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computers and people

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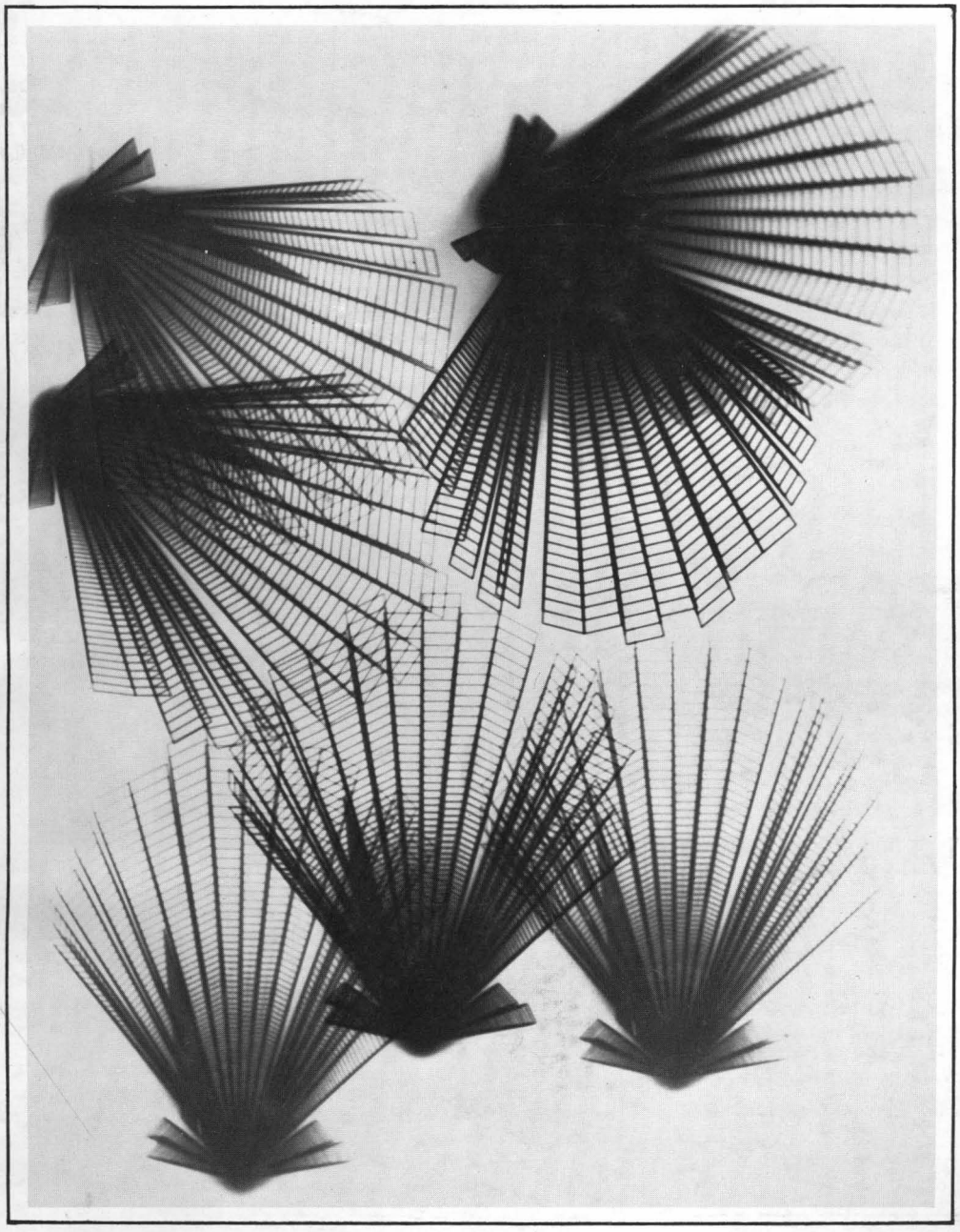

SEA FANS
by Grace C. Hertlein

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.

If you entered the field of computers and data processing in 1969 or earlier and wish to be considered for inclusion in the *Who's Who in Computers and Data Processing* – or if you have already been included and your biography should be updated – please complete the following form (which may be copied or extended on any piece of paper).

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(may be copied and expanded on any piece of paper)

1. Name (Please print)_____
2. Home Address (with Zip)_____
3. Organization_____
4. Its Address (with Zip)_____
5. Your Title_____
6. Your Main Interests:

Applications	( )	Logic	( )	Sales	( )
Business	( )	Management	( )	Systems	( )
Construction	( )	Mathematics	( )	Other	( )
Design	( )	Programming	( )	please specify:	

_____

7. Year of Birth_____
8. Education and Degrees_____
9. Year Entered Computer Field_____
10. Your Present Occupation_____
11. Publications, Honors, Memberships, and other Distinctions:_____
12. Do you have access to a computer? ( ) Yes ( ) No
    a. If yes, what kind: Manufacturer? _____ _____Model?_____
    b. Where is it installed: Organization?_____ Address?_____
    c. Is your access: Batch ( ) Time-Shared ( ) Other ( ) Please explain_____
13. Do you subscribe: – to *Computers and People* (formerly *Computers and Automation*): ( ) Yes ( ) No
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MULTI-ACCESS FORUM

SWEDEN ON PRIVACY

SWEDEN TRIES A LEGISLATIVE COMPROMISE BETWEEN COMPUTERS AND PRIVACY, AND DEFINES DATA TRESPASS

Thomas Land
London Correspondent of "Computers and People"
64 Highgate High St.
Highgate Village
London, N6 5HX, Great Britain

Sweden has produced the first comprehensive national law for the regulation of giant computer data systems. Its flexible administration will create a store of invaluable experience available to other countries which are equally concerned with a threat to privacy in the computer age.

Computerised personal letters from shrewd advertising agencies have congratulated lucky parents on the birth of their babies and recommended to them certain brands of baby food. Uninvited personal advice has been sent in the mail to recipients of tax rebates on how best to spend their money. Such actions have paved the way to the first comprehensive national law for safeguarding personal privacy in the age of automatic data processing. Law makers throughout the Western world are likely to study closely the Swedish experiment.

The new Swedish Data Act amounts to a careful compromise to reconcile Sweden's much prized tradition of open access to information held by public authorities with the citizen's need for privacy. The availability of personal information from officialdom is unique to Sweden; but the essential problems the new legislation has been designed to solve are common to all technologically advanced democracies. As most Western countries are currently considering laws to tame the computer, the first such national legislation is of considerable international importance.

Income tax files, health records and much other publicly held information are open in this country for inspection by anyone without, until recently, causing undue inconvenience to most people. But the arrival of the giant computer capable of digesting endless trivia on millions of people and then to assemble detailed personal profiles on any one of them has changed this.

