gone a long way toward improving both long distance service and the accurate billing of long distance calls.

Traffic Service Position System

In 1964 the first TSPS installation was introduced in Cleveland, Ohio. TSPS, which stands for traffic service position system, is actually a computer complex consisting of a base location and several operator consoles. The base location is the building which houses the SPC or stored program control (the computer hardware and software) and the TSPS application (the telephone equipment needed to perform the programmed instructions). Associated with each base location is a maximum of 280 operator consoles, grouped into offices, which may be located as far as eighty miles away from the base location. The maximum number of offices in a TSPS complex is nine; each with a maximum of sixty-two operator positions (providing the entire complex does not exceed 280 positions). There are currently seventy-eight such complexes in operation in the United States.

TSPS removes the operator from the traditional switchboard and sits her in front of a modern electronic console with no cords, plugs, or jacks. The console is connected to the TSPS computer which now performs many of the routine tasks associated with completing calls. To illustrate, let's assume our Grand Prairie to LaGrange call is actually a collect call being placed through a TSPS operator. To begin with, the customer in Grand Prairie dials "0" plus the LaGrange area code and telephone number, much as he would for a DDD call. By dialing "0" before the number, the caller signals the TSPS computer that he will require operator assistance for this call. The call proceeds through the toll dialing network in the same automatic manner as a DDD call except that, as the call is progressing, the computer simultaneously connects the customer to the first available TSPS operator. The call is signaled on the operator's console as a lighted button which she depresses to answer the call. By the time the operator answers, the computer has already recorded the date, calling number, and called number, therefore the operator need only determine the type of call the customer wishes to place. In this case, the Grand Prairie customer announces this is a collect call; the operator quickly depresses the collect button which instructs the computer to bill the call to the LaGrange number at the correct rate. She then depresses another button which allows the call to make the final connection and ring the LaGrange number. This accomplished, another button is depressed to begin automatic timing of the call and still another disconnects the operator from the call. The call is automatically timed and disconnected by the computer thereby freeing the operator to help another customer.

Although the button pushing sequence varies slightly for person to person, credit card, or other types of calls, the significant advantages of TSPS remain constant: 1) The call is dialed into the toll dialing network by the customer; it is no longer necessary for the operator to place the call. 2) All routine billing information is automatically recorded by the computer; only non-routine information such as credit card numbers are entered by the operator. 3) Timing and disconnecting are automatic. 4) The operator is only involved long enough to ascertain non-routine billing information and/or to announce the call (i.e. person to person). 5) The operator is able to give her undivided attention to each customer. 6) The computer may connect the call to any of 280 operator positions. (This greatly increases the number of operators available to serve each customer.) 7) Offices can be located in areas where qualified help is readily available; it is no longer necessary to establish an office in close proximity to the calling customers.

In spite of the many advantages of TSPS, it is far from perfect. It cannot yet complete overseas calls; help a customer who has a bad connection: or call the police in an emergency, but it does make the job easier for the people who can perform these tasks, the operators. The net result is better service for all telephone users. As new computer programs are designed that enable TSPS to handle more and different types of calls, one can't help but wonder how long it will be before voice controlled computers will be saying, "May I have your credit card number please?"

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ELECTRONIC FUNDS TRANSFER SYSTEMS: The Status in Mid-1974—Part 2

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"In no community is there more fierce competition for future EFTS services than in New York City. ... [this city] bears watching because of its overall significance to both the retail and banking industries and because of the highly competitive situation."

In Part 1 of this article (August 1974), Mr. Sprague defines the elements, broadly and simply, which comprise EFTS, outlines its main divisions, and sketches the major reasons for accelerated activity in EFTS this year. Here the author relates specific events in the EFTS POS national spectrum, and offers some suggestions for future attitudes in planning EFTS networks.

Community Developments

One way of measuring what is happening or what is likely to happen in EFTS, is to watch the activity in various communities. Some of the key areas are: Atlanta, Ga., New York City, Cleveland and Columbus, Ohio, Lincoln, Nebraska, Pittsfield, Mass., Wilmington, Del., Seattle, Wash., and Boston, Mass.

Atlanta:

Until mid-1974, many participants believed that the Atlanta Payments Project would become the leading, successful example of a community-based EFTS network. It seemed to have everything going for it. The services planned for the Atlanta area were all-encompassing, including both SCOPE off-line and COPE on-line transaction processing. All interested commercial banks were to share in the ownership and operation of both an automated clearing house and a switching and processing center for point of sale transactions. The Fed was supporting and participating in the project. What appeared to be good cooperative planning had taken place. An economically viable set of services and technologically feasible systems approach were projected.

Two problems had developed by mid-1974 that could stop or slow down the APP progress. The first was the withdrawal of further financial support for the point of sale portion of the project by the Federal Reserve. The second was a failure by the banks, consultants, APP staff, and the Fed, to appreciate or understand the enormous gap in interests and concerns between the financial institutions and the retailers in the community, particularly the large retailers.

Without cooperation and participation from the retailers, and through them the consumers in a community, point of sale EFTS has little or no chance of success. In Atlanta, the major retailers, led by Rich's, would not participate on the basis proposed by the banks.

In the case of the Fed, the overwhelmingly negative response to the Fed's request for response concerning their participating as sponsor in EFTS-POS projects, plus the delayed response by the Justice Dept. expressing the opinion that POS should be left to private enterprise, combined to bring about their withdrawal from APP.

Cleveland-Columbus:

A highly competitive situation involving a three-way battle developed in Cleveland and Columbus, Ohio, in 1974. The City National Bank of Columbus, having completed a Point of Sale test called POST I in Upper Arlington, a northern suburb of Columbus, proposed a second, larger test called POST II in both Cleveland and Columbus. They sought the financial support of the Cleveland Fed and some of the Cleveland commercial banks. Other Cleveland and Columbus banks proposed their own point of sale project in competition with City National. This competition tended to be (though not entirely) a lineup of Bankamericard banks (City National) vs. MasterCharge banks in Cleveland. The latter had installed a number of POS terminals in Cleveland tied into their processing center run by Banksystems Inc.

The Cleveland Fed, having been asked to participate by the City National group and having been asked to stay out by the competitive group, conducted a study of a potential POS-EFTS network for their entire area (Ohio plus Pittsburgh). They employed the TRW Co. in conducting this study and issued a report(1) on their findings in the spring of 1974. The Fed's decision not to participate in Ohio was anticipated following the Atlanta decision.

The third part of the Columbus-Cleveland battle is the potential plan of the Ohio Savings and Loan League and the cash-card-based, EFTS-franchised program offered by Buckeye Federal S&L in Columbus. This program includes a point-of-sale network and transfer service plan that would compete with POST II.

With the Fed's withdrawal and the Federal Home Loan Bank Board supporting the plans for tests of various S&L's, including Buckeye Federal, the outcome in Columbus and Cleveland is now difficult to determine.

New York City:

In no community is there more fierce competition for future EFTS services than in New York City. The commercial banks operate their own automated clearing house on a cooperative basis with no Fed involvement. That is where the cooperation ends. Another three-way battle is taking place for POS-EFTS. The three groups are: the First National City Bank and their subsidiary, Transaction Technology; a group of four banks, Chase Manhattan, Bankers Trust, Chemical Bank and Manufacturers Hanover working together; and a group of savings banks led by the Central Savings Bank in Manhattan.

The battle was made fiercer in May and June, as a result of several large savings banks, led by the Bowery, announcing Payment Accounts, that resembled the NOW accounts of Massachusetts. This move would presumably permit funds to be transferred from point-of-sale terminals out of savings accounts or Payment Accounts in savings banks.

FNCB installed a number of terminals in various retail stores in 1973 and 1974 and introduced a new type of cash card, nicknamed the "magic middle" card. The technology involves scanning holes in a metallic layer in the center of a plastic covered card. FNCB and Transaction Technology claimed it is more secure and tamper-proof than the bank's standard magnetic stripe.

The Chase group plans to install a standard magnetic stripe card reading terminal in retail locations and the savings banks plan to install terminals and cash dispensers capable of reading the third magnetic stripe on cash cards.

It is difficult to see how all three of these groups can be successful with EFTS-POS in New York. The retailers in New York, especially the larger ones, will not tolerate more than one POS terminal at a point of sale, either their own terminal, or possibly one EFTS terminal next to a cash register.

In addition, retailers would prefer that all consumers with demand deposit or savings accounts be given equal treatment in their stores, not just those depositors of one bank or one group of banks or thrift institutions.

New York City bears watching because of its overall significance to both the retail and banking industries and because of the highly competitive situation.

Pittsfield, Mass:

At the other end of the competitive spectrum from New York City is Pittsfield, Mass. Commercial banks, savings banks, savings and loans, credit unions and Payment Systems Inc., have all joined in a cooperative, shared ownership effort. A corporation for EFTS in the Western Massachusetts area was formed, with all of the financial institutions desiring to participate, owning stock. The EFTS services to be offered will be implemented in two phases. Phase I is a batch processing based, cash card, transfer authorization service, involving a check-like document at a point of sale. Phase II will involve installing point-of-sale terminals at locations where the volume justifies doing so.

This is the only known case in which the four types of financial institutions all share in the ownership and operation of an EFTS center. The Massachusetts laws which permit third party transfer powers from both thrift and commercial bank institutions, are essential to the cooperative arrangement in Pittsfield. Payment Systems Inc. is a consulting and systems implementation contractor to the corporation.

Lincoln, Nebraska:

As unlikely as it may seem, the First Federal Savings and Loan of Lincoln, Nebraska and the Hinky Dinky Supermarkets are attracting the attention of the EFTS world. The Federal Home Loan Bank Board gave First Federal permission to implement an EFTS pilot using IBM POS terminals in the Hinky Dinky stores in Lincoln and in Iowa. First issued a cash card which can be used to transfer funds from consumer savings accounts to Hinky Dinky's account. In addition, other financially based services such as deposits and check cashing authorizations are possible from the terminals located at special service desks inside the supermarkets. At first, Hinky Dinky manned the special desk. However, the smaller commercial banks, through a Nebraska state banker's association filed suit and obtained a court injunction to stop the operation. After a day or two the operation opened again using First Federal personnel.

This test is being watched closely, nationally, because it is the first thrift institution to perform an on-line transfer of funds using terminals. The Federal Home Loan Bank Board has made it known that they will support further tests and pilots. Various new regulations have been issued to enhance these tests.

Other Communities:

In the State of Washington a shared EFTS network is planned by all of the Savings & Loan companies. In Wilmington, Delaware, a company called MTSI, Money Transfer Systems Inc., jointly owned by the Wilmington Savings Fund Society and Payment Systems Inc. is operating a batch processing type of EFTS network with terminals planned for the future. In Boston, the New England Automated Clearing House, NEACH, has been formed by the commercial banks with Federal approval, to offer SCOPE services In other communities around the country, ACH-SCOPE services are in operation or planned.

National Networks:

The Fed Wire and Bank Wire national funds transfer networks and services have been progressing rapidly for the last few years. New developments and competition for national EFTS business is taking place in 1974. National Bankamericard Inc. has announced a new nationwide program called Base III and Base IV, that will enhance the possibility for their local members to offer Point of Sale EFTS services in their communities and to utilize a national asset card.(2)

It is anticipated that Interbank will respond with a similar national program for Master Charge banks and that one or two private entrepreneurs with national authorization networks (Example: National Data Corp.) may also offer a national POS-EFTS service.

The likelihood that any national EFTS project dealing with point of sale transfers will be successful is highly dependent on building a solid base in communities. Since the community POS successes appear to be dependent upon cooperative efforts among various financial institutions, retailers and others, it is difficult to forecast any National EFTS trends beyond the bulk money transfer functions.

National Banks:

One other possible avenue for implementation of EFTS services nationally is being considered at the strategic planning level of several major banks. The idea is to create a true national bank through the acquisition of finance companies by the bank holding company. While traditional bank branches are not permitted across state lines, the finance company offices owned by the holding company can transact many of the services that could create a national base for EFTS. This movement is too young to make any forecasts, but it is likely to run into severe legal and regulatory problems sooner or later. Among the banks apparently adopting this strategy are the First National City Bank in New York and the First National Bank of Chicago.

Is EFTS Good for Retailers?

Ask the average man or woman on the street what he or she thinks of EFTS after a brief explanation, and you will receive a negative reaction. Ask the average credit granting retailer and you will receive a strong negative comment, or at best, the reaction, "What has EFTS got to do with me. I see no reason at all to be interested or to get involved."

The prime questions the President's Commission will be struggling with for most of the two years will be on the subject of, "Is EFTS good or bad for the consumer?" and, "Is it good or bad for retailing?"

The larger retailers who have been exposed to the idea or offered EFTS partial services of one type or another by commercial banks, have turned down all propositions. The credit granting retailers have concluded that EFTS is just one more maneuver, like bank credit cards, by financial institutions to steal their credit business away from them. As a result of this attitude, very little dialog has taken place between retailers and financial institutions on the subject of EFTS. Retailers do not appreciate the basic differences between bank credit and bank debit cards. Banks, on the other hand, do not understand what the retailer wants and must have at his points of sale, nor do they know the speed with which retailers are ordering and installing their own point of sale terminals and systems.

The financial institutions have viewed the retailers as potential customers for EFTS services and not as potential partners in implementing planning and marketing EFTS to consumers. Retailers however, hold most of the trump cards for EFTS-POS. They own now or will soon own, most of the point of sale terminals and systems that will ever be installed in retail stores. They control the policies, procedures and financial modes of payment at the points of sale and they have a much closer relationship to the consumer when he or she is purchasing merchandise or services, than do the financial institutions.

The Solution to the POS Dilemma

There is a seemingly obvious solution to this problem of the gap of understanding and cooperation between the two industries. It is to sit down and reason together as partners, not as sellers and buyers. Only through a partnership form of dialog will the fundamental differences be resolved. One study conducted empirically by Touche Ross & Co in the mid 1960's showed there were thirty points of concern by retailers about EFTS that would have to be resolved before a successful retail/financial institution EFTS-POS project could be launched.