It has also created a security risk taken only too seriously in this traditionally heavily armed European neutral State. Think, for example, of the use a hostile Power could make of a computerised list of divorced and recently retired Swedish military specialists all under the burden of heavy matrimonial maintenance payments.

The issue is further complicated by the distinction between publicly and privately operated computers since personal information is readily available from the former for storage in private data banks under strict secrecy. There are an estimated 50,000 computerised personal registers here in this data-conscious nation; and arrangements to link up many of them in a single storage system would have social repercussions of simply incomprehensible magnitude.

Indeed, Sweden's new law has been created to satisfy popular demand provoked by Government proposals for the establishment of a computerised master data bank to include all personal information held by the various public bodies.

Instead of introducing an unwanted element of secrecy in the administration of publicly held records, the Data Act restricts the use of computers in information processing. The courts now consider all magnetic tapes and discs used for information storage as documents protected under the law; and data prespass has been established as a new offence punishable by two years' imprisonment. Information filed by public agencies remains available for inspection, but its nature is severely restricted.

"By regulating what data may be put into a public computer," says one Swedish official, "privacy can be protected without conflict with the free-access principle because there is no access to what is not put in."

A new Data Inspection Board has just been set up with wide ranging powers over the administration of both governmental and privately owned computers. All organisations running computerised personal registers must apply for an operation licence before the end of this year. The Board is responsible to an Ombudsman who is in turn controlled by Parliament. The Board is entrusted with the task of protecting personal privacy. Its power to do so lies in the nature of the operational licences granted.

The terms of each licence define the purpose for which a computer may be used, the nature of the information it is allowed to store, the manner of collecting that information and the ways it may be processed and divulged. Failure to comply with the terms of the licence amounts to data trespass. The law is thus uniquely flexible in its application since its administration depends on the terms of each licence tailored to suit particular and widely different circumstances and requirements.

These licence terms may well evolve in time with experience and also with the need to keep abreast with the rapid advance of computer technology. Without allowing for such flexibility, law makers indeed would face an impossible task in their attempt to protect society from the ill effects of an evolving technology as it grows through its present, still early stage of development.

This very flexibility in a fluid situation will thus result in an invaluable store of experience available for other countries which are also seeking an administrative solution.

Sweden, too, is drawing on experience from abroad. Its terms of operation licence to be granted to computerised credit reporting agencies, for example, may well include a provision already enacted in Provincial legislation in some parts of Canada and in the American Fair Credit Reporting Act of 1972 enabling individuals to correct erroneous data about themselves held in computers.

Sweden's Data Act owes its existence to a public furore in this highly civilised and technological society at the beginning of this decade. At that time the Government was about to sell computerised records of the national census and to establish a national data system compiling all available information on each citizen. At about the same time,

(please turn to page 35)

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NOTE: The above rates do not include our publication "The Computer Directory and Buyers' Guide". If you elect to receive "The Computer Directory and Buyers' Guide," please add $12.00 per year to your subscription rate in U.S. and Canada, and $15.00 in Mexico; elsewhere, the price of the Directory is Swiss francs 90, not including postage and handling; please order through Reliable Information Publishing Company, P.O. Box 52, 6354 Vitznau, Switzerland.

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Key

[A] — Article
[C] — Monthly Column
[E] — Editorial
[F] — Forum

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ANNOUNCEMENT

THE COMPUTER CENSUS

which *Computers and People* has published in the past will now be published separately and more completely as a quarterly service, regular subscription price $33.00 per year. Until December 10, 1974, any subscriber to *Computers and People* may subscribe at half price. Outside U.S., Canada, and Mexico, please add $5.00 per year for additional costs.

NEW CONTRACTS AND NEW INSTALLATIONS

which *Computers and People* has published in the past will now be published separately and more completely as a bimonthly service, regular subscription price $30.00 per year. Until December 10, 1974, any subscriber to *Computers and People* may subscribe at half price. Outside U.S., Canada, and Mexico, please add $5.00 per year for additional costs.

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The Limits to Growth, and the Crunch - II

In December 1973 we printed an editorial on this same subject. It is interesting that almost all of what was said then is still true; and it is saddening that so little forward movement in national adaptation to the CRUNCH has been made in the United States. Almost everybody in this country (except perhaps Nelson Rockefeller and other millionaires) is feeling the crunch, especially in the price of food.

Item: Prices of food in the United States have risen 30 to 50% in the last two years, and in many cases – as with sugar – much higher.

Item: The Ford Foundation has announced that it will have to cut its grants by about 50%.

Item: The multinational oil companies (not only the Arabian ones) are restricting the supply of gasoline in order to keep prices 50 to 70% higher than they ever used to be; the United States government talks tough about the international cartel of oil producing companies – but is supine.

Item: The chief of public relations (Steven Laine – remember his name), of the U.S. Department of Agriculture under Agriculture Secretary Earl Butz, (in order to "improve the image of the department") is recommending "an audio-visual display of the country's food and farm industry history from the first Thanksgiving to the 1974 harvest": "For maximum emotional impact all audio will be musical, ranging from a hymn of thanksgiving to 'America the Beautiful'." Ralph Nader commented, "Secretary Butz, after presiding over a massive gouging of consumers by monopolistic food prices is now presiding over a massive brainwashing attempt paid for by those same consumers' taxes."

The present administration in the United States clearly does not know enough to deal freshly and constructively with the most important problems facing the people of the whole world:

1) War Making Establishments: the vested interests in war in almost every country in the world; the absence of control over nuclear weapons; the waste of money on armaments; etc.;
2) The Population Explosion and its imminent consequences, starvation and famine, in India, Africa, and Latin America;
3) The Exhaustion of Resources;
4) Pollution of the Environment;
5) Monopolistic Control of Oil, Food, etc.

The administration seems eager to pardon the Watergate criminals, and to do business as usual in a way that is good for the rich. But it does not seem eager to do anything new that matches the needs.

The crunch of course continues to affect "Computers and People" (formerly "Computers and Automation"). Due to the pressure of inflation and worse economic conditions, we are now making the following changes:

1. The *Computer Census* will be published once a year in the "Computer Directory and Buyers' Guide" issue of "Computers and People". But all the information we gather will be available as a quarterly service, at a subscription rate.

2. *New Contracts and New Installations:* Once a year in the "Computer Directory and Buyers Guide", we will publish an excerpt. All the information we succeed in gathering (instead of just one page of it) will be collected and will be available as a bimonthly service, at a subscription rate.

3. *Calendar of Coming Events:* This will be dropped. In substance, it is available elsewhere.

We intend to continue to publish in each issue four or five articles in the computer field that are interesting, informative, important, and mind-provoking. In other words, they contain ideas that one wants to come back to again and again, and think about. Forum, and Computing and Data Processing Newsletter, will remain. Advertising will continue to be almost nil; so when we publish 36 pages, that compares with 64 or 70 pages in an ordinary trade magazine with advertising. We hope the table of contents will stay at two pages – so that our bill of fare is presented quickly and frankly to our readers, and can save their time.