Equity participation by retailers based on their contribution of systems, planning and marketing assets, is one of the probable essential approaches that will have to be taken. Another important technical consideration is the use of retail POS systems interfaced to the local or regional EFTS networks. The interfacing would take place at retail systems and organizational levels ranging from store level to corporate headquarters level.

What About the Consumer?

If consumers do not participate in EFTS, the concept has no chance for success. There are four types of negative reactions to EFTS by consumers. The first is, "I don't see anything in it for me. What would I get out of it?" The second is, "What about my privacy?" The third is, "I will never, never be able to pay cash immediately for everything, nor do I want to." The fourth is, "I want to keep all of my options open on where I spend, and store, and receive my money." The latter reaction can be expanded to, "I don't want my pay to be deposited directly. I want to see and feel that check or cash. And, "I want to keep my checking accounts, savings accounts, cash, different banks, retail credit accounts etc. that I have now, and I want to decide what money goes where, when and how."

There are possible answers to all of these negative attitudes, but the financial institutions have not appreciated the fact that the attitudes exist and are important. They have therefore not come up with the answers. In fact, individual banks or thrifts acting alone and in competition with each other can not possibly design an EFTS network and services that will answer all of the consumers' concerns. The retention of all options by the consumer on where money is stored requires a cooperative effort by all financial institutions.

The Pot of Gold

There may be a perfect solution to all of the problems raised by retailers, consumers, regulators and financial institutions, that would make EFTS attractive to everyone. An analogy can be used to describe the approach to this solution in a community. The differential between the costs of implementing and operating a perfect EFTS network in a community, and the savings that can accrue collectively to all parties, is a very large number of annual dollars. Nationally, estimates have been made that would place the total at around $60 billion a year. If this were divided among 200 communities or regions, each would benefit to the tune of $300 million annually.

This number represents a pot of gold at the end of a rainbow. To reach the pot it is necessary for all participants to proceed cooperatively and together over the rainbow. When they reach it, the pot is to be divided up equitably. All participants receive their share of the differential, especially the retailers and the consumers. However, any split in the ranks of the participants causes the rainbow to collapse and the pot to disappear.

A complete description of the perfect community approach would occupy too much space for this article.(3) It can be summarized as follows. An EFTS corporation is formed by the entire community with equity positions available to all individuals and organizations interested in participating. Contributions may take the form of money, people, systems, marketing effort etc. Each participant shares in the overall profits, savings and benefits of the community network. Financial agreements between the corporation and each participant are developed in ways that pass these rewards directly back to each one equitably.

Financial institutions, retailers, corporations, individuals and other organizations act in concert on a cooperative, partnership basis to draw up the objectives and requirements of each participant. The total collection of these objectives and requirements forms the specifications for design of the EFTS network, for the corporation's charter, and for the financial agreements with each participant. Legal and regulatory problems are solved by involving the proper federal, state and local agencies from the beginning. Some of the problems caused by money handling and storing regulations and laws are solved by separating money functions from information functions in the network design. Maximum use is made of systems owned by the various participants, especially retailers. The total EFTS network in the

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Reading Aloud by Computer

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"The computer can pronounce a word by figuring it out in much the same way as humans do, applying literally thousands of learned rules of pronunciation."

"Supercalifragilistic" is the word typed into the computer sitting in the MIT electronics laboratory. During a 10-second pause, the computer digests the nonsense word, its display screen flickering as it shows how the word is broken apart and complex rules of pronunciation are applied.

Pronouncing Any Word in English

Then, incredibly, out of a loudspeaker atop the computer comes an eery, flat voice proclaiming "SUPERCALIFRAGILISTIC."

What is remarkable about this computer, developed by engineers in MIT's Research Laboratory of Electronics (RLE), is that it can pronounce any word in the English language, or any string of words.

Even more remarkable is that the computer need never have encountered a word before, but can pronounce it by figuring it out much the same way humans do, applying literally thousands of learned rules of pronunciation.

And also remarkably, the computer voice that utters the words is completely nonhuman in origin, having been constructed by a model of the human vocal tract programmed into the computer.

Machine to Read to the Blind

The text-to-speech system, developed by MIT engineers under the leadership of Jonathan Allen, associate professor of electrical engineering, began as part of an overall effort at RLE to build a machine to read to the blind.

According to Professor Allen major contributions to the work were made by RLE staff members Eric Jensen, Sharon Hunnicutt and Francis Carroll. Their contributions made much of the project possible, he said. Graduate students who have worked on the project include Thomas Barnwell, Yves Willems, and Douglas O'Shaughnessy. The research effort was first motivated by the late Samuel J. Mason, Cecil H. Green Professor of Electrical Engineering and Associate Director of MIT's Research Laboratory of Electronics, who died suddenly in March.

Two Stages

The reading machine project actually involved two enormous problems — first, building a machine to scan and recognize printed matter and transform it into computer language, and, second, building a computer to transform the scanned text into understandable speech.

Early work on computer-generated handwriting and pattern recognition was done at RLE by Professor Murray Eden. Extensive work on character recognition systems, particularly the recognition of type fonts, was done later at RLE by Professor Mason and Jon Clemens, then a doctoral student. Extensive work also was done on scanning devices by Professor William Schreiber and Donald E. Troxel at RLE.

Machine to Convert Written Copy

A commercial outgrowth of the work at RLE has been the Autoreader, manufactured by ECRM, Inc., of Cambridge, Mass. The Autoreader transforms typewritten copy into computer representations of the copy and is used primarily in the newspaper industry for computer-controlled typesetting. ECRM has made a gift of an Autoreader to RLE and this device is connected to the text-to-speech computer.

Professor Allen's own work on the text-to-speech system is based on earlier work by Professor Francis F. Lee of RLE.

Although a reading machine for the blind is still one goal of Professor Allen's work in text-to-speech conversion, he also sees a wide range of other uses for a talking computer. A major use of the machine would be as a general computer output device, enabling a human to hear what information a computer has to offer. For instance, a library user of the future, desiring information over the phone, could have it automatically read to him from a computer.

Many Applications of the Ideas Developed

The pronouncing computer could also be quite valuable in computer-aided instruction, such as teaching children to read, said Professor Allen.

And, in fact, reading instruction could also be aided by what the MIT researchers discovered they had to do to teach the computer to read. Their experience in programming the computer represents at least a partial statement of the capabilities used by humans in order to learn to read aloud. In addition, the text-to-speech computer can be used as a general model for a machine that can ingest and apply large numbers of rules to problems. Thus, the basic strategy of programming could be applied to other computer projects.

Sources of Funds

Earlier work on the reading machine for the blind received initial support from the Moses Foundation with supplementary funds from Miss Madeline Moses. Various aspects of the overall research was supported by the National Institute of General Medical Sciences and the National Institute for Neurological

Diseases and Stroke, both parts of the National Institutes of Health, and by the Joint Services Electronics Program.

Strategy of Reading Aloud

In developing their "pronouncing computer," Professor Allen and his colleagues avoided what they term the "brute force" method of teaching a computer to read aloud.

"We could have attempted to feed all the words in the English language into the computer's memory, and instructed the computer to match each word in a text with a pronunciation," he said.

"This would have been unwise, however, because the number of English words is enormous — several-hundred-thousand — and because new words are constantly being invented.

"It would be extremely difficult and unwieldy to cram all the known words into a limited computer memory, and to attempt to keep up with the words that enter our language continually, It is much better to proceed from a basic understanding of the general linguistic rules of pronunciation. The basic properties of English would be applicable for a much longer period than mere word lists."

Basic Atomic Units or "Morphs"

Fortunately for the engineers, almost all words, both old and new, are made up of a relatively few basic atomic units, which remain the same over long periods. For instance, "earthrise" and "cranapple" are such new words invented out of old ones.

According to Professor Allen there are "only" about 11,000 of these units, called morphs, and using these, a computer can understand at least ten times that number of words.

"The morph lexicon within our computer includes, not only all the commonly known prefixes, suffixes and Latin roots, but many special cases of pronunciation which we found convenient to put intact into the computer," said Professor Allen. "For instance, the word 'of' is a frequently used exception to the rule that 'f' is pronounced as in 'fragment'."

Breaking Words into 11,000 Morphs

Although feeding the 11,000 morphs into the computer was relatively simple, the engineers soon found themselves up to their linguistic necks in the problem of correctly breaking words down into their morphs.

For instance, morphs often change when they become part of a word — "choke" loses an "e" in the process of becoming "choking," and "pit" gains a "t" when it becomes "pitted". Professor Lee had developed a powerful set of rules to enable the computer to break up the word into the correct chunks.

Example "Scarcity"

Professor Allen added to these rules by developing a computer program to select the correct set of chunks for each word. For instance, the word "scarcity" is broken down by the computer as scar-city, scarce-ity, or scar-cite-y. The correct choice among these requires a special rule, and the computer has been taught to prefer the set of chunks containing a prefix or suffix over the set made of compounded words. Thus, it chooses scarce-ity as the correct set of morphs.

The Supplementary 400 Rules for Letters to Sounds

Even with these rules, the computer would still not be a successful pronouncer — just as with a human, a pronouncing computer must resort occasionally to sounding out words phonetically it cannot recognize as combinations of known morphs.

To achieve this, the research team developed and taught the computer more than 400 letter-to-sound rules for sounding out words not recognizable as understandable chunks. In using these rules, the computer first breaks off understandable prefixes and suffixes, then figures out the consonant sounds in the remaining chunk, and finally determines the vowel sounds.

Not only are the basic sounds of letters and combinations included in these 400 rules, but also rules governing allowable combinations of sounds. For example, in stripping the word "corpuscular" the computer knows it is not allowed to strip off the initial "co-" because one of its rules tells it — there is no such initial sequence as "rp" in the English language.

Whole Word Rules

By combining the 11,000 morphs, and the 400 letter-to-sound rules, the engineers had a computer that could pronounce individual syllables strung together, but pronouncing entire words created still more problems.

When syllables are strung together into words, pronunciation changes show up because of the influence of the other syllables.

"Morphophonemic changes" occur in pronouncing letters, according to where they occur in a word. Thus, "s" is pronounced differently in "agress" and "agression."

"Lexical stress" changes are shifts in pronunciation according to what morphs are present. Thus, the noun "rebel" is pronounced much differently when it is part of "rebellion," and "reverent" changes when it becomes part of "reverential."

The MIT engineers drew on rules of linguistics developed by numerous researchers, prominent among them Noam Chomsky, the F. P. Ward Professor of Modern Languages and Linguistics; and Morris Halle, Professor of Foreign Languages. Using these rules the engineers taught the computer how to combine their hard-won syllables into correctly pronounced words.

Simulated Vocal Tract

Even with all this analysis, the text-to-speech computer would still have stood mute before its creators, for it would lack a vocal tract to convert pronunciation instructions to intelligible speech, Basically, said Professor Allen, this means transforming pronunciation marks into dynamic information telling a vocal tract how to alter itself from microsecond to microsecond as it proceeds through a word pronunciation.

The computer was given an electronic voice by Dennis Klatt, a research associate in electrical

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GAMES AND PUZZLES for Nimble Minds – and Computers

Edmund C. Berkeley
Editor

It is fun to use one's mind, and it is fun to use the artificial mind of a computer. We publish here a variety of puzzles and problems, related in one way or another to computer game playing and computer puzzle solving, or to the programming of a computer to understand and use free and unconstrained natural language.

We hope these puzzles will entertain and challenge the readers of *Computers and People.*

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

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 749

```
              S A F E T Y
            x B R E E D S
            -------------
            T G E D D Y R
          R B A T S E N
        S R E S R R A
      S R E S R R A           F = B
      D S T N R N
    T N R E F D G
    -----------------
  = T E S E R Y B Y G S R R
            77680  922
```

NAYMANDIJ

In this kind of puzzle 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 be expressible in not more than four English words. (But Man can use more words to express it and still win.)

NAYMANDIJ PUZZLE 749

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

MAXIMDIJ

In this kind of puzzle, a maxim (common saying, proverb, some good advice, etc.) using 14 or fewer different letters is enciphered (using a simple substitution cipher) into the 10 decimal digits or equivalent signs for them. To compress any extra letters into the 10 digits, the encipherer may use puns, minor misspellings, equivalents like F for PH or vice versa, etc. But the spaces between words are kept.

MAXIMDIJ PUZZLE 749

ΣΔΠΘ ΠΘ ΥΞΛΛΩ ΣΨ ΦΛ

GIZZMO

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

GIZZMO PUZZLE 749

Problem: The requirements of a good TARRON are that it must be simple, conceivable, and not absurd, and have the property that GROONS can be made from it which are susceptible of being HILFED. The making and HILFING of the GROONS is verification. If the evidence produced in the HILFING proves the GROONS, then the TARRON is said to be verified positively. But if the GROONS are disproved, then the TARRON is said to be verified negatively. Thus TARRONS are usually verified indirectly, that is, by verifying the GROONS. Note that it takes a large number of HILFINGS and a large number of verifications of GROONS in order to substantially confirm a TARRON and even then the TARRON is not verified beyond the power of some HILFING to disprove it.

What is a TARRON? What is a GROON? What is HILFING?

ALGORITHMO

In this puzzle, the objective is to express a procedure for going in a given situation from given input to given output. The following conditions apply: the situation is a little off the beaten path and is interesting; the procedure is fairly evident and fairly short; the procedure is to be expressed in precise English words, with perhaps defined terms in addition; the procedure is to be completely and accurately expressed, i.e., the calculating procedure must work. (In addition the procedure may, if desired, be expressed in a common computer programming language such as BASIC, LISP, FORTRAN, or APL, together with complete translation into precise English words and satisfactory evidence, in terms of several examples run, that the program works correctly.)

For the following puzzle we hope to publish in the December issue the best solution received before November 2 from a reader of *Computers and People.*

ALGORITHMO PUZZLE 749

Problem: ONE OR L RECOGNIZER BASED ON CONTEXT. *Input.* Any common word, phrase, or expression typed with a typewriter in which lower case L is used both for 1 (one) and l (lower case L). *Output:* A numeral 1 or a lower case L recognized or distinguished on the basis of context. *Examples:* 123.1, two ones; lily, two L's.

SIXWORDO

The problem is 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 749

In regard to the content of knowledge that one studies in any subject, it is an interesting fact that all scientific subjects and a great many other subjects (excluding astrology, fortune telling, and other branches of nonsense) are organized essentially in the same simple way: in terms of sensible ideas and sensible relations between them. So the problem of studying and learning a subject regularly breaks down into two parts: identifying the ideas peculiar to the subject; determining the relations that associate the ideas.

Hint: One solution to the puzzle above requires 22 sentences of 6 words or less.

PICTORIAL REASONING

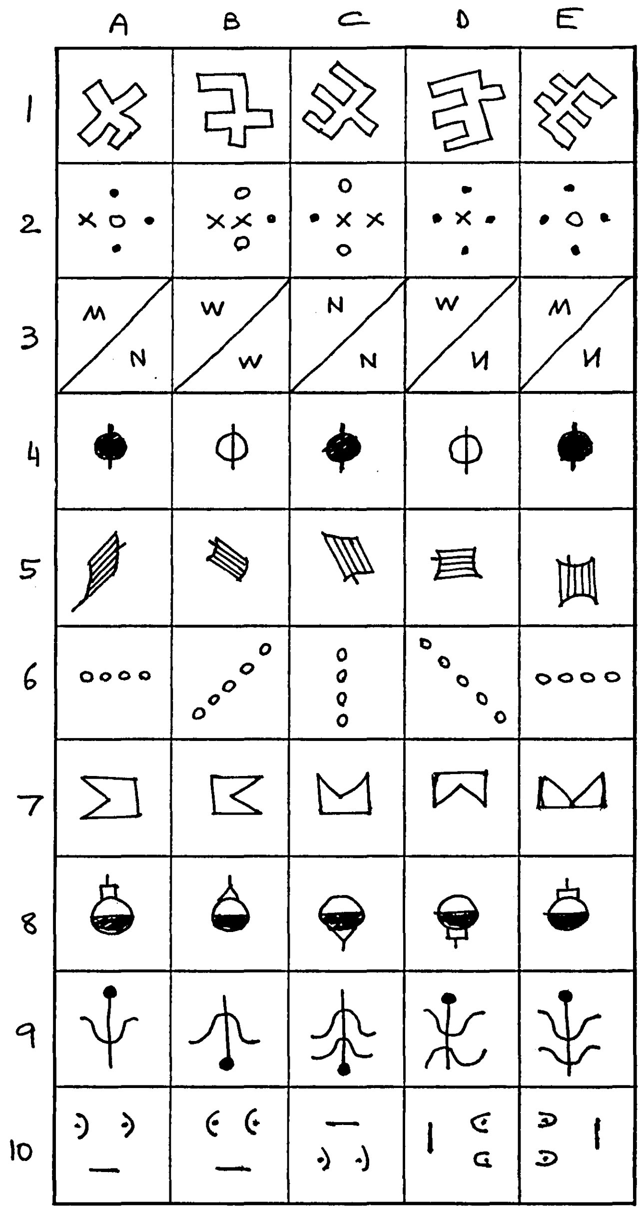
The following pictorial reasoning test is a test to see how carefully you can observe and reason. It is not timed.

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 749



RE MAXIMDIJ AND OTHER TOPICS

1. From Leon Davidson
Blue-Book Publishers
64 Prospect St.
White Plains, NY 10606

I have some comments.

(1) Maximdij 747: Solution:
"Deeds are the test v (of) greatness."

(2) July 1974 p. 28: Table 5, K7: 243, not 247.

(3) You are to be commended, as usual, on publishing the articles by Chastain, Sprague, etc., in recent issues. The pair of articles by Boche and Carlin in the July issue was fascinating.

(4) I don't have the time to even try to solve your COMPMEANO puzzles or your NAYMANDIJ puzzles, although I tried some of the latter. I would say they might be aimed at the "retiree" market, because the time required to solve them is not justified by the "satisfaction" of finding the result, if one must also put in a normal week's work at making a living.

(5) MAXIMDIJ, on the other hand, takes very little time to attack (usually by inspection), since you limit it to 14 letters and 10 symbols. These I dig.

(6) But then, as on p. 9 of the July issue, you throw a lot of extra "Maximdij"-type messages into the magazine. This means I have to take the time to solve these, to be sure I don't miss any important "message" you might be imparting.

(7) Now, I find the following rather puzzling collection of solutions to the July 1974, p. 9, box of "Maximdij" sayings:

- DEEDS ARE THE TEST (OF) GREATNESS.
- HE THAT READS HAS HEAD AND HANDS.
- THREE HEADS ARE NEVER NEEDED.
- SEVEN HENS HAVE SEVEN HEADS.
- DEATH (O)VENS ARE (O)AST DANGERS.
- STATES AND EVENTS NEVER END.

(8) The fifth statement above I would like your explanation for, if I may impose on you. From my crossword-puzzle vocabulary, an "OAST" is an oven or kiln. The connotations of the words "Death Ovens" (re Nazi Germany) make this seem in bad taste, which you undoubtedly didn't intend. "(V)AST" might be another solution for that word, but the subject still doesn't seem appropriate for a "pastime".

(9) A problem to which you might try to find a solution is one stated in the "BENT" of Tau Beta Pi, latest issue.

Problem:

– Postage stamps in only seven demoninations are available in unlimited quantities. Each denomination is an integral no. of cents.)

– Stamps of any of the denominations may be repeated on a given piece of mail.

– What is the set of seven denominations which will provide complete coverage of all integral postage amounts from 1 cent to the largest possible value, under the above conditions?

One way to solve this is to try an exhaustive (computerized) calculation of all possibilities.

Is there any number-theoretical or other elegant way of handling this?

2. From the Editor

Re (1), (5), (6), (7), and (8):

In the Maximdij puzzle, as soon as more than 10 different letters are used, room for some tricks appears. In this case the word "of" is represented by a single character ϒ. Hence the code ϒ or ϒϒ can be translated in several ways including the following:

v – which is a common shorthand abbreviation for "of"
ov – as in "oven", which is the sound of the word "of"
of – which is the word the single character stands for

Each of these translations is available (under the rule of allowing puns or jokes).

The fifth coded expression on page 9 of the July issue is:

Ξ Δ Ψ Π Γ   ϒ ϒ Δ Θ Φ   Ψ Σ Δ   ϒ Ψ Φ Π
Ξ Ψ Θ Λ Δ Σ Φ

and the translation is "Death ovens are vast dangers". The reference is to the Nazi crematoria, and the reference is intentional. A part of the policy of *Computers and People* is not to forget important, and sometimes even sad and dreadful, subjects even in pastimes.

The ten letters A D E G H N R S T V are the ten letters used in "deeds are the test v greatness". These ten letters (with repetitions allowed) make more than eleven hundred English words. I hope that this supply of words can lead to some more puzzles. This supply of words, an empty quarter page to be filled with something at the last minute, and some experimenting, led to the five additional messages that you translate in (7).

Re (2): You are correct. We regret the error. Thank you for the correction.

Re (3): Thank you for your kind comments on our articles. We shall keep trying to publish important, even unforgettable, articles.

Re (4): I agree with you about COMPMEANO puzzles. They need a computer and computer programs to cut down the work of dealing with them.

But the NAYMANDIJ problems are easy, if you develop your power to observe keenly. The first general rule is to look for patterns of 0's, or 1's, or 2's, etc. All the recent Naymandij puzzles have been easy. Not one should take more than 3 to 5 minutes of answering (by observation) a series of logical questions. You are protected by the fact that Nature's rule has to be expressible in not more than four English words.

For example, take the NAYMANDIJ puzzle in the August issue, for which the solution is "Make M of 8's". Following is a copy of the puzzle with the M of 8's marked:

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

(please turn to page 33)

The Assassination of the Reverend Martin Luther King, Jr., and Possible Links With the Kennedy Murders — Part 8

Wayne Chastain, Jr.
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Was the murder of the Reverend Martin Luther King, Jr., the result of a conspiracy? Previous installments of this series described the "eggs and sausage" man, later given the code name of Jack Armstrong, who appeared on the scene the day of the murder. Also appearing on the scene were Tony Benavides and J. Christ Bonnevecche who claimed to have information and understanding of Dr. King's and John F. Kennedy's assassinations. Are these two men to be believed? Are they one and the same person — possibly aliases for Jack Armstrong?*

Is there a relationship between these assassinations? a conspiracy at work by an organization or several individuals? or are these murders more simply vendettas? Mr. Chastain continues to seek the answer to these questions and to the murders of Dr. King and the Kennedys.

Thompson's Private Investigation

Thompson and his wife were gone six weeks. When they returned to Memphis, Ray was in custody in England. Thompson said he called Canale, the FBI, and Holloman, and asked when they were going to show him the photographs of the man that may have been Benavides.

"They seemed diffident and evasive." Thompson said. "Everytime I mentioned the name Benavides, I seem to have touched some exposed nerve."

When the authorities expressed interest in Thompson's story, he said they seemed very intrigued by the Denver address I supplied them with. When I mentioned this to them on my return to Memphis, this did not seem to re-awaken their interest in the man called Benavides. Canale finally told him to forget Benavides. "He was just a nut, Russ," Canale said.

Then, Thompson related a bizzare footnote to the Benavides affair. It involved an incident which occured in late August 1968 — after Ray had been safely extradited to the States and was being held under maximum security in the Shelby County Jail. It started when Thompson got a call from a fellow attorney.

"This attorney, a friend of mine, represented a Mississippi man — with blond hair — who had been arrested in Mississippi on a warrant, had been extradited and held in the county jail for several days on a charge not related to murder," Thompson said.

"During his confinement, he was interrogated by a battery of FBI agents, prosecutors, and even U.S. Justice Department attorneys," Thompson added.

*Parts 1 through 7 were published in the February through August issues of *Computers and People,* and are available from the publisher as back copies at $2 each.

Finally, the man was released from custody. The minute he was free he went to the attorney friend of Thompson and asked him to represent him because he was afraid he was going to be charged with the murder of Dr. King — even though Ray had been charged with the crime and was incarcerated in the same jail.

Why did he think he was going to be charged for the King murder, the attorney asked his new client? The Mississippi man told him that the King murder was the subject matter of this prolonged interrogation. He said the interrogators kept asking him: "Why did you go see this attorney Thompson and give your name as Benavides?" The Mississippi man said he had never heard of Russell Thompson.

The attorney contacted Thompson and asked him what it was all about. Other than Thompson's two

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

law associates, Thompson had not told anyone about the Benavides visit except the police, FBI, and Canale.

Thompson, however, went ahead and told his attorney friend about it. After all, had not the FBI, police, and Canale told him to forget about Benavides, as if they had some evidence that showed he was not connected with King's death?

Thompson said he viewed photographs of the client of his friend, and said the client was "definitely the man who visited me and called himself Tony Benavides".

The incident indicated, Thompson said, that despite statements to Thompson by authorities that they were no longer interested in the man called Benavides, they were still very much interested in him. It also suggested they did not have any idea who Benavides was.

Then Thompson learned about the man called Bonnevecche who visited the two ministers. He also learned about the references to the Mafia, and the assassinations of John F. Kennedy and Robert F. Kennedy. The prediction that Robert F. Kennedy would be next took on even more significance now, because Robert F. Kennedy had now been assassinated — on the morning after he won the California primary.

Quietly, Thompson launched his own private investigation. After all, he spent almost 20 years as an insurance investigator and he knew how to go about and get information about sensitive matters.

Thus, Thompson learned about the Mafia figure and his identity that Bonnevecche had alluded to in his conversation with the ministers. He learned that the Mafia figure had indeed been arrested on the day of the assassination of President Kennedy. The man was Eugene Brading. Ironically, the information Thompson uncovered was developed from a tip that Benavides had provided him — namely, the address of the rooming house in Denver.

Confused Identities

In checking out the Denver address, Thompson learned all sorts of things about the Denver underworld. Some of this information led to more information in Texas.

This resulted in learning of Brading's identity as the man who was arrested in Dealey Plaza, but who was turned loose when he presented Dallas police with identification indicating a phoney name.

Thompson also learned that the similarity in names resulted in confusion between Brading — now a resident of Los Angeles with close ties to the Denver, Colo., underworld — and Eugene Bradley, a leading right-wing spokesman and associate of Life Line, a hard-line anti-Communist organization financed by H.L. Hunt of Dallas. Bradley was erroneously reported to be in Dallas too on the day of the Kennedy assassination and was also questioned by the FBI.

Thompson had to untangle a skein of confusion, contradiction, and coincidences. For example, Bradley was apparently mistaken for Brading, and this was what prompted FBI agents to think Bradley was in Dallas.

Then an uncanny coincidence was uncovered. The phoney identification Brading used was that of an oilman. He said he had come to Dallas to see Lamar Hunt — son of H.L. Hunt — on an oil deal. It was the invocation of the magic name "Hunt" — well respected in Dallas — that prompted Brading's release.

Then Thompson realized why the FBI, the Memphis Police Department, and the Attorney General's office were so interested in the Denver connection — the story related by Benavides about his friend, Pete, and he being roommates in Denver.

Thompson pieced together a tenuous relationship between Brading and Benavides. This process was aided when Renfro Hays, a private detective hired by Ray's first attorney, Arthur Hanes, came to his office and showed him the photographs — all of the same man.