As to the section "The Information Engineer and the Pursuit of Truth", we shall continue to try to publish information that is critically important to understanding what is going on in the real world, and which is unlikely to be published elsewhere in any other magazine reaching computer professionals (i.e., "information engineers"). But these articles may yet go into a separate publication: tell us your suggestions.

If you like "Computers and People" and want us to continue to publish it during CRUNCH NO. 2 that is now developing, PLEASE RENEW YOUR SUBSCRIPTION NOW. As Smokey Bear said, "Only you can prevent forest fires"; and we say to you, our good subscribers and readers, only you can keep "Computers and People" being published.

Edmund C. Berkeley

Edmund C. Berkeley
Editor

JOB ENRICHMENT AND THE COMPUTER: A NEGLECTED SUBJECT

Dr. Edward A. Tomeski
Associate Professor of Management
Fordham University
Bronx, NY 20458

"TO MAKE COMPUTERIZATION A REAL SUCCESS, SYSTEMS NEED TO BE ORIENTED TO PEOPLE."

Experience has indicated that the problems of communicating and motivating — and not the technical ones — are the most critical in computer efforts. Rico, in an outstanding study of the people problems related to computers, concluded:

> The advancing level of office technology has serious manpower implications for the firm. ... The electronic computer produces a significant change in a firm's work methods, resulting in important qualitative changes in the process by which human resources are utilized.
>
> The personnel department plays a sterile and inconsequential role in the management of change in most firms. The personnel department is not consulted, and generally has had little or no idea of the organizational and manpower problems associated with computerization.[1]

There are of course far-reaching changes when a computer is installed or an existing activity is computerized — changes that affect operating procedures, document content and format, reporting practices, and the like. People will respond to these changes with attitudes which range from quiet acceptance, through passive indifference, to hostile rejection. If an atmosphere of cooperative acceptance is to be established and maintained, management must play an active role as both motivator and monitor. A conference on personnel research concluded that:

> ...if computer science is to become socially responsive, it needs to become thoroughly humanized — which means the scientific study of the human use of computers — an orientation ... that is nowhere on the computer horizon today.[2]

Unfortunately, in the intervening years since that conference little progress has been made towards a humanistic approach to computerization. A study, by the author, of about 100 organizations indicated that there are serious shortcomings in dealing with the human problems related to computers in many instances. People-oriented systems are needed to make computerization a real success.

COMPUTERS AFFECTING PEOPLE

Specific ways in which the computer is altering work and work relationships are illustrated below:

Displacement of People

Bank clerks once had the job of sorting and posting the massive numbers of checks processed in our national banking system. Now the process is largely automated; magnetic ink recording characters (MICR) on checks are automatically read by computers which manipulate the checks and data speedily and accurately.

Change in Supervisory-Subordinate Relationships

Department store clerks previously had to obtain supervisory approval to sell items on credit. Point-of-sales devices, connected by communication

Dr. Edward A. Tomeski, a faculty member of Fordham Univ., has established the computer curriculum there, and is currently developing a program in public administration. He has been affiliated with W. R. Grace & Co., Mobil Oil Co., Bankers Trust Corp., and ITT Corp. He has been a consultant to the City of New York, the U.S. State Department, and others. He is the author of three books: *The Computer Revolution,* Macmillan; *Executive Use of Computers,* Collier Books; and *People-Oriented Computer Systems,* to be published soon by Van Nostrand-Reinhold (co-authored by Harold Lazarus). This article is drawn from that book.

lines to a computer, now perform a search of the credit status of the customer's account and inform the sales clerk whether to make the sale or not. In addition, the single entry at point-of-sales can simultaneously update sales records, customer records, and inventory records. In essence, the accounting records reflect the real-time condition of the organization; time lag is eliminated.

Relieving Shortages of Skilled Employees

Medical reports and analyses were often late, because of the need for accuracy as well as the shortage of trained health personnel. The computer is facilitating physical examinations (e.g., electrocardiogram, heart sounds, blood pressure, electroencephalogram) and providing analysis of laboratory tests. In theory, at least, the computer can handle every physiological signal used in disease detection or diagnosis. This helps relieve the shortage of staff in the medical field, make medical care more widely available, and provide more rapid response where life may be at stake.

Custom Training

A continuing problem in teaching is the ability of a teacher to satisfy the needs of the many diverse students that are usually in a class. Some students are bound to be neglected and their educational progress restricted. Computer-aided instruction (CAI) provides a data terminal for the student, who interacts with the computer (e.g., to learn mathematical skills) and progresses at his or her own pace.

Performing Work Not Practical for Humans to Perform

Some research is either too complex or too impractical to carry out by conventional laboratory procedures. In the area of physics known as X-ray crystallography, the computer provides the only known practical technique for discovering the molecular structure of proteins, that group of chemical compounds so essential for life. In many types of scientific and engineering applications the computer can accomplish computations in a few seconds which would have taken many man-years of effort without computers.

Expanding the Capacity of Employees

Crime is one of our most pressing social concerns. Law enforcement is becoming increasingly sophisticated. The computer is used to analyze information about crimes and plot or pinpoint problem areas, and also to optimize the deployment of crime fighters. A crime information system can provide rapid data about wanted criminals or stolen property.

Mass Data Processing Only Feasible by Automation

The Internal Revenue Service, of the Federal Government, handles over 100 million returns a year. The computer is used to process the returns, make refunds, check for irregularities, and catch mistakes. Large business organizations must maintain records on many thousands of customers, stockholders, resources, etc. which would be difficult to keep up-to-date by means other than computer systems.

Creation of Completely New Positions

Not many years ago, positions such as systems analyst, computer programmer, and management scientist were unknown. The rapidly growing importance of computers in our society has made the computer-related occupations the fastest growing segment of our labor force.

Higher-Level Skills Required

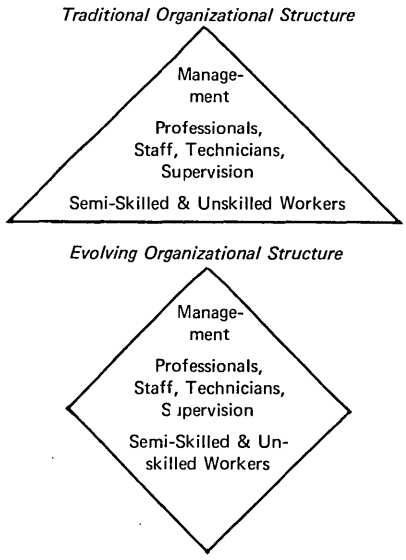
As the computer absorbs more and more of the routine work of organizations, the employees (particularly the managers and their staffs) are freed to cope with the less structured, novel, and policy-type challenges. In addition, the humans must be capable of interpreting and appraising the computer-generated information. As a consequence, many employees are required to have the ability to deal with higher levels of abstraction.