It was then when Thompson picked out the one photograph that appeared to be Benavides — the rugged, outdoors type with crude hair apparently bleached by the sun. This was the man the Committee To Investigate Assassinations tentatively identified by the code name Jack Armstrong.

Mafia Linked to Assassinations

Based on these findings, Thompson became convinced of the thesis that somehow the Mafia was linked to the assassinations of both Kennedys and King. He arrived at this conclusion after he had finished a discreet but thorough check of the man called "Jack Armstrong". He then visited the FBI and provided them with everything he knew about the man called Jack Armstrong. The FBI did not seem interested — even when he provided them with his real name, a street address, and the city in which he lived.

He also provided the FBI with information that not only linked Armstrong with Brading and Denver Mafiaso figures, but also with the disappearance of a Cleveland Mafia figure in late 1956. One report said this particular figure had been killed in a plane crash in Northern Mexico when he was smuggling gold out of the U.S. His pilot was Jack Armstrong, or Tony Benavides, or J. Christ Bonnevecche.

The wreckage of the plane owned by the Mafia figure, who had a genteel and respectable reputation in Ohio, was never located. Neither were the corpse or cargo, Thompson said.

That was approximately in early 1957. The same year, Armstrong bought an airplane and joined the guerilla army then being organized in Mexico City by Fidel Castro.

FBI Turns a Cold Shoulder

"When I related everything I had uncovered, the FBI would always appear stoney-faced and indifferent," Thompson said. "Jensen would appear bored and sometimes irritated. He once even became insulting and compared me to some crackpot who wrote him letters from Texas about the Kennedy assassination. I would always remind him that it was the FBI — and the Attorney General — who got all excited when I first reported the Tony Benavides episode. At the time, I wasn't sure whether Benavides was not some nut running around without any connection to the King slaying."

Thompson said it was the sharp questioning by Canale and FBI agents that got him interested in Benavides.

William Lawrence, head of counter-intelligence for subversive activities in the Memphis FBI area, finally told Thompson, after Jensen began refusing to see Thompson, that he had actually talked to and interviewed the man called Benavides.

"Russ, forget the man called Benavides," Lawrence said. "He was just a nut. Believe me, he has nothing to do with the assassination."

Thompson said he was willing to accept Lawrence's assurances, but just for caution's sake, why not show Thompson a picture of the man Lawrence said he interviewed and see if it were the same man who visited Thompson's office on April 9?

"The FBI would not give an inch," Thompson said. "They would not only refuse to show me pictures of the man they insisted was Benavides, but they would not confirm or deny the identity as that of Jack (Armstrong)..."

Lawrence retired from the FBI after 25 years in late 1969, only a few months after this last conference with Thompson. Note, Lawrence's statement to Thompson that Lawrence had located and interviewed the man called Benavides. This statement conflicts with the report given by Frank in his book, "An American Death".[1] Frank, purporting to relate what was in the official records of the Memphis police department, wrote:

"Within a few days (after the two ministers and Thompson separately reported their visits from their respective visitor), Zachary had complete reports from the sheriff at Brownsville. The town had less than a 15,000 population — small enough so a stranger would be noticed if he tried to contact any well-known citizen. The exhaustive check failed to disclose anyone resembling the man, with or without his tinted glasses. The FBI ran a check of its file as well: '<u>no man, no name or alias such as Benevitas</u>[2] <u>was found</u>'."

Thompson was convinced Lawrence never interviewed the real Benavides — Jack Armstrong. Instead, Thompson believed Lawrence had interviewed the blond man from Mississippi — the one his fellow attorney told him about.

Reverend Latimer Interviewed

Meanwhile, this writer interviewed Rev. Latimer in early 1973. I showed him several pictures, mostly mug shots from the Miami Police Department's intelligence division and from Miami newspaper clippings. Latimer pointed out at least two or three photographs which he said looked like Bonnevecche.

Then, Latimer studied one photograph in particular. It was from a Miami Herald Newspaper clipping. Then Latimer said he remembered something that he had completely forgotten.

In Feb. 1969, shortly before Ray was about to stand trial, and at a point of time when Latimer and his friend had felt that the excitement concerning Bonnevecche had died down as far as the police and FBI were concerned, a big man visited him at his church.

"He said he was an investigator for the Attorney General's office," Rev. Latimer said. "I should have asked, I guess, whether he meant the Shelby Attorney General's office, the State Attorney General's office or the U.S. Attorney General's office. But I didn't."

The man showed Latimer several pictures — some which Latimer believed were the same ones as I had shown him. Latimer said he was sure that the investigator showed him a glossy print of a photograph of the same man shown in the Miami newspaper clipping.

Latimer said he recalled pointing out this particular photograph as well as several others that he thought were those of Bonnevecche, but the investigator never revealed the identities of the men in the pictures.

The Official Police Theory: Ray as Lone Assassin

The official lone assassin theory, the crux of the case of The State of Tennessee v. James Earl Ray, can be briefly summarized as follows:

First, a bundle containing a rifle, some shells, a pair of binoculars, a radio, a suitcase containing clothing — all wrapped inside a bedspread — was found lying in a doorway on the sidewalk only a few feet from the stairwell leading to the rooming house above Jim's Cafe by Inspector N. E. Zachary of the Memphis police department less than 15 minutes after King was killed.

Second, the rifle in the bundle was purchased at a sporting goods store in Birmingham less than a month before King was killed. The buyer has been identified by a store clerk as James Earl Ray.

Third, although the fatal bullet had shattered inside King and it was impossible to definitely link the fatal bullet to the rifle found in the doorway, enough fragments were salvaged from King's body to make a tentative determination that the fatal bullet was of the same caliber and generally of the same make as the bullets found with the rifle in the bundle. The inferences drawn from this third set of facts do not follow a neat, syllogistic sequence, but the police and FBI insist that these inferences compel the following conclusions:

a) The rifle found in the doorway must have been the murder weapon because of its propinquity to the murder scene as well as to the bullets of the same caliber found with it in the bundle.
b) Ray must have been the killer because he purchased the weapon.

Fourth, binoculars had been bought at a sporting goods store in Memphis the day before King was slain. The clerk at that store also identified Ray as the buyer.

Fifth, the radio was imprinted with the serial number Ray had when he was a prisoner at the Missouri State Prison.

The photograph in the newspaper clipping showed a man with dark wavy hair, high cheekbones, long sideburns, a trim beard and goatee, and mustache. He was dark and very handsome.

He was the man identified by the code name used by The Committee To Investigate Assassinations as Jack Armstrong.

Sixth, the suitcase contained clothing, some of which fitted Ray, and carried the laundry mark of an alias Ray used right up to the time King was killed.

Seventh, Ray's fingerprints were on the rifle, the shells, the binoculars, the radio and the suitcase.

Eighth, the bedspread contained fibers that matched fibers taken from the fabric lining of the trunk of Ray's car. This proved that the bundle had been inside the trunk of Ray's car before King was killed and before Ray had moved into the rooming house.

Ninth, a witness, Willie Stephens, a resident of the rooming house, identified Ray as the man who came out of the bathroom with a rifle seconds after the sound of a shot was heard inside the bathroom. Stephens made the identification in a signed statement to police five weeks after King was killed.

These are the nine major points of evidence that police and FBI used to link Ray with the slaying of Dr. King. But do these nine points of evidence preclude the possibility of a conspiracy behind Dr. King's slaying? Do they conclusively prove that Ray acted as lone assassin?

Circumstantial Evidence

First, is this evidence sufficient to even prove Ray guilty? The first eight points, of course, constitute circumstantial evidence. Many law professors, mostly those with prosecuting proclivities, are fond of arguing that circumstantial evidence is superior to direct evidence — that is, evidence gained by eyewitness testimony identifying the defendant as having committed the crime in the eyewitness's presence.

"Humans can lie, and occasionally err, but physical evidence cannot" is a maxim many law professors quote in their criminal law and evidence courses in law school.

Discretion — defined as a healthy sense of survival — characterizes the better part of valor of the average law student, so the fallacy inherent in the maxim usually goes unchallenged inside the classroom lecture. At coffee breaks, outside the earshot of the professor, most students perceive the speciousness of the argument and it becomes obvious that physical evidence can lie — especially if it has been manufactured and planted on an unsuspecting defendant by the real culprit who has framed him.

As Sam Spade, the fictional private detective spawned by the pen of Dashiel Hammett[1], cynically explained to the fat man in the classic "Maltese Falcon", any criminal conspiracy can be successful if the conspirators leave a fall guy for the police. It is essential to plant enough physical evidence that will incriminate the fall guy, if the cover-up is to be successful. The police must have an apparent "open and shut case", and the police will invariably avoid dredging up conspiracy clues because "they like to keep it simple...they want to close the file", Spade explains.

Thus, would a reasonable criminal leave all this physical evidence behind that would identify him as the killer? If Ray knew he had to make a fast getaway once he fired the fatal shot, would he not have put all of these items beforehand in the trunk of the car, except perhaps the rifle? Also, Ray's defense attorneys quickly point out that the rifle was neatly placed back in the leather covering. Would an assassin take such pains to put the rifle back when he wanted to make a quick get-away?

The Memphis police and FBI would respond to these questions in their sur-rebuttal by arguing:

Ray did not originally intend to leave the bundle on the sidewalk. He was in the process of carrying it to the trunk of his car only a few feet away when police began swarming over the area from every direction. He set the bundle down inside the doorway so he would not be conspicuous when he walked to the curb to get in his car.

Ray was not a very reasonable man anyway. All of his crimes were marred with a fey blend of blunder and bad luck. "Inept" would be a fair adjective to describe his performance in every crime he committed, all of which resulted in his eventual capture. (A key FBI agent made this analysis, but this did not prevent him from later concluding that Ray masterminded and executed King's murder — as well as carrying out his successful escape — without any help from a criminal confederate!)

Ray wanted to be caught anyway. He may have either consciously or subconsciously left the bundle there as a way of notifying the world that he had killed King, a major achievement in the world of racists and common criminals.

Of course, point nine is based on direct evidence — namely, the eyewitness testimony of Charles Stephens. More will be said later about the weight of credibility that should be accorded to Mr. Stephens.

Even if one can accept all nine points of evidence as of sufficient weight to implicate Ray, how can this evidence suggest a "lone assassin" or non-conspiracy theory?

But first, is the evidence — circumstantial or not — indicative of Ray's guilt?

Is Ray Guilty?

Let's view the other points:

Point Two: The clerk in the Birmingham store identified Ray as the buyer. He said Ray called himself by the alias Harvey Loweyer. Ray actually made two trips to the store, the clerk said. On his first trip, he seemed unfamiliar with firearms and was not sure what he wanted to buy, the clerk said. He finally bought a rifle, and paid cash. Later that day, before closing, Ray called back and said he wanted to come in the next day and exchange the rifle for a more expensive and heavier kind. He seemed to know more about what he wanted and indicated he had talked to someone in the interim that gave him an elementary education on firearms, the clerk said. On his second visit, Ray bought the second rifle — the one found in the doorway — and said he did not know much about firearms but his brother did. He was buying the rifle to go hunting with his brother, the clerk quoted him as saying.

Taking this combination of physical and direct evidence at face value, does it suggest conspiracy? Or does it tend to substantiate the lone assassin theory?

Atty. Gen. Ramsey Clark flew to Memphis the day after King was killed and conferred with FBI agents in organizing the manhunt for the alleged assassin of King. At the time, Clark made an announcement that there was no evidence suggesting a conspiracy.

Yet two weeks later, the FBI office in Birmingham, after interviewing the clerk in the sporting goods store, concluded otherwise. They applied and received a warrant from the Federal district court charging James Earl Ray (by that time he had been identified by the fingerprints and serial number on the radio as the purported owner of the bundle) with conspiracy to violate the rights of Dr. Martin Luther King.

This impetuous move by Birmingham FBI agents not only embarrassed Mr. Clark, but irritated state department officials, who later faced the job of extraditing Ray from England.

In England, an alien cannot be extradited for "political crimes". In the long history of English jurisprudence, the term "political crimes" evokes connotations that might elude the average American attorney. "Conspiracies" in British and European experience have usually involved political and economic controversies. Most Conspiracy statutes were so abused in both England and America during the 19th and 20th century — especially against labor unions — that the modern libertarian tradition in Great Britain today has fostered a suspicion in the minds of many legal scholars that these conspiracy statutes, when applied, are usually the tools of politically-minded prosecutors seeking to repress some faction or political opposition.

To insure a successful extradition, the idea of conspiracy had to be played down. Instead of trying ing to get Ray back to the U.S. on the federal conspiracy warrant, the State and Justice Departments decided to rely exclusively on the murder indictment rendered by the Shelby County Grand Jury against Ray. The international impression that the slaying of Dr. King was nothing more than a murder case perpetrated by a common criminal had to be carefully nurtured.

The Other Points

Point Three: If the famous Professor Wigmore, internationally recognized authority on legal evidence and former Harvard law professor, had reviewed this evidence, he would probably have rejected it as conclusive proof of Ray's guilt, and not regarded it as even very good circumstantial evidence. Steeped in philosophy as well as law, Professor Wigmore always applied a rigorous set of theorems — much like the professors of logic in the department of philosophy. The conclusions of the prosecutors — namely, that the rifle must have been the murder weapon because it was found near the scene of the crime and that Ray must have been the killer because he purchased the weapon — both embrace the common fallacy that the professor of philosophy always warns his freshman class against: "Post Hoc Ergo Propter Hoc". (It means: "after this, therefore because of this." The fallacy is that you cannot deduce a cause and effect relationship between two events merely because of temporal sequence.)

Points Four and Five: This evidence cannot be accepted as indicative of guilt until it can be determined that Ray carried these items from his car into the rooming house and then from the rooming house to the spot where they were deposited on the sidewalk.