COMPUTER-INDUCED WORK CHANGE AND THE ORGANIZATION

The computer is a force in the change of the general organization pattern from the traditional pyramid structure to one that is diamond shaped (see Figure 1). This new organizational paradigm evidences a reduction in those at the base of the organization (semi-skilled and unskilled workers) — and a notable expansion of those at the middle strata (e.g., professionals, staff personnel, technicians). There is also some relative expansion of upper management personnel.

Figure 1

CHANGING ORGANIZATIONAL PATTERN



Thus, the computer not only impacts specific job classifications and categories of employees, but it contributes to a fundamental trend in manpower distribution design. The better educated employee of today is less willing to accept authoritarian supervision. In addition, the higher educational level of employees makes them less receptive to performing menial tasks and creates a desire on their part to work with challenging and diversified work assignments.

Unfortunately, it is the author's finding that many organizations have not applied computers with sensitivity to the interface between human systems and computer systems. Little thought is given to the appropriate distribution of work to humans and the computer. Computer technicians too frequently are oblivious to the need for a "job enrichment" approach in designing systems. Rather, the computer technicians seem to fluctuate between two extremes:

One, "let's put everything on the computer and then we won't have any people problems." Second, "we just don't have time, so we can't program that job for the computer." Both of these attitudes tend to alienate managers and employees and reinforce the unfortunate image of the computer technician as a cold, sometimes ruthless, and often impractical individual who disrupts the organization more than he helps it.

DIFFERING APPROACHES TO CHANGE

Effective computerization should include careful study of how it will affect work flows, jobs, and employees' morale. This calls for detailed and logical understanding of the composition of operations, the steps required to carry them out, and human motivation.

Scientific Management Approach

It appears that some of the classic lessons from history have still not been absorbed and implemented. Some decades ago Frederick Taylor (1856-1915) and the school of scientific management practitioners promoted the following ideas:

- There is a "one best way" of doing any work.
- Tools, techniques, and methods were the prime ways of improving operations.
- Management and supervisors should be completely rational in planning and making decisions.
- Most workers are like robots. If properly trained, supervised, and motivated by financial gain or penalties, they will produce to reach the organization's objectives.

The tenets of the scientific management practitioners led to some substantial achievements; but the movement lost much respectability as society became more enlightened about human and social values. Still, strong vestiges of scientific management's views and practices persist in plants, offices — and in the computer profession.

Human Relations

Some years after Taylor's delineation of scientific management, Elton Mayo and Fritz J. Roethlisberger conducted the Hawthorne Experiments, at Western Electric Company, during 1927 to 1932. This work was to have profound effect upon the entire field of management. It challenged a number of prevalent assumptions as to the nature of the worker and his work, and served to discredit many of the underlying precepts of the scientific management school. The following are generalizations of some of Mayo's and Roethlisberger's main findings:

- There is no "one best way" of doing work; the "best way" is frequently situational.
- Individual and group motivation are prime variables for improving operations.
- People are not merely "economic-rational man" — but, also "emotional-irrational man."
- Workers are individualistic, and have subtle differences in attitudes, needs, and behavior. Formal and informal human relationships are critical factors influencing whether or not the organization will attain its goals.

Although more than forty years have passed since the Hawthorne studies and the findings have gained wide acceptance by many leaders of thought, the actual implementation of the ideas in every-day management and supervision seems inadequate. And it appears that the computer professionals only give hollow support to the notions of Mayo and Roethlisberger.

ATTITUDES PREVALENT IN THE COMPUTER FIELD

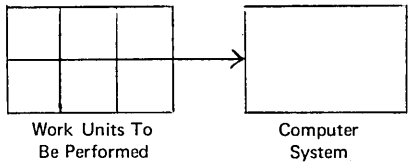
The computer field, absorbed with modern tools and techniques, seems, by and large, to embrace the principles of the school of scientific management — while setting aside human relations concepts as ethereal and impractical to incorporate into computer systems and applications. This discounting of human nature and social systems can bring discredit to the computer field — in the same way as the scientific management movement was stigmatized many years ago.

Systems should be designed to allocate work between humans and machines, and assure a man/machine interface that is not inimical to the social system. See Figure 2. Too often in the past and present, the human system has been twisted to suit the machine system. This has resulted in increased job boredom, reduced motivation and loyalty, and lowered productivity. Humanely designed systems can result in an enlightened distribution of work to man and machine, bringing forth job enrichment with its healthier and more productive possibilities. Computer specialists have concentrated, thusfar, on data and things — but have neglected people. Is there any wonder why many workers have adverse attitudes about computers and automation?

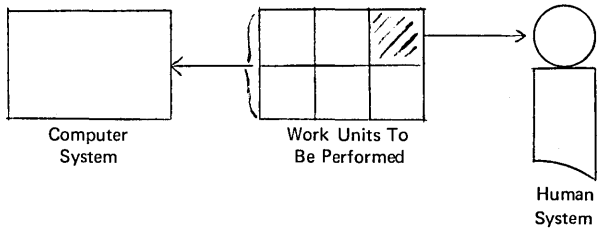
Figure 2

INTERFACE OF MAN & MACHINE

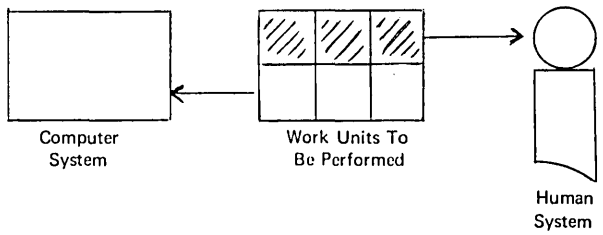
APPROACH 1: Computerize Everything



APPROACH 2: Turn Over to Humans What Cannot Be Computerized



APPROACH 3: Seek the Best Distribution of Work to the Computer and Humans



JOB ENRICHMENT AND COMPUTER SYSTEMS

Few computer systems are planned, designed, and implemented with any consideration whatsoever for

job enrichment. The key to job enrichment is the motivation-hygiene theory of Frederick Herzberg. There is an important relationship between meaningful experience in work and mental health. According to this theory man has two sets of basic needs: to avoid discomfort and to grow psychologically.

Job experiences which lead to good reactions most often are related to the content of the jobs, that is, the task content. The bad reactions are most often related to the context in which the job is performed, that is, the surroundings and factors on the periphery of task content. The factors causing bad responses are related to avoidance of discomfort. The factors causing good responses are related to personal growth, or fulfillment of psychological needs.