Point Six: I purposely omitted the fact that there was other clothing in the suitcase that did not fit James Earl Ray and did not carry the laundry mark. I omitted this fact because the police and the FBI always meticulously omitted this fact when they cited the evidence against Ray in the news releases. The fact is that the clothing that did not fit Ray would have fitted a much smaller man. Later on, we will discuss the testimony of another rooming house tenant, Mrs. Grace Walden, the commonlaw wife of Stephens, who contradicted the testimony of Stephens. Mrs. Walden said she saw the man who came out of the bathroom. He was white and was a much smaller man than Ray — a man whom the clothing would have fitted.

Point Seven: This evidence really amounts to nothing more than pseudo-corroboration of the other evidence. One would have to presume that all of the other evidence would lead the reasonable man to conclude beyond a reasonable doubt that Ray was in the rooming house. Since reasonable men might draw differing and conflicting inferences from the other evidence, how would the fingerprints on these items — standing alone — incriminate Ray?

Point Eight: This is an even weaker thread of evidence. The fibers on the bedspread match the fibers in the trunk of the car. All this proves is that the bundle had been in the trunk of the car. It does not prove who took the bundle from the car into the rooming house. Nor does it prove who set the bundle on the sidewalk. Later on, we will see that the evidence showed that there were two sets of keys to the Mustang that Ray allegedly drove to and from Memphis. The evidence will also show that Ray only had one set of those keys. Thus, the party who had the other set of keys could have easily put the bundle in the trunk or removed it. Also, the person with the second set of keys might have been the party the police alleged to in Point One that intended to put the bundle in the trunk but decided to lay it on the sidewalk when he saw police converging on the scene. In fact, the logic is much more compelling that if Ray had the bundle, he would have been tempted to walk a few more feet to the trunk of the car, open it and put the bundle in, before driving away. Another party, who knew that there was nothing in the bundle to incriminate him, would more likely have played it safe and gambled on appearing inconspicuous as he walked to the car.

As we have seen by analyzing each of these points (I am saving point nine for later), inferences of conspiracy can be drawn from the very evidence police used to infer Ray's guilt as the sniper.

How can they stick with a "lone assassin" theory if they used this evidence to convict Ray?

(To be continued)

Footnotes

1. Gerold Frank. "An American Death". Garden City, N.Y.: Doubleday & Co., Inc., p. 155
2. Frank consistently misspelled Benavides' name, apparently because he relied almost exclusively on official Memphis police department reports. As most veteran police reporters will confirm, policemen — even those with college training — tend to be extremely bad spellers. Frank apparently did not use any method of cross-checking information in the reports by interviewing the persons quoted in the police reports and comparing what they actually said with what the police quoted them as saying. Also, Frank consistently refers to the destination of Bonnevecche and Benavides as Brownsville, Texas. In fact, it was Brownsville, Tenn.
3. Many of Hammett's theories about crime and law enforcement were not mere spinoffs of a fiction writer's fantasies. Before he started writing mysteries, Hammett spent 10 years as a private detective with the Pinkertons — noted for their expertise in framing union leaders for violent incidents perpetrated by agents provocateurs the Pinkertons had planted in the unions. Some of the episodes Hammett cites in his non-fiction writing dwarfs the Watergate episode by comparison and makes E. Howard Hunt look like a bungling amateur.

FORUM — *Continued from page 7*
"Computers, Social Responsibility, and Man". This is an interdisciplinary course for seniors and graduates with full course credit, offered by the Dept. of Computer Science.[1]

One of the important projects is to take a long, hard look at the major problems of man. Students are asked to identify what they believe are the major problems confronting mankind, and to list them in order of significance. They make a list of these problems. Then they do research to determine what has been found out about these world problems. They may revise their listing of problems at this time — many do.

After identifying and researching these problems, students choose one problem that is of particular interest to them. They study how computers and other technology are used with reference to this problem. Sometimes computers make the problem easier to solve; sometimes they intensify the problem, as with privacy. The student then explores his or her personal ideas, how he or she may fit into the solving of important problems confronting mankind. How am I going to use computers and technology? What is my purpose? How do I identify my own personal idea of social responsiblity?

What is Social Responsiblity?

Here is not the place to discuss what Moses, Gandhi, Kant, Thoreau, Tolstoi and others wrote on social responsiblity, although their views are discussed in this course. But I would like to list some typical student reactions to the idea of social responsiblity:

- Assuming full liability for one's actions
- Agreeing that any person with special training should exercise special care in using this training (doctors, lawyers, computer scientists, engineers, locksmiths, plumbers, etc.)
- Considering effects before taking actions
- Becoming emotionally mature so that one cares what happens to persons beyond the family circle
- Wanting a beneficial and not a harmful effect from one's work and life
- Acknowledging the interrelatedness of all peoples and forms of life on the earth.

Here are some very different reactions, also from students:

- I don't care about the starving people in India and Africa. Let them starve. It's none of my business.
- I'm a scientist. I care only about professional computer science problems. The idea of social responsibility is too broad to be meaningful to me. It is not measurable.
- I have no use for do-gooders. I am here to get a degree, to get a good job, to earn a good life for myself and my family. I am not concerned with other people — let them earn their own way.
- This is a dog-eat-dog world. I accept it. There's nothing I can do about great world problems.

These reactions are only a partial listing, but they are typical of the reactions discussed each semester.

The Problem of War

One of the major problems identified by students is the problem of war — the destruction, horror, and death produced by war. War is something that man has practiced for thousands of years. And because man has always engaged in war, it is clearly a part of our cultural heritage and very difficult to eliminate.

But can computers and the rest of modern technology aid in eliminating war? It is not possible to wage many forms of modern war without major use of computers. Should computer professionals refuse to participate in war-making? Will such refusal work?

This may pose a personal question for each student: When I graduate, will I take a job that helps in war-making or will I avoid all such jobs? What do I as a person feel about this? If I feel strongly about this issue, what areas of computer work are there where I can use my professional training to enhance living and help make a much better society? Am I preparing myself for a constructive role during my life?

Many of the students I have taught have promised to write me in the future, and tell me how they solve their problem of personal social responsibility. I believe that this is a matter for individual decision, and that there is no one answer applicable to everybody. But it is clear and evident that computers and technology can be used for constructive and humane purposes, to make life a better experience for everybody.

[1]For a syllabus of this course and further discussion, see Proceedings, CUCC/5 (Computers in the Undergraduate Curriculum Conference), Washington State Univ., Pullman, Washington, June, 1974.

COMPUTER CHESS

THE FIRST WORLD CHAMPIONSHIP

Neil Macdonald
Assistant Editor

The First World Computer Chess Championship contest was held at the IFIP Congress in Stockholm August 5 to 8.

The Russian computer program designed by V. L. Arlazaroff and (initials not known) Donskoy of the Institute of Control Science, Moscow, U.S.S.R., won. The computer was an ICL System 4/70 located in Moscow.

There were 12 other participants. In the following listing the successive items are: Program Name / Author(s) / Affiliation / Computer / Location of the computer. (Information as of July 12.)

CHESS 4.0 / Larry Atkin, David Slate / Northwestern Univ., Evanston, Ill., USA / CDC 6600 / Control-Data Sweden, Stockholm.

TECH II / Alan Baisley and others / Mass. Inst. of Techn., Artificial Intelligence Lab., Cambridge, Mass., USA / PDP 10 / MIT via ARPA Link in Norway or London.

CHAOS / I. Ruben, F. Swartz, J. Winograd, V. Berman, W. Toikka / UNIVAC, Blue Bell, Pa., USA / UNIVAC 1108 / Stockholm.

OSTRICH / Monroe Newborn[1], George Arnold / Columbia Univ., New York, NY, USA / Data General 840 / Stockholm.

MASTER / Peter Kent, J. A. Birmingham / Atlas Computer Lab, Chilton, England / IBM 370/195 / Rutherford Lab, Chilton, England.

FREEDOM PROGRAM / Nils Aall Barricelli / University of Oslo, Blindern, Norway / CDC Cyber 74 / Kjeller, Norway.

TELL / Johann Joss / Eidgenossische Technische Hochschule, Zurich, Switzerland / HP 2115 or HP 2100 / Zurich or Stockholm.

RIBBIT / Jim Parry, Ron Hansen, Russell Crook / University of Waterloo, Waterloo, Ontario, Canada / Honeywell 6660 / ASEA, Vasteras, Sweden.

FRANTZ / Gerhard Wolf / Rechenzentrum / Graz, Austria / Univac 494 / Graz, Austria.

— / Don Beal / Queen Mary College, London, England / CDC 6400 or CDC 6600 / London or Stockholm

A16CHS / Robert Prinsen / Interscan Data Systems, Ltd., Hounslow, England / CCS-Alpha 16 / Hounslow

SCHACH MVS.1 / Helmut Richter, Werner Martens / Univ. of Hamburg, Hamburg, Germany / Telefunken TR 440 / Hamburg

1. On leave at Israel Inst. of Technology, Haifa, Israel

GAMES AND PUZZLES – *Continued from page 26*

Re (9): There should be a known way to solve your problem of postage stamps in seven denominations. I would look for a method to deal with it in a book on the branch of mathematics called combinatory analysis. I do not know the solution of your problem, and like you do not have time to work on the solution, since I have not yet retired from work!

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

SOLUTIONS

MAXIMDIJ 748: In politics there is no honor. (—Benjamin Disraeli)

NAYMANDIJ 748: Make M of 8's.

NUMBLE 748: Old love, ever bright.

Our thanks to the following individuals for sending us their solutions to – **Argumento 745:** Gertrude Coates, Chicago, Ill. – **Maximdij 747:** Leon Davidson, White Plains, N.Y. – **Maximdij 748:** Jean Robbins, Pasadena, Calif. – **Naymandij 747:** John E. Baugher and Michael S. Weisser, Sacramento, Calif. – **Numble 748:** Jeffrey P. Ethier, Haverhill, Mass.; Jean Robbins, Pasadena, Calif.; Major Gus Strassburger, Ft. Meade, Md. – **Numble 747:** John E. Baugher and Michael S. Weisser, Sacramento, Calif.; T. P. Finn, Indianapolis, Ind.; Abe Schwartz, Jamaica, N.Y.

Meredith – *Continued from page 23*

engineering. Dr. Klatt developed a computer model of the human vocal tract and a set of rules for transforming phonetic symbols into control instructions for that model. Thus, as information on the pronunciation of a word is available, the computer instructs the vocal tract model in how to build the speech wave within it. When these waves are fed through a loudspeaker, the computer "gives voice to its thoughts."

Basic work in speech analysis and synthesis which formed the basis for Dr. Klatt's work has been underway in RLE's Speech Communications Group under the direction of Professor Kenneth M. Stevens for nearly two decades.

Sentence Pauses and Inflections

Although the MIT computer system can correctly pronounce any word in the English language, its voice is still quite flat and featureless. This is because the MIT engineers are still very much immersed in the problem of teaching the computer how to pause and inflect at the proper place in a sentence, and even to change the pronunciation of words according to how they are used in the sentence.

Without this capability in the computer, people listening to the machine would be occasionally confused by unclear phrasing and by different possible pronunciations and meanings of such words as "refuse," "survey," and "separate."

"Our task at the sentence level is nothing less than to determine from a given text the speaker's intent and to compute the corresponding acoustic information to supplement and modify what the computer has learned about pronouncing the individual words," said Professor Allen.

Although much remains to be done to program a computer to utter natural-sounding sentences, the engineers do have a handle on the problem.

Improved Parsing

For instance, in order to obtain natural sounding speech, the computer must be able to parse correctly each sentence — dividing the sentence into its component grammatical parts to understand its meaning. Most computer programs to parse sentences work from the beginning of a sentence to the end. If such a "parser" runs into difficulty at the beginning of a sentence, it gives up, even though it may have been able to analyze successfully later parts of the sentence. Professor Allen and his colleagues have found that a sentence analyzer can be developed which looks for useful phrasings throughout the sentence, and then searches for ways to connect them later.

"Using such local analysis, even if a parser fails to 'understand' a particular sentence, it fails gracefully, still obtaining as many recognizable phrases as possible," said Professor Allen.

Practical Devices are Beginning

The MIT scientists recognize that, even with this powerful approach, they will still have to make substantial progress in linguistics and parsing techniques before a computer can analyze sentences and speak them naturally. However, the techniques are advanced enough now to begin utilizing them in practical devices. □

ACROSS THE EDITOR'S DESK

Computing and Data Processing Newsletter

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APPLICATIONS

SPANISH-SPEAKING COMPUTER IN CALIFORNIA SCHEDULES TELEPHONE OPERATORS IN MEXICO

Jim Furlong
Computer Sciences Corporation
650 North Sepulveda Boulevard
El Segundo, CA 90245

A Spanish-speaking computer in California will soon be scheduling the working hours of telephone operators throughout Mexico, including their lunch and coffee breaks. The computer will even take into account the work shift each operator prefers, when each is due for a day off, and vacation schedules. The automated scheduling service to Telefonos de Mexico, which serves all of Mexico, will be provided through CSC's Infonet computer timesharing network.

When service begins this fall, the Infonet computers will be bilingual. Employees of Telefonos de Mexico will be able to request and receive shift schedules in Spanish or English, using low-speed keyboard terminals linked to Infonet by telephone circuits. Schedules will be developed for operators in more than 200 central offices, from sector headquarters in Monterrey, Guadalajara, Mexico City, Puebla and Texcoco. The service will be the first large-scale timesharing application in Mexico.

SCIENTISTS USE COMPUTER TO MAKE BODY MEASUREMENTS FOR RESEARCH

Frank J. Weaver, Public Relations
Baylor College of Medicine
Texas Medical Center
Houston, Texas 77025

Scientists at the Texas Institute for Rehabilitation and Research are using a computer to produce highly accurate, three dimensional measurements of the human body for studies ranging from spinal deformities in children to weight loss in astronauts.

Researchers use dual cameras to take two overlapping photographs of each side of a person's body simultaneously. As in aerial mapping, a plotting device identifies reference points common to each photo to create a three dimensional image. The reference points, which can range from less than one hundred to over 40,000, are entered into the IBM computer with other body measurement data to produce precise measurements of the entire body or any part of it.