The factors identified as satisfiers, which are motivators in jobs, are: achievement, recognition, work itself, responsibility, advancement, and growth.

The factors identified as dissatisfiers, which are negative motivators in jobs, are: salary, company policy and administration, supervision, working conditions, and interpersonal relations. These are called hygiene factors — meaning preventive and environmental.

There are three principles at the heart of the motivation-hygiene theory; they are:

- The factors involved in producing job satisfaction are separate and distinct from the factors that lead to job dissatisfaction. Growth occurs with achievement, and achievement requires a task to perform. Hygiene factors are relatively unrelated to tasks.
- The opposite of satisfaction on the job is not dissatisfaction; it is merely no job satisfaction. Satisfaction and dissatisfaction are discrete feelings. They are not opposite ends of the same continuum.
- The motivators have a much more long-lasting effect on sustaining satisfaction than the hygiene factors have on preventing dissatisfaction. The motivators in a work experience tend to be more self-sustaining and are not dependent upon constant supervisory attention. Hygiene needs, however, are related to things for which our appetites are never completely satisfied.

Figure 3

JOB ENRICHMENT

Change to Work	*Motivators involved*
– Remove some controls while at the same time retaining accountability.	– Responsibility and personal achievement.
– Increase the accountability of individuals for their own work.	– Responsibility and recognition.
– Give a person a complete natural unit of work.	– Responsibility, achievement, and recognition.
– Grant additional authority to an employee in his activity; more job freedom.	– Responsibility, achievement, and recognition.
– Make periodic reports of output and progress to the worker himself/herself rather than to supervision only.	– Internal recognition.
– Introduce new and more difficult tasks not previously handled.	– Growth and learning.
– Assign individuals specific or specialized tasks, enabling them to become experts.	– Responsibility, growth, and advancement.

Figure 3 indicates some of the practical approaches that can be used to strengthen positive motivators and thus result in job enrichment.

Interestingly, it is reported that International Business Machines Corp. (IBM) — the largest computer manufacturer — is increasingly concerned about the dehumanizing aspects of the computers it uses for internal purposes. It appears that IBM may be one of the most aware organizations that there may be a crisis with its own product: the computer. As examples of this, IBM has:

- Instituted manufacturing facilities that are composed of small work groups (rather than impersonal assembly lines) and employee job enlargement techniques (which replace monotonous minute tasks).
- In addition, because of dynamic computer technology, the work process is subject to planned change; thus the worker is frequently involved in training programs and in adding new skills which prevent job boredom and provide for personal growth.
- Emphasized the individual rather than some abstraction of the person. For instance, IBM's records make prime reference to employees by name — and not by identification number.
- IBM has apparently been using its internal computers in an imaginative way for personnel-related applications (e.g., manpower planning).
- Encouraged company socializing by use of company-supported employee activities including country clubs, sports facilities, parties, and formal recognition of employees' accomplishments.

One probable by-product of IBM's active personnel posture is the fact that it is the nation's largest non-union employer.

A NEW APPROACH TO COMPUTER USE

It is evident that either systems designers should receive more training in psychology and sociology (in addition to technical skills in computers) — or else humanists (psychologists, sociologists, professional personnel staff, etc.) should become integral parts of systems efforts. With a more humanistic view, the system designer will design systems that are more conducive to optimal performance — from the standpoint of combining human satisfaction and productivity. For instance, the computer systems design would take into account such factors as these:

- Pace. Rather than having the computer pace the work of humans, the humans might set the pace for the computer.
- Participation. Individuals affected by computerization would be deeply and sincerely invited to participate in the planning, designing, and implementation of computer applications.
- Sharing. Rather than arbitrarily turning over work to computers, the designers would first study what would be the appropriate distribution or sharing between man and machine — so that employees will have a complete and natural unit of work.
- Job Freedom. Investigate with the employees affected by computerization how the new

system will provide them with more job freedom.
- Intercommunication. Design computer systems so information dissemination improves communication not only with managers — but also workers.
- Upgraded Assignments. When work is absorbed by the computer, make certain that the affected workers are given more challenging (not more routine and boring) assignments.
- Employee Development. Use computerization as an opportunity to develop employees — not to reduce their importance or to get rid of them.

With proper approaches and experience, attitudes and utilization of computers change appropriately. For instance, medical personnel might feel dehumanized when computers take over their diagnostic and record-keeping functions, in that "helping professions" are especially sensitive to their interpersonal relationships. Once a constructive interface is established, however, these persons may revise their outlooks and see computers as providing objectivity and a variety of safeguards, as well as offering a major labor-saving mechanism.[3]

CONCLUSIONS

Unfortunately, the computer field has not yet sufficiently concentrated on the important need of developing ways of providing for the human factor. Job enrichment theory could be a very productive starting point for doing this. The fact that the young computer field has lagged in this regard is not surprising. The older field of plant automation has only recently been somewhat rudely awakened, by "rebellions" of assembly line workers (e.g., Lordstown Syndrome in General Motors Corp. plants). Both fields need to try to achieve not only maximum productivity and profits — but also maximum employee satisfaction.

FOOTNOTES

1. Leonard Rico, The Advance Against Paperwork (Ann Arbor, Michigan: University of Michigan, 1967), pp. 8, 304-305).

2. "Conference on Personnel Research," Datamation, August 1968, p. 76.

3. Marvin Reznikoff, Charles H. Holland, and Charles F. Stroebel, "Attitudes Toward Computers Among Employees of a Psychiatric Hospital," Mental Hygiene, July 1967, pp. 419-425; Marvin Reznikoff, et. al.,,"Attitudes of Nursing Students Toward Computers," Nursing Outlook, July 1967, pp. 44-46.

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Page 1

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PS Form 3526 July 1971

AUTOMATION TECHNOLOGY — Key To More Productivity

Thomas D. Morris
Assistant Comptroller General of the United States
General Accounting Office
U.S. Government
Washington, DC 20548

"The secret of doing more with the same resources . . . in repetitive output activities . . . is the substitution of capital for labor, in the form of mechanization, automation, and computerization."

An Economy of Labor-Intensive Services

In the General Accounting Office we have begun to understand with increasing clarity the importance of revolutionizing our techniques and processes of delivering governmental services to the public.

During the lifetime of everyone in this audience, the United States has converted from a goods-producing economy to one dominated by labor-intensive services.

- Eli Ginsberg, the noted economist and expert on human resources, sums it up this way:

> "... in 1920 the goods-producing sector-agriculture, mining, manufacturing, and construction -- accounted for about three out of five workers ... in 1970 it had accounted for only slightly more than one out of three."

He goes on to say that the difference "was absorbed entirely by the service sector, particularly by trade, personal, professional, and business services and government."

The Governmental Portion

Let's take a deeper look at the governmental component of the service sector.

Governments at the Federal, State and local levels now employ 13,000,000 -- one out of every six American workers -- and have a payroll of approximately $149 billion. Yet some vital public services appear to have declined in level or quality while their costs steadily increase.

Thus, public resources are squeezed between public demands for services and the rising costs of meeting those needs, on the one hand, and a growing resistance on the part of the public to providing more resources through higher taxes, on the other.

Improved Productivity

One answer to this dilemma is improved productivity. I like the definition of productivity used by Mr. Gerstenberg, Chairman of General Motors. It is:

> "I regard productivity as a measure of management's efficiency, or lack of efficiency, in employing all the necessary resources -- natural, human, and financial."

The secret of doing more with the same resources -- or the same amount of work with fewer resources -- is better systems, better working conditions, but probably most important of all in repetitive output activities, it is the substitution of capital for labor, in the form of mechanization, automation, and computerization.

The Federal Project To Measure and Enhance Productivity

Automation in the service sector has received little concentrated attention. There are a few instances of wide-spread automation today -- with computer systems and mechanized paper handling being the principal manifestations. Although automation and services appear to offer the best means of improving productivity, comprehensive data documenting this fact are difficult to find. This is due, in part, to the absence of meaningful measures of productivity in most of the services.

Over the past three years we at the Federal level have been engaged in a research project aimed at learning how to measure and enhance Federal productivity. I would like to briefly summarize for you the results of this effort.

It started with a letter from Senator Proxmire to Comptroller General Elmer Staats in September 1970, stating that he found it "distressing that we have no real measures of the efficiency of the Federal sector." He then urged Mr. Staats to undertake a new assessment of the possibilities of measuring the productivity of Federal workers.

Mr. Staats had been a principal supporter of early efforts to measure Federal productivity in the 1960's. He decided the project was sufficiently important to deserve the combined attention of the three central management agencies -- OMB, CSC, and GAO. He invited these agencies to join him in an attempt to measure and enhance Federal productivity. Subsequently, a joint research project of the three agencies was established.

Based on an address at the Conference on Automation Technology at the National Bureau of Standards, Washington, D.C., May, 1974.

Permanent Productivity Measurement System

The final report of the team, submitted in June 1973, covered the design of a permanent productivity measurement system covering 187 organizational elements which employ 60 percent of the Federal civilian workforce. We found that the average rate of change in productivity between 1967 and 1972 had been 1.7 percent per annum on a cummulative basis. More important, we learned a great deal about productivity behavior in a wide variety of organizations, and I believe the final report of that joint effort is a useful contribution to the literature for those who wish to study organizational productivity trends.

Senator Proxmire was delighted and characterized the effort as a potential breakthrough in better government management. In fact, he made a speech along these lines on May 13. In this speech he proudly said, "for the first time in its history the government has just begun to measure its productivity and has found that contrary to the assumptions of most economists it has improved year by year."

Those of us who have been involved in this effort feel that we have opened up some new insights into the real meaning of productivity, but we quickly acknowledge that this is but a first step.

Continuation of Productivity Measurement

On July 9, 1973, the Director of OMB issued a memoranda to heads of departments and agencies directing the continuation of productivity measurement and enhancement efforts, and spelling out roles and responsibilities. One of these responsibilities is the preparation of an annual report to the President and the Congress analyzing productivity trends and the factors which have caused productivity changes. The 1973 report is now in preparation.

Questions To Make This Meaningful

Productivity measurement would be rather meaningless if it consisted only of gathering statistics and adding up the results. The relevant questions are:

- Is the change which occurred the result of planned actions to improve either quantity or quality of performance? Or is it simply a happenstance result?

- What are the positive and negative factors which produced the result?

- How can we optimize productivity in relation to service to the public, accuracy of output, or other essential quality criteria?

- What will be the trend? What can we do about it now?

The joint team has addressed questions of this type to a number of Federal managers.

The Most Potent Influence

We found that the single most potent influence on change was mechanization, computerization, and automation. We also found that these changes did not happen casually or overnight, nor would they fit just any situation. A dependable, predictable, and increasing workload -- such as has been experienced in population-related activities -- fosters this type of innovation. Further, the road to success has been strewn with mistakes and costly failures, and we have learned that proper leadtime and adequate preplanning are necessary if we are to reap the real benefits.

Let me select one of the large categories of Federal activities that we examined as part of the productivity study to illustrate the importance of computerization.

Citizens Records Activities Are Highly Automated

This group of activities -- representing 14 organizations -- maintains and processes records, at some time or another, on practically every citizen. It includes the Social Security Administration, Internal Revenue Service, Immigration and Naturalization Service, and the Selective Service System, among others. Collectively, it utilized 160,000 man-years in fiscal year 1973. Its gross output has grown since 1967 at an annual rate of almost 5 percent, while its employment growth has been held to less than 2 percent. This has resulted in a very respectable labor productivity increase, averaging over 3 percent a year.

Let me cite a few examples of how automation has significantly contributed to this productivity growth:

- Social Security Administration: The use of automatic data processing equipment and telecommunications equipment are major innovations which have affected SSA's productivity. During the period of 1967 - 1973, the SSA saved almost 3,200 man-years as a result of automation. Some of the most significant actions included (1) direct input of data from the agency's district offices via telecommunications; (2) use of microfilm records in the district offices to reduce manual recordkeeping using computer output microfilm (COM); and (3) encouraging health insurance contractors, employers, and others to submit data in machinable form.

- Railroad Retirement Board: An arrangement was worked out with IRS and SSA to electronically furnish the addresses of a group of non-retired railroad employees. The Board was able to eliminate all manual processing which would have been otherwise required to locate the addresses of over 40,000 non-retired employees.

- VA - Department of Veterans Benefits: A major project is underway to develop a comprehensive ADP systems design which will automate all compensation, pension, and education, loan guaranty and insurance programs -- for which 5 million veterans are eligible. Continuing computer program refinements and the use of optical readers have contributed significantly to DVB's 26 percent productivity increase since fiscal year 1967.

  It has been DVB's experience that they achieve upward trends in productivity about every third year due to the leadtime for introducing and perfecting new ADP systems.

- Treasury - Bureau of the Public Debt: In the Savings Bond function, additional issuing agents began reporting issues on magnetic tape rather than by card stubs. This is a continuing program in which a standing committee evaluates test submissions by each agency under consideration and recommends their conversion to this

system when all problems have been resolved. Better productivity is achieved by magnetic tape input to the computer, as well as in the microfilming where stub images are developed from tapes by means of a Micromation Printer. Recurring annual savings resulting from this conversion in fiscal year 1973 were estimated at $135,000.