Using a computer-driven plotter, the measurements can be presented in several ways, such as: cross sections or slices of the body or its parts; contour maps of the body or body parts; or a graph showing how body volume is distributed from head to foot.

Dr. R. E. Herron, director of the Institute's Biostereometrics Laboratory and Professor of Rehabilitation, Baylor College of Medicine, says the system enables his research team to study and analyze the human body with a very high level of accuracy. "Two dimensional drawings, photographs, X-rays and plaster models ... are difficult to interpret as they are actually distortions of the three dimensional living form. The computer is enabling us to extend the scope of our research into a wide range of uncharted fields not possible with conventional two dimensional methods," he said.

The new method could make it relatively easy for physicians to measure a child's growth pattern. Using the computer generated measurements a physician could determine any deviation from the normal range as part of a routine physical examination.

Dr. Herron's research team is using the system to study scoliosis, a curvature of the spine that develops during early childhood. The system can detect any change along various levels of the spine. It can aid a physician in measuring the degree of a deformity to determine if surgery is necessary. Following surgery a physician can continue to use the system to track a patient's progress. By comparing measurement charts made before and after surgery, the physician can determine how the patient responded and suggest additional treatment accordingly.

The computer, an IBM System/360 Model 50, also is being used to study other areas where precise measurements are necessary including: development of more realistic "dummy models" used by the Department of Transportation in staging automobile accidents; reconstructive surgery to aid plastic surgeons in accurately restoring damaged areas; and fitting artificial limbs.

The Texas Institute for Rehabilitation and Research is an affiliated hospital of the Baylor College of Medicine, located at the Texas Medical Center.

COMPUTER CUTS $100,000 FROM COMPANY'S ELECTRIC BILL

Grant E. Alpaugh
TRW Equipment Group
23555 Euclid Ave.
Cleveland, OH 44117

TRW's Equipment Group is using a small IBM computer to save over $100,000 a year on its electric bill. TRW engineers say their energy management system, if used widely, could help ease the nation's spiraling demand for electricity. It also could reduce power companies' mounting needs for fuel oil and coal to run their generators.

Using leased telephone lines, TRW has linked an IBM System/7 to four high-energy consuming types of equipment serving its corporate offices and the Equipment Group's plant here: (1) air conditioners; (2) air compressors; (3) an 8,000 ton metal press and furnace; and (4) a 12,000 ton metal press and furnace. When the computer predicts that power demand will exceed a pre-determined level, it begins shutting down this equipment in sequential steps. When power demand drops or when a new half-hour monitoring period begins, the computer restarts the equipment.

"Just as with homeowners, we are billed each month for the electricity we actually consume," says Chuck Bingham, manager, operating services. "In addition, we pay a premium for the highest volume of electricity we used in any half-hour period during the previous month."

Senior Engineer Norm Vicha adds, "For example, last month we might have consumed a peak of 20,000 kilowatts of demand during just one of these half-hour periods, while our average half-hour usage may only have been 17,000. The electric company must have 20,000 kilowatts of capacity available again this month because we might need it for another peak half hour. Therefore, we pay many thousands of dollars for the convenience of having 20,000 kilowatts of demand available all the time, even though we may use that much electricity only a few minutes a month."

The computer now keeps this peak, short-term power usage in check. As the demand for electricity threatens to exceed 17,000 kilowatts in any half-hour period, the System/7 automatically begins shutting down air conditioning units in 12 sequential steps. If the demand remains excessive, air compressors are turned off in seven steps. The two big furnaces are the last to be shut down. Before that happens, an automatic signal alerts the operator so any metal pieces in the furnace or press won't be damaged. As a new half-hour demand period begins, everything automatically is turned back on by the IBM system.

"We found that even on a very hot day the air conditioners can be off for 15 minutes before anyone feels the difference," Vicha points out.

Electricity already is the largest regular expense in many companies' operating budgets. Power companies predict these costs will quadruple in the next 10 years.

Vicha explains that keeping the plant's power demand some 3,000 kilowatts lower than when it was uncontrolled is saving TRW Equipment about $9,000 a month. He says, "The new control system may drop next year's electricity requirements from a 15 percent increase projected by the power company to 7 percent. If a large number of companies in this area adopted similar controls and got similar results, the electric company would have to add only half the capacity planned for next year. That would mean a considerable reduction in their projected power plant and fuel requirements and a sizeable savings for their industrial and commercial customers."

A side benefit of the system is its ability to quickly reduce electricity consumption levels, with minimal effect on production, when required to do so by a power company. This situation can occur fairly frequently during the summer in areas where high usage of air conditioners threatens brownouts.

RESEARCH FRONTIER

ELECTRONIC "EAR" AND MINICOMPUTER COMBINE TO DETECT HEART DEFECTS

Raymond F. Shanahan
General Electric Public Information
Research and Development Center
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Schenectady, NY 12301

A minicomputer with a supersensitive "ear" is helping researchers at the General Electric Research and Development Center identify heart defects that can escape detection during routine electrocardiographic (ECG) examinations. Similar in principle to the stethoscope, the new listening technique can provide physicians with a much broader and more accurate range of heart sounds, all fully computer-analyzed for on-the-spot interpretation and diagnosis. The data then can be accurately interpreted by family physicians and cardiac specialists alike.

The new GE technique is designed to supplement rather than replace ECG examinations and is expected to be clinically qualified and ready for wide-scale application within two to five years.

Only about three minutes are required for a comprehensive "reading" with the new method. The speed and accuracy of the examination will make it especially useful for mass screening procedures to detect potential heart ailments. Once a serious heart ailment has been detected, the technique also can be used to evaluate its severity, thus reducing the need for complicated catheterization procedures that require the injection of chemicals through tubes inserted into the heart.

Key to the new technique is a small electronic sound sensor about the size of a silver dollar, which is placed directly on the patient's chest. The sensor detects sounds in the frequency range of 1 - 1500 cycles per second, compared to the 30 - 500 cycles per second normally "heard" with an ordinary stethoscope. The sounds detected by GE's supersensitive "ear" are converted to digital signals, fed into a computer, and analyzed, and the results are immediately printed out. The physician then interprets the data and makes the diagnosis.

— Biologist Paul M. Griffen (right), who heads the GE development discusses the electronic sensor and heart "readings" with other team members, Mrs. Judy R. McCullough, a scientific computer programmer, and Leslie D. Meyer, a biomechanical engineer.

The new phonocardiology technique will help eliminate many of the variables that can produce inconclusive stethoscopic findings, i.e., the pressure with which a stethoscope is placed against the patient's chest can affect the heart sound. By contrast, the GE transducer rests on the patient at a constant pressure.

In tests at four major teaching hospitals and at GE's Industrial Clinic in Schenectady, N.Y., the unique listening technique has been instrumental in detecting restricted blood flow, abnormal muscle contradiction, arterial blockage, and the very early stages of weakening heart valves. At the GE Industrial Clinic, the phonocardiac tests were given simultaneously with electrocardiograms. The ECG measures electrical functions of the heart, and provides medical examiners with basic information about heart rhythm and conduction. The phonocardiac tests, by contrast, measure mechanical functions, such as valve opening and closing, muscle contraction, and the flow of blood into and out of the heart.

According to Dr. Arthur M. Bueche, GE Vice president for research and development, prevention rather than cure offers the best hope in controlling heart attacks. "The earliest possible discovery of cardiac problems — when they are easiest to treat — is a major goal of the medical profession," he said.

The three-member development team, headed by Paul M. Griffen, manager of biomedical programs at the GE Research and Development Center, expects that the new technique will be applied in such areas as post-operative diagnostics, continuous monitoring of heart patients, and mass physical examinations.

Other members of the GE phonocardiology research team are Mrs. Judy R. McCullough, a scientific computer programmer, and Leslie D. Meyer, a biomechanical engineer.

ANALYSIS OF PROTEIN STRUCTURE USING NEW COMPUTER TECHNIQUE

R. M. Neudecker
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Yorktown Heights, NY 10598

Dr. David Sayre, a mathematician of the IBM Thomas J. Watson Research Center, has developed a new computer technique for use in the final stages of determining the arrangement of atoms in proteins and other large molecules.

The new technique starts at a point where individual atoms cannot yet be seen on a topological map showing the density of electrons in the molecule. At the end of the computation, a map is produced on which almost all of the atoms have come clearly into view.

In the first application of the new technique, Sayre used it to determine, at high resolution, the structure of the bacterial protein, rubredoxin, which he is examining on the electron-density map in the picture. Refining the structure of rubredoxin from 2.5 to 1.5 Angstroms resolution took about 15 hours of computation on an IBM System/360 Model 91. On the 1.5 Angstrom map, Sayre was able to locate and identify 400 of the protein's 424 atoms.

Sayre reported his results on rubredoxin in the March 1974 issue of "Acta Crystallographica".

MISCELLANEOUS

EVEN THE BULLET LEAVES A TRAIL

Gil Aberg
The Pennsylvania State University
312 Old Main Bldg.
University Park, PA 16802

Fingerprints...
...A smear of blood.
...A speck of dust.
...A thread.
...A hair.

Over the years, police scientists have developed increasingly subtle ways of linking a suspect to a crime. Now, a brand new forensic technique has been opened up by a discovery made at The Pennsylvania State University.

A bullet fired from virtually any gun leaves an invisible, long-lasting trail of its entire flight-path. That trail, on the floor, ground or other surface over which the slug has passed, can be reconstructed by a technique already in wide use in police laboratories: neutron activation analysis. Dr. K.K.S. Pillay announced the findings at a Philadelphia meeting of the American Nuclear Society on June 24th.

The bullet trail that Pillay has discovered is a kind of "fallout," consisting of residues from the initial detonation in the gun. "These residues," he says, "are sucked into the vacuum created by a rifling bullet and chase it all the way to the target, falling out enroute in extremely minute amounts that can nevertheless be detected. They show up in samples lifted from the surface below the flight path." The fall-out forms a wide pattern, from which the entire trajectory can be reconstructed and certain conclusions reached about the kind of ammunition used and perhaps even the calibre of the weapon.

To make the trail "visible" requires the application of neutron activation analysis. Samples lifted from a floor are bombarded with neutrons in a nuclear reactor and the resulting emissions analyzed for the presence of barium and antimony. Both are present in significant amounts in primer, and antimony is present in the lead of the bullet itself.

From the amount and distribution on a surface of barium and antimony, Pillay says, he can, first, prove that a bullet was fired over a particular surface, determine the direction from which it was fired, roughly determine the distance it travelled, and state whether the ammunition used was of the rim or center-firing variety. As research proceeds on the technique, which is yet to be used in an actual police case, he hopes to be able to associate a particular residue trail with a particular type of weapon.

Homicide investigators, Pillay believes, will be quick to appreciate the forensic possibilities of the discovery, especially for crimes committed indoors or under cover. Residues will remain indefinitely, he says, if not disturbed. Outdoor shootings would be more difficult, Pillay points out, but not altogether impossible.

Pillay's research was sponsored, in part, by the Governor's Justice Commission and the State Police of Pennsylvania, Associated with him in the project, which is continuing, are Dr. William Jester and graduate students D.C. Driscoll and B.W. Lee. Sgt. James Duffley and his staff at the Ballistics Division of the Pennsylvania State Police assisted in the range testing.

HIGH TECHNOLOGY RELIES ON ANCIENT TECHNOLOGY OF WATER WHEELS TO PROVIDE ELECTRICAL NEEDS FOR A NUMBER OF NEW ENGLAND FIRMS

Marlane Weber McGarry
Simon/Public Relations, Inc.
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The closest most people get to water wheels is the pages of a history book. But for a number of New England businesses this ancient technology is proving to be more reliable than some current forms of high technology.

As blackouts and brownouts roll across the country, a common fear is how to keep the food in the freezer from defrosting. But for large companies that depend on computers for their daily operations, a power failure can mean disaster on a grand scale.

A few companies, like National Community Services, Lowell, Mass., find themselves in the enviable position of not having to worry about being shortcircuited. The multi-million dollar firm, which helps schools and other nonprofit organizations raise money, is one of a number of companies in the Lowell area that depends on a water supply based on 18 water wheels, electrically interconnected, and tied into a local utility. The wheels — some of which were built in the mid-1800's — provide about 20-million kilowatt hours of power annually, and supply as much as 75 per cent of the electrical needs of the companies it serves.

NCS is also one of those companies that depends on a computer for information essential for its daily operations — everything from printing mailing labels to sales analyses. "Even if the utility shuts us down completely for hours or days, we still are able to use critical lights and equipment including our minicomputer," says Joseph Mendola, Treasurer of NCS. "We've been using the Model 400, produced by Basic/Four Corporation, for almost a year, and new systems like this don't have to be pampered like earlier computers. There are a few unusual aspects that have to be thought of since the water supply is more difficult to control, but that problem is easily solved by using voltage regulators.

"Unlike a lot of other types of computers though, the Basic Four system doesn't require air conditioning to stabilize its operating temperatures," explained Mendola, "so we really don't have to be concerned if there's a blackout or the airconditioning is cut off. The minicomputer just isn't that temperamental. We benefit from the water wheel-generated electricity all the time," the NCS executive stated. At off hours, when most of the other companies are closed, the water wheel generates more than enough power to provide the 1600 volt-amps needed by the computer, in addition to the lights and other equipment.

"It's rather a funny juxtaposition of old and new," Mendola pointed out, "when you realize that the water wheel's origins date back to hundreds of years before Christ, and the computer is one of the most sophisticated, advanced technologies."