Most Gains Are from Computerization

Out of the 14 organizations, all but three reported productivity gains, and most of these gains were the direct result of computerization. Hence, for the first time we have tangible evidence that the huge investment in human effort and dollars by those who have pioneered the use of computers in our mass paper work operations is paying off. During the past six years, we estimate that the 14 organizations responsible for citizens records have enjoyed cummulative payroll savings of over $300 million due to productivity gains. But we have also learned that they cannot slacken their efforts; otherwise, they will reach a plateau, or even experience a declining productivity trend with the growth in data requirements being levied on them.

Timely Financing of Capital Investments

Our study team found that Federal managers in many cases have been discouraged from pursuing opportunities for productivity improvements due to the competition for capital investment funds from program items or facilities concerned primarily with pollution abatement, health, energy, or safety.

In the absence of a formal capital budget, the Federal manager lacks the ability of his counterpart in the private sector to separately display and justify investments having a fast payback based on more efficient use of resources.

To demonstrate the scope of this problem, the joint team obtained examples from a number of agencies and found 392 unfunded projects which would be self-liquidating in less than three years. Examples are tape-driven machine tools, mechanized warehouse equipment, automated laboratory equipment, etc. Work on this problem is continuing under the guidance of GSA and a great deal of interest has been displayed in improving the capital budget process by the Joint Economic Committee.

Technology Applied To State and Local Governments

But the Federal sector employs less than 3 million out of the 13 million personnel in the public sector. Thus, it is very important that we ask: What is happening in State and local governments to improve productivity?

I know of no simple source of such knowledge, but we are finding a ferment of effort and interest. There are projects being sponsored by numerous Federal agencies, by the public interest groups, by the foundations, and by such public policy organizations as the American Assembly and the Committee for Economic Development.

The challenge is how to coordinate these efforts without discouraging such praiseworthy initiatives.

Recently, the Comptroller General and Associate Director Marik of OMB met with key agencies to discuss their current programs. Here are a few examples of what was reported:

- HEW is working on programs to help Chief Executives of State and local governments improve their capabilities to plan and manage human service programs, including related information and communication technology.

- DOT is stressing assistance aimed at upgrading the technical and planning capabilities at State and local levels.

- HUD is testing new methods of building the analytic capabilities of local governments, including information systems and effectiveness measures. Through the Urban Observatory program in 10 cities, it is attempting to tie together the research and analytical capabilities of universities and local governments.

- NSF has a variety of programs aimed at aiding State and local governments to increase their capability to employ science and technology. One of the principal instrumentalities utilized is a non-profit organization, known as Public Technology Incorporated, formed by the International City Management Association.

Urban Technology System

One of the interesting current projects of NSF and PTI is the Urban Technology System. This system is designed to bring to bear research and information resources from throughout the Nation on the solution of problems in individual cities and counties. Experts -- called Technology Agents -- are being appointed in 27 localities. The system will be jointly funded by the Federal government, the selected local governments, and other participating organizations. This is an imaginative experiment which could have high payoffs for large numbers of jurisdictions.

In addition to the agencies mentioned, there are significant efforts, which I will not attempt to describe, being administered by the Civil Service Commission, the Department of Labor, Environmental Protection Agency, the Law Enforcement Assistance Administration, Department of Agriculture, NASA, and the National Bureau of Standards. We are all looking forward to the report on the service sector which has been prepared under Dr. Ruth Davis' leadership by the Federal Council on Science and Technology Committee on Automation. Recognition should also be given to the projects which have been sponsored by the National Commission on Productivity in such areas as measuring government productivity and enhancing productivity in such functions as refuse collection, police activities, and medical activities. Also among the important research contributions are the studies of the Urban Institute sponsored by NCOP and NSF.

Better Measures of Performance

As we examine this array of efforts to harness technology in maintaining the quality and reducing the cost of public services, it seems to me that we should stress three basic improvements in our management approach:

- First, we need more and better measures of our performance -- both in terms of productive efficiency and benefits to the recipient. To many people, developing measures is unexciting and threatening; but without measures, we lack visibility as to our progress, or lack thereof, and the discipline to improve.

(please turn to page 21)

Dr. Ruth M. Davis
Director, Institute for Computer Sciences
National Bureau of Standards
Washington, DC 20760

Computers and the International Balance of Power

"Many different means of expressing the balance of power between countries are dependent upon the computer capabilities possessed by a country."

Frustration of Policy-Makers With Computer Technology

There is a certain frustration associated with being a computer scientist or technologist or with attempting to manage or control computer science and its applications. It is the frustration of the organized mind and the curse of the policy-maker as each attempts to describe, classify, assess, rank and predict the impact, the potential and the value of computers and supporting technologies.

The introduction of the computer has been compared with the industrial revolution in terms of the changes made upon society and man's way of life. And yet, in 1974, the computer was still being described as only useful for counting pencils and light bulbs. The computer has been compared by Brezhnev with the steam engine in terms of its utility in our everyday lives. And yet, in the 1970's, students were burning and sabotaging computer installations to protest their college records being maintained by computers and their being assigned an identification number for record-keeping purposes.

Air travel would be impossible without computers. No one would venture onto planes, hundreds of which converge at one air-strip in a single day if air traffic control were done solely by people. At the same time, consumers in Massachusetts have threatened to boycott the first supermarket chain which installs an automated (computerized) check-out counter.

Computers are touted as being the most significant invention in history in terms of potential to free humans from tedious, boring and hazardous jobs. Indeed, such potential has already been partially realized. Meanwhile, we see today a tremendous concern about computers as a principal foe of individual privacy. Many national governments are slowing the pace and spread of computer applications until policy-makers and the public feel comfortable about protection of their rights of privacy.

Problems Resulting From Misconceptions of Computers

Do such vagaries in people's conception of computer technology and computer applications really cause problems on the international and domestic scene? I suggest that the answer is an emphatic yes.

Based on an address given at the Congress of the International Federation for Information Processing, Stockholm, Sweden, August, 1974.

Policy-makers and national leaders view resources in terms of their value as instruments for achieving domestic and international goals: they are continuously seeking means and procedures for developing domestic and international strategies. Strategies are pursued that will expedite the attainment of domestic and international goals. Goals are pursued in order to obtain the approval of the public or the governing group in society.

Computers are presently feared, misunderstood, coveted and distrusted by policy-makers and national leaders. As a result, their support for computer science and technologies and the computer profession is variable and erratic. This situation will undoubtedly continue until the role of computers, computer science and computer technology in the quest for power and in the development of national strategies is greatly clarified.

Presently, there is no good understanding of computers or computer technology as national resources or as instruments of power. We know that computer hardware, software and production technology are subjected to more export controls than other non-military products or services. We know that the strategic value of computers is uncertain: but at the same time that value is far more complex to ascertain than, say, a typical military resource such as submarines. Few submarines, for example, are built for private companies or individuals.

Scarcities that Tilt Balances of Power

We know that computer capabilities developed for purposes of national defense have been easily transferred to significantly improve domestic, economic or business postures. Recently, the inverse action has also become common. Computer applications developed for business have been deemed useful for military functions. Thus, many different means of expressing the balance of power between countries are dependent upon the computer capabilities possessed by a country.

Balances of power are always precarious. They are becoming increasingly so as the simplistic equating of balance of power to military strength becomes less realistic. Control over scarce resources has become a remarkably effective agent for tilting the balance of power as population increases and economic strength of nations becomes dependent upon geographically isolated resources. Oil and

grain are well known to all of us today as scarce resources whose control leads to considerable power.

Control over technological resources and applications has always been a necessary companion to certain limited manifestations of power -- national defense being the prime example. Today, however, our dependence upon man-made, technologically dependent products and services of all types is growing rapidly.

Standards To Combat Power Imbalances

Recent estimates (1971) indicate that 80% of us are dependent upon products and services which are man-planned, man-designed, man-made and man-maintained. Products and services are increasing in complexity as high technologies such as computer technology lead us farther from nature and create products and services which fewer and fewer of us understand.

Standards and consumer information are the principal mechanisms for helping the customer when he is faced with such technical complexity in the marketplace. The absence of standards permits power to be exercised in all marketplaces in uncontrollable ways not able to be properly influenced by the public or by government acting for the individual citizen.

A marketplace may involve one software vendor and one customer for a computer program to handle airline reservations: it may involve all large computer manufacturers and several lesser developed countries acting in unison to obtain computers for much-needed agriculture censuses. Or, as is more and more frequently the case, it may involve one large industrial nation attempting to decide what computer production technology and facilities it will allow another large industrial nation to buy. No matter what the computer marketplace in question is, there are less than 50 computer standards which govern it. Such a potential for misuse of power cannot much longer be tolerated.

Before continuing to review the effect of computers on international balances of power, it will be useful to address some attention to a more precise view of power.

Perceptions of Power

Power is the capability to make things happen or to keep things from happening. Power is the pacer of development and change, and is the ultimate arbiter of the wills of nations, organizations, business enterprises, and individuals.

Power is acquired in two basic ways. It can be conferred by societal groups through such mechanisms as constitutions and laws. Or it can be built through the aggregation, development, transformation and concentration of human and natural resources.

The condition of power can be arrived at through evolution or revolution. In our time, revolution seems to have become a commonplace avenue to power. Arnold Toynbee has said that:

> Every revolution is a misfortune (because) it is a symptom that the times are out of joint. Its outbreak is a sign that the traditional structure of society has ceased to answer to the conditions, needs and demands of at least a portion of the members of the society that is numerous enough, or strong enough, to have the power to change the structure of society by force, if its demands continue to be resisted by the reigning establishment.

Power takes many forms. It can be expressed, for example, in terms of military strength, political power, economic output and production capacity, control and use of natural resources, and intellectual and ideological power.

Viewed in the contemporary scene and historical perspective, science and technology may be considered an important adjunct of power. One of the frustrations we face, as scientists and technologists, is that there is no absolute measure of the importance of science and technology in the total scheme of power. The assessment of value ranges from the arrogant technologist who says that science and technology is the most important and potent of all forms of power, to the political leader who takes a passive attitude toward science and technology and accords it no special recognition in the overall power environment.

Science appears to spurt with wars and crises. At other times, it suffers more rebuffs than honor. History certainly makes it difficult not to associate science with the most blatant of all power forms -- war and new methods of destruction. Scientists are associated with the advice they give to national and military leaders and with the "Big Science" of wars and crises. Only medical science appears to have escaped this gross generalization.

From a historical point of view, given a highly developed and broad-based capability to science and technology and reasonable access to natural resources, we seem able to build power of staggering dimension. In one form or another, it would appear that science and technology is a rather basic, if not requisite, building block of modern power systems: its availability enhances power, and its absence inhibits or impedes the growth of power. Science and technology seems to be a flexible tool in the context of international power balance: by extending it to have-not nations, we can alter power balances and change societal structures, and by withholding it we can inhibit the development of nations and new power.

Donald Frey, board chairman of Bell & Howell, has pointed out that:

> Disillusionment with technology springs from our failure to understand its limits or recognize the role that human managers must play in guiding its development .... The rudiments of technological control include: the ability to recognize the interrelationships between subsystems and larger systems; an understanding of the relationship between technology and human behavior, including limitations within that relationship; the principle of trade-offs, by which some disadvantages are bartered for highly desired advantages; the use of realistic time scales in attacking problems; and adequate economic analysis in considering alternative solutions.

Toynbee believes that:

> In our day we are living in the state of permanent revolution. .... By our time the advance in technology has shot far ahead of the advance in religion and morals, but our surviving records show this is a recent phenomenon.... In human history viewed as a whole, revolution has been the exception. In fact,

> it is safe to say that during the major part of human history, there was no possibility of revolutions, because during this period the pace of change in the conditions of life, and therefore also in needs and demands, was so slow that the necessary corresponding changes in institutions were bound to be brought about by the evolutionary process of gradual adjustment.

Toynbee further believes that the first people to become aware of a revolutionary technological change must have been the users of lower Paleolithic tools (unsophisticated) who encountered the users of Upper Paleolithic tools (sophisticated). "This experience must have confronted the Lower Paleolithic victims with a choice between making a revolution and going under. They now had to copy and learn to use the more efficient tools of their Upper Paleolithic tool-using contemporaries if they were not to be exterminated; if they succeeded in adopting the new technology, they would develop new needs and would make new demands; and these sudden new conditions, needs, and demands would require a rapid adjustment of traditional institutions." Toynbee concludes "Here we have put a finger on one of the causes of revolutions. This cause is the difference ... in the rates of technological and spiritual change as between different sections of the human race."

Alvin Toffler has cited the "great, growling engine of change -- technology" as a principal source of the "accelerative thrust" in our society. That engine has been built by centuries of innovation and invention, much of which has been aimed at finding ways to augment, replace or amplify human muscle power. These ranged from the horse collar of the Middle Ages that brought significant changes in the methods of agriculture to the atomic bomb that changed the methods of warfare.

But man was not content with augmenting his muscle power. For good reason, man has always zealously guarded his rights to intellect, control and power. Indeed, two important and highly visible characteristics of man are his intelligence and his ability to perform in and control his environment. As individuals we have always wanted to increase our intelligence, our ability to control our environment and our ability to use all the power at our disposal for our own ends. Thus, it is not surprising that, simultaneously and in parallel, people have always wanted to:

1. Understand the phenomena of intelligence, control and power.

2. Produce artifacts (machines) that would increase and extend their own intelligence, control and power.

3. Create artifacts in their own image which would possess the human attributes of intelligence, control and power. These artifacts or machines could then be employed as extensions of or replacements for men for the purpose of augmenting him or doing work he found offensive.

Significantly, man's attempts