NEW CONTRACTS

TO	FROM	FOR	AMOUNT
Burroughs Corporation, Detroit, Michigan	United States Air Force, Washington, D.C.	8-year contract, renewable annually, continuing lease (with option to buy) and maintenance of 135 B 3500's; also installing B 3700 and 4700 systems and other specified equipment at selected sites	$206 million (approximately)
Control Data Corporation, Minneapolis, Minn.	Victoria Totalizator Agency Board, Victoria, Australia	A computer-based betting system, called the Generalized Wagering System, which is based on over a dozen System 17 mini-computers that can substitute for each other	$12 million
Digital Resources Corporation, Hauppauge, N. Y.	SONATRACH, Algiers, Algeria	Assistance in development of geophysical seismic processing applications; computerized petrochemical and process control applications, and expansion of computer center for business data processing	$5.7 million
Integrated Systems Support, Inc., Falls Church, Virginia	Navy Supply Center, Norfolk, Virginia	Providing computer program related support in production of Navy Tactical Data System (NTDS) software	$4.2+ million
National Sharedata Corporation, Dallas, Texas	First National Bank and Trust Company, Evanston, Ill.	Management of FNB&T's data processing facility, and marketing of automated services to other banks and businesses	$4 million
Recognition Equipment, Dallas, Texas	National Bank of North America, New York, N.Y.	Installation of a TRACE© item processing system for processing all NBNA's checks and deposit tickets	$3.3 million (approximately)
CompuScan, Inc., Teterboro, N.J.	Mergenthaler Linotype Company, Plainview, N.Y.	Specified optical scanning systems, called OCR-100, for international marketing	$2 million (approximately)
National Sharedata Corporation Dallas, Texas	Oak Park Trust and Savings Bank, Oak Park, Ill.	Managing bank's data processing facility, and marketing of automated bank and commercial services to local businesses	$2 million (approximately)
Ferranti, Limited, Digital Systems Division, Berkshire, England	Ministry of Defence, London, England	The first production FM1600B computer action-information system for new class of Royal Navy mine counter-measure vessels, and development of necessary operational computer programs	$1.8 million (approximately)
Applied Digital Data Systems, Hauppauge, N.Y.	Modular Computer Systems, Ft. Lauderdale, Fl.	1000 terminals, from low-cost Consul 580 to new Consul 980 for sale with Mod Comp mini-computers	$1.6 million (approximately)
Sweda International, Morristown, N.J.	W. T. Grant Company New York, N.Y.	Series 700 System electronic sales terminals and central data processors, which will equip 22 more general merchandise stores in Northeastern United States	$1.2 million
Brandon Applied Systems, Inc. San Francisco, Calif.	Federal Communications Commission, Washington, D.C.	Conversion of 324 programs from SALT, used on Univac III computer, to COBOL, to be operated on Honeywell 6023	$1 million (approximately)
Computer Sciences Corp. El Segundo, Calif.	Los Angeles County Supervisors, Los Angeles, Calif.	Study of county's needs; design of a Welfare Case Management and Information System"; aid in equipment procurement; and defining cost and time schedules for project's next phase (implementation of system)	$670,000
Raytheon Cossor Data Systems, Lexington, Mass.	Thomson Holidays, United Kingdom	140 PTS-100 programmable display terminals at 9 locations in England, Scotland, and Wales, which will be linked to an IBM 370/158	$600,000 (approximately)
Applied Digital Data Systems, Hauppauge, N.Y.	Microdata Corporation, Irvine, Calif.	Consul 580 terminals for inclusion in its mini-computer business system, REALTY	$500,000 (approximately)
Computer Sciences Corporation, El Segundo, Calif.	Taiwan Power Company Taiwan	Engineering and technical services in developing automated on-line dispatch and control system	$370,000
Incoterm Corporation, Natick, Mass.	American Airlines, Boston, Mass.	Over 40 SPD 10/20 programmable visual display systems for flight control and fleet maintenance applications	$320,000
	Japan Air Lines Company, Ltd. Tokyo, Japan	74 SPD 20/20 computer terminal systems, to increase reservations capability of JALCOM II world-wide communication system	$295,000
Boeing Computer Services, Inc. Dover, N.J.	United States Air Force, Washington, D.C.	Use of two proprietary performance measurement software packages (SARA and CLARA), and conversion of SARA for use with the Honeywell 6000 series.	——
Dataproducts Corporation, Woodland Hills, Calif.	Digital Equipment Corporation, Maynard, Mass.	Line printers and core memory stacks, to be used by DEC throughout their lines of computers and minicomputer products.	——
Westinghouse Electric Corp., Pittsburgh, Penn.	System-Pan Electric Milan, Italy	10 W2570 process control systems; Pan Electric will add application software and hardware and market systems to industries in Europe and the Middle East	——
American Management Systems, Inc., Arlington, Virginia	Council for Exceptional Children, Reston, Virginia	Computer, keypunching, and complete technical support for CEC's computer system	——
Memorex Corporation, Santa Clara, Calif.	American Used Computer Corp., Boston, Mass.	Purchase of firm's entire computer systems inventory in a joint purchase from Memorex and ILC Leasing Corp.; inventory had original purchase price of over $6.5 million	——
TRW Data Systems, Hawthorne, Calif.	Playboy Clubs International, Inc. Chicago, Ill.	TRW's Validata Service, a computer credit card verification system	——

NEW INSTALLATIONS

OF	AT	FOR
Burroughs B 1714 system	Snyder County Trust Company, Selinsgrove, Pa.	Processing demand deposit and installment loan accounts; more applications are planned (system valued at $141,000)
Burroughs B 1726 system	Monterey Peninsula College, Monterey, Calif.	Instructional, administrative and office requirements (system valued at $124,000)
Burroughs B 2700 system	Alaska Railroad, Anchorage, Alaska	Financial and personnel data, inventory, supply and logistical operations, including freight car acctg. (system valued at about $800,000)
	First National Bank, Des Plaines, Ill.	Increasing range of data processing services within the bank and to clients in the area (system valued at $400,000)
Burroughs B 6700 system B 1700 systems (2)	New York State Board of Equalization and Assessment (NYSBEA) Albany, N.Y.	Continuing development of a state-wide real estate property information systems (systems valued at $5.1 million)
Computer Automation ALPHA 16	Stromberg Carlson, St. Louis, Mo.	Monitoring telephone traffic in large corporate or industrial environments, printing out time, call destination, cost information for hundreds of phones
Computer Automation NAKED MINI/LSI-Type 2	Union Carbide Corp. Tarrytown, N.Y.	Vital part of automated laboratory system, UC's CentrifiChem System, which performs simultaneous analysis of up to 30 samples of body fluids, in batch parallel mode
Control Data 6400 system	Drake University, Des Moines, Iowa	Increasing the University's computing capability through a network of terminals installed in offices, classrooms and laboratories
Control Data CYBER 70 Model 72	Ramsey County Courthouse Ramsey County, Minn.	Merging welfare department's processing (previously on IBM 370/145) and data handling of all other departments (previously on Univac 9400) onto single CDC computer; resulting savings is over $200,000/year
HP-3000 system	Santa Rosa Junior College, Santa Rosa, Calif.	Teaching programming to students, and to aid administration functions
Honeywell Model 66/20 system	Virginia Federal Savings and Loan Association Richmond, Va.	Savings, mortgage loans, certificates of deposit and other teller services; also payroll, off-line branch settlement reports and mailings of advertising and statements. (system valued at over $1 million)
Honeywell Model 2050 system	CTF-Adaps Ltd., Adelaide, Australia (3 systems)	Replacement of smaller 125 systems at CTF-Adaps data centers in Sydney, Melbourne and Adelaide; increases throughput by about 300 percent (systems valued at over $1.8 million)
Honeywell Model 2070 system	F&T Industries, Ltd., Melbourne, Australia	Production planning and control, inventory management, and financial and cost accounting (system valued at over $1.2 million)
IBM System/3 Model 6	Budd Mayer Co., Miami, Fl.	Producing food orders, sales analyses, accounting and merchandising reports
IBM 370/158 system	Scientific Time Sharing Corp. Washington, D.C.	Increased capacity, needed to cope with increase in monthly sales throughout the past year (system valued at $2.1 million)
NCR Century 100 system	Concorde-Lafayette Hotel Paris, France	Processing management data and handling all accounting for the Concorde chain
NCR Century 200 system	Lucerne, Switzerland	Tax invoicing and processing of municipal accounts; serving Public Health Insurance Fund and Public Bldg. Directorate; and computing electricity charges for Lucerne Power Station
NCR Century 300 system	Treasury of West Australia, Perth, Australia	Varied applications for government departments from processing motor vehicle registrations and drivers' licenses to monitoring cattle disease and doing prawn analysis; replaces two smaller computers
SYSTEMS 85 computer system	French National Aerospace Agency, Helicopter Div., Marignane, France	A variety of real-time testing, data acquisition, and scientific computation requirements
Univac 90/70 system	Registro Italiano Navale, Genoa, Italy	Administration, ship register file processing, ship structure design, hydrostatic and hydrodynamic calculations and interactive optimization techniques (system valued at $1.3 million)
Univac 1106 system	Wollongong University, Wollongong, Australia	Student instruction in data processing, scientific, engineering and commercial applications; surplus capacity used by City of Wollongong (system valued at about $1 million)
Xerox Sigma 9 system	Com-Share Co. Ann Arbor, Mich.	Time-sharing and data management; joins three other Sigma 9's already installed (system valued at $1.1 million)
	New York Institute of Technology Long Island, N.Y.	Expanded computer-aided instruction (CAI) and computer-managed instruction (CMI) at both NYIT and secondary schools, including programs in math, English and physics; also administrative tasks (system valued at $845,000)
	Texas Christian University, Fort Worth, Texas	Administrative and academic applications from student admissions to maintaining federal files for HEW (system valued at over $1 million)

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 AUGUST 15, 1974

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL $(000)	NUMBER OF INSTALLATIONS In U.S.A.	Outside U.S.A.	In World	NUMBER OF UNFILLED ORDERS
Part 3. Manufacturers Outside United States							
A/S Norsk Data Elektronikk	NORD-1	8/68	2.0	0	142	142	22
Oslo, Norway	NORD-2B	8/69	4.0 (S)	0	20	20	X
(A) (Mar. 1974)	NORD-5	2/72	-	0	1	1	4
	NORD-10	5/73	2.0	0	30	30	40
	NORD-20	1/72	3.5 (S)	0	43	43	8
A/S Regnecentralen	GIER	12/60	2.3-7.5	0	57	57	0
Copenhagen, Denmark	RC 4000	6/67	3.0-20.0	0	23	23	3
(A) (Aug. 1973)							
Elbit Computers Ltd.	Elbit-100	10/67	4.9 (S)	-	-	325	10
Haifa, Israel							
(A) (Nov. 1973)							
GEC Computers Ltd.	902	5/68	X	0	17	17	X
Borehamwood, Hertfordshire	903	12/65	X	-	-	-	X
England	920B	12/65	-	-	-	-	-
(A) (April 1974)	GEC 905	5/69	X	0	77	77	X
	GEC 920M	7/67	-	0	130	130	103
	GEC 920C	7/68	X	0	19	19	X
	Myriad I	1/66	X	0	47	47	X
	Myriad II	11/67	X	0	32	32	X
	GEC M2140	10/69	X	9	21	30	X
	GEC 2050	6/72	10.0 and up(S)	8	101	109	61
	GEC 4080	10/73	30.0 and up(S)	0	11	11	29
Hitachi, Ltd.	301	5/59	X	-	-	-	X
Tokyo, Japan	101	9/60	X	-	-	-	X
(A) (April 1974)	102	8/59	X	-	-	-	X
	103	12/61	X	-	-	-	X
	201	4/62	X	-	-	-	X
	3010	11/62	X	-	-	-	X
	5020	3/65	X	-	-	-	X
	4010	5/65	X	-	-	-	X
	8400	2/67	10.0-50.0	-	-	-	-
	8200	2/67	3.3-8.3	-	-	-	-
	8300	4/67	8.3-15.3	-	-	-	-
	8100	5/67	1.3-4.0	-	-	-	-
	8500	8/68	16.7-66.7	-	-	-	-
	8210	12/68	2.6-10.0	-	-	-	-
	8350	2/71	11.7-40.0	-	-	-	-
	8700	3/72	60.0-167.0	-	-	-	-
	8450	6/72	23.3-66.7	-	-	-	-
	8150	11/72	1.7-5.0	-	-	-	-
	8800	12/72	13.0 and up	-	-	-	-
	8250	4/73	5.0-13.0	-	-	-	-
International Computers, Ltd. (ICL)	Atlas 1 & 2	1/62	65.0	0	6	6	X
London, England	Deuce	4/55	-	0	2	2	X
(R) (Sept. 1972)	KDF 6-10	9/61	10-36	0	34	34	X
	KDN 2	4/63	-	0	1	1	X
	Leo 1, 2, 3	-/53	10-24	0	43	43	X
	Mercury	-/57	-	0	4	4	X
	Orion 1 & 2	1/63	20.0	0	10	10	X
	Pegasus	4/55	-	0	9	9	X
	Sirius	-/61	-	0	8	8	X
	503	-/64	-	0	18	18	X
	803 A, B, C	12/60	-	0	107	107	X
	1100/1	-/60	5.0	0	13	13	X
	1200/1/2	-/55	3.9	0	11	11	X
	1300/1/2	-/62	4.0	0	82	82	X
	1500	7/62	6.0	0	35	35	X
	2400	12/61	23.0	0	3	3	X
	1900-1909	12/64	3-54	2	2200	2202	-
	Elliott 4120/4130	10/65	2.4-11.4	0	100	100	X
	System 4-30 to 4-75	10/67	5.2-54	0	200	200	-
Japanese Mfrs. (except Hitachi, Ltd.	(Other manufacturers of various models include: Fijitsu, Ltd.; Matsushita Electric Co. of America; Mitsubishi Electric Corp.; Nippon Electric Co., Ltd.; Oki Electric Industry Co.; Tokyo Shibaura Electric Co., Ltd.(Toshiba).)				12,809	-	800 E

NAME OF MANUFACTURER	NAME OF COMPUTER	DATE OF FIRST INSTALLATION	AVERAGE OR RANGE OF MONTHLY RENTAL $(000)	NUMBER OF INSTALLATIONS In U.S.A.	Outside U.S.A.	In World	NUMBER OF UNFILLED ORDERS
Philips Electrologica BV	P1000	8/68	7.2-35.8	-	-	150	43
Apeldoorn, Netherlands	P9200	3/68	-	-	-	299	1
(A) (January 1974)	P9200 t.s.	3/70	-	-	-	6	-
	P880	9/70	-	-	-	58	8
	P850/55/60 (OEM)	9/70	-	-	-	298	827
	ELX	5/58	6-21	-	-	25	-
	PR 8000	1/66	-	-	-	23	-
Philips' Telecommunicatie	DS 714	-/67	-	13	34	47	10
Industrie BV	DS 18	9/72	-	0	9	9	4
Hilversum, Netherlands							
(A) (April 1974)							
Redifon Electronic Systems, Ltd.	R2000	7/70	-	1	26	27	2
Crawley, Sussex, England	R2000A	6/73	-	-	2	2	12
(A) (Aug. 1973)							
Saab-Scania Aktiebolag	D21	12/62	7.0	0	18	18	-
Linkoping, Sweden	D22	11/68	15.0	0	37	37	2
(A) (May 1974)	D220	4/69	10.0	0	17	17	0
	D23	-/73	25.0	0	0	0	6
	D5/30	12/71	1.0	0	28	28	33
	D5/20	5/71	0.6	18	685	703	1987
Selenia S.p.A.	GP-16	7/69	10.9 (S)	0	269	269	53
Roma, Italy	GP-160	-	5.6 (S)	-	1	1	43
(A) (April 1974)							
Siemens	300 Series	4/65-4/72	0.9-7.9	-	-	680	160
Munich, Germany	2002	6/59	16.4	-	-	41	X
(A) (Jan. 1974)	3003	12/63	15.8	-	-	29	X
	4004/15/16	10/65	6.1	-	-	83	1
	4004/25/26	1/66	10.0	1	-	96	4
	4004/35	2/67	14.2	-	-	212	7
	4004/127	4/73	14.0	-	-	57	42
	4004/135	10/71	20.5	-	-	164	25
	4004/45	7/66	27.3	-	-	334	20
	4004/46	4/69	41.0	-	-	10	X
	4004/55/60	7/66	35.0	-	-	23	X
	4004/150	2/72	49.0	-	-	139	33
	4004/151	3/72	61.0	-	-	29	17
	4004/220	1/75	-	-	-	-	51
	4004/230	1/75	-	-	-	-	41
	404/2	11/73	3.0	-	-	-	71
	404/3	4/71	2.1	-	-	101	35
	404/6	10/71	4.5	-	-	105	16
Telefunken Computer GmbH	TR 4	10/61	X	-	-	35	X
Konstanz, Germany	TR 440	6/70	60.0	-	-	29	-
(A) (Jan. 1974)							
USSR	BESM 4	-	-	-	-	C	C
(N)	BESM 6	-	-	-	-	C	C
(May 1969)	MINSK 2	-	-	-	-	C	C
	MINSK 22	-	-	-	-	C	C
	MIE	-	-	-	-	C	C
	NAIR 1	-	-	-	-	C	C
	ONEGA 1	-	-	-	-	C	C
	URAL 11/14/16 and others	-	-	-	-	C	C

SPRAGUE — *Continued from page 21*

community encompasses all of the items listed under the definition of EFTS given earlier in this article.

The above approach may sound illegal, impossible, dreamlike, and unacceptable, to many of the financial institutions and governmental regulatory bodies interested in EFTS. Yet, it may be the only approach that will allow all of the parties to cross the rainbow together and to reach the pot of gold.

Footnotes

(1) The Cleveland Fed POS Report, sometimes referred to as the Hendricks Report, after William Hendricks of the Cleveland Fed, was originally made available to interested parties on a limited basis. It is no longer available.

(2) The terms "Asset Card", "Debit Card", and "Cash Card" are used interchangably to mean a card that permits a consumer to obtain cash from his checking or savings account, or to cash a check, or to transfer funds out of his account.

(3) For a complete description of the perfect community approach, see two prior articles by the author. "System for Automatic Value Exchange", Touche Ross & Co. report 1967 and "The Community Approach to Funds Transfer" Sprague Research & Consulting report, 1969. □

FORD — *Continued from page 16*

tively tackle the quality of working life issues, will be the goers on what could be an increasingly sticky track in the future.

Footnotes

1. This problem of insensitivity is often compounded by the fact that engineers, having convinced themselves that they are the builders of the society, often develop a tendency towards arrogance and to brush away any criticism of their roles.
2. The University of California at Los Angeles offers a Masters degree in socio-technical systems.
3. The ability to develop a sociological imagination is not confined to sociologists. In fact, the training of many of the senior sociologists at Australian Universities has left them with one common denominator, i.e. their work shows an almost total lack of imagination.
4. There appears to be an increasing number of computer people who want to be judged by what they contributed to their children's world and not by what they "ripped off it".

Reference

Fujio Yoshida. "Technology Assessment in Business". The Wheels Extended. Vol. 3, No. 3. Winter '73-74, p. 21. □

CALENDAR OF COMING EVENTS

Sept. 24-27, 1974: International Conference and Exhibition on Computers in Engineering and Building Design, Imperial College, London, England / contact: Conference Organizer M.I. Dawes, IPC House, 32 High St., Guildford, Surrey, England GU1 3EW

Sept. 25-28, 1974: II Seminar of Technical Computing, Caracas, Venezuela / contact: E. Lorenzoni, c/o AVICE, Apartado de Correos 2006, Caracas, Venezuela

Oct. 2-4, 1974: Systems, Man & Cybernetics Society Annual Meeting, Fairmont Hotel, Dallas, Tex. / contact: A. P. Sage, Southern Methodist Univ., Inst. of Tech., EE Dept., Dallas, TX 75275

Oct. 8-9, 1974: 8th Annual Instrumentation and Computer Fair, Washington, D.C. / contact: Robert E. Harar, Instrumentation Fair, Inc., 5012 Herzel Place, Beltsville, MD 20705

Oct. 9-10, 1974: 1974 Conference on Display Devices and Systems, Statler Hilton Hotel, New York, N.Y. / contact: Society for Information Display, 654 N. Sepulveda Blvd., Los Angeles, CA 90049

Oct. 10-16, 1974: 6th INTERKAMA – International Congress and Exhibition for Instrumentation and Automation, Düsseldorf, Germany / contact: INTERKAMA '74: Düsseldorfer Messegesellschaft mbH, 4000 Düsseldorf 30, Germany

Oct. 14-16, 1974: 15th Annual Symposium on Switching and Automata Theory, New Orleans, La. / contact: Prof. Fred Hosch, Dept. of Computer Science, Louisiana State Univ. at New Orleans, Lake Front, New Orleans, LA 70122

Oct. 14-16, 1974: First Conference on Computer-Assisted Test Construction, Royal Inn at the Wharf, San Diego, Calif. / contact: CATC Conference, Educational Testing Service, 1947 Center St., Berkeley, CA 94704

Oct. 16-18, 1974: 46th National Meeting of Operations Research Society of America, and 21st International Meeting of The Institute of Management Sciences, Americana and El San Juan Hotels, San Juan, Puerto Rico / contact: Rafael Fernandez, P.O. Box 2342, Mayaguez, Puerto Rico 00708

Oct. 16-18, 1974: 9th Annual Iomec Users Assoc. Conference and Seminars, Place du Puis Holiday Inn, Montreal, Canada / contact: Glenn Lutat, IUA, 3300 Scott Blvd., Santa Clara, CA 95050

Oct. 16-18, 1974: 30th Annual National Electronics Conf. and Exhibition, Hyatt Regency O'Hare, Chicago, Ill. / contact: National Electronics Conf., Inc., Oakbrook Executive Plaza 1, 1301 W. 22nd St., Oak Brook, IL 60521

Oct. 16-18, 1974: 12th Annual GIDEP Workshop, Government-Industry Data Exchange Program, Hyatt House, San Jose, Calif. / contact: Henry Reichenberg, Publicity Chairman, 12th Annual GIDEP Workshop, Applied Physics Laboratory / Johns Hopkins University, 8621 Georgia Avenue, Silver Spring, MD 20910

Oct. 21-23, 1974: 1974 International Symposium, International Society for Hybrid Microelectronics, Sheraton-Boston Hotel, Boston, Mass. / contact: ISHM, P.O. Box 3255, Montgomery, AL 36109

Oct. 23-25, 1974: ADAPSO 41st Management Conference and 14th Annual Meeting, Waldorf-Astoria Hotel, New York City, N.Y. / contact: ADAPSO' 210 Summit Avenue, Montvale, NJ 07645

Oct. 27-31, 1974: Information Theory International Symposium, Center for Continuing Education, Notre Dame Univ., Notre Dame, Ind. / contact: J.L. Massey, Dept. of EE, Univ. of Notre Dame, Notre Dame, IN 46556

Oct. 27-31, 1974: National Retail Merchants Association's EDP Conference, Quebec Hilton, Quebec City, Canada / contact: NRMA Information Systems Division, 100 West 31 St., New York, NY 10001

Oct. 28-30, 1974: CONVERGENCE 74, First International Colloquium on Automotive Technology, Somerset Inn, Troy, Mich. / contact: SAE, 18121 E. Eight Mile Rd., East Detroit, MI 48021

Oct. 29-31, 1974: 28th Northeast Electronics Research and Engineering Meeting, Sheraton-Boston Hotel and Hynes Auditorium, Boston, Mass. / contact: S. Swartz, Nerem Business Office, 31 Channing St., Newton, MA 02158

Oct. 31-Nov. 1, 1974: Canadian Symposium on Communications, Queen Elizabeth Hotel, Montreal, Quebec / contact: George Armitage, IEEE Canadian Region Office, 7061 Yonge St., Thornhill, Ontario L3T 2A6, Canada

Nov. 5-8, 1974: 1974 Fall DECUS Symposium, Town and Country Hotel, San Diego, Calif. / contact: DECUS, 146 Main St., Maynard, MA 01754

Nov. 11-13, 1974: 29th Annual ACM Technical Conference, San Diego, Calif. / contact: Lyn Swan, ACM '74, P.O. Box 9366, San Diego, CA, 92109

Nov. 12-14, 1974: 5th Annual Canadian Computer Show, Place Bonaventure, Montreal, Canada / contact: Ray Argyle, The Argyle Syndicate, Ltd., 47 Colborne St., Ste. 301, Toronto, Ontario, Canada M5E 1E3

Nov. 13-15, 1974: 13th International Automation and Instrumentation Conference, Milan Fair Ground, Milan, Italy / contact: Secretariat, Federazione delle Associazioni Scientifiche e Techniche, Piazzale R. Morandi, 2, 20121 Milano, Italy

Nov. 18-19, 1974: Environmental Sensors and Applications Conf., Royal Society, London, England / contact: Information Officer, Institution of Electronic & Radio Engineers, 8-9 Bedford Square, London WC1B 3RG, England

Nov. 19-22, 1974: State Energy Systems – Modeling and Planning, University of Wisconsin, Madison, Wis. / contact: Dr. Robert C. Lutton, UW-Extension, Engineering Department, 432 North Lake St., Madison, WI 53706

ADVERTISING INDEX

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

THE 20th ANNUAL EDITION OF THE

COMPUTER DIRECTORY AND BUYERS' GUIDE, 1974

. . . is due off the press in September, 1974, as a special 13th issue of *Computers and People.*

The COMPUTER DIRECTORY AND BUYERS' GUIDE is:

- an annual comprehensive directory of the firms which offer products and services to the computing and data processing industry.
- a basic buyers' guide to the products and services available for designing, building, and using computing and data processing systems.

CONTENTS (162 pages)

Roster of Organizations in Computers and Data Processing
Buyers' Guide to Products and Services in Computers and Data Processing
Special Geographic Roster of Organizations in Computers and Data Processing
Characteristics of Digital Computers (14,000 entries for 380 computers made by 80 manufacturers)
Survey of Programming Languages in Business
A Short Guide to Programming Languages
Over 2600 Applications of Computers and Data Processing
Roster of College and University Computer Facilities
Roster of Computer Associations
Roster of Computer Users Groups
World Computer Census
Some Basic Arithmetical Tables
American Standard Code for Information Interchange (ASCII)

PRICE:

- Prepublication price for subscribers to *Computers and People* whose present subscription does not include the Directory (magazine address label is marked *N)
  $13.00 (U.S., Canada) $15.00 (elsewhere)
- Special prepublication price for non-subscribers
  $15.00 (U.S., Canada) $17.00 (elsewhere)
  (After publication, price to non-subscribers is $18.50)
- The Directory is included in the $23.50 full annual subscription (13 issues) to *Computers and People* (magazine address label is marked *D)

RETURNABLE IN 7 DAYS FOR FULL REFUND IF NOT SATISFACTORY

- - - - - - - - - - -(may be copied on any piece of paper) - - - - - - - -

To: Berkeley Enterprises, Inc.
815 Washington St.
Newtonville, MA 02160

( ) Yes, please send me the 1974 Computer Directory and Buyers' Guide when published.
I enclose ____________

My name and address are attached.

WHO'S WHO IN COMPUTERS AND DATA PROCESSING

The Sixth Cumulative Edition Is Due To Be Published in 1975

STYLE OF ENTRY FORM

Who's Who in Computers and Data Processing is published jointly by Quadrangle/The New York Times Book Co. and *Computers and People* (formerly *Computers and Automation*). The Fifth Edition (hard cover, three volumes, over 1000 pages) containing over 15,000 capsule biographies was published in the Spring, 1971. Three supplements, together containing over 3000 entries, have been published, bringing updating through 1973.

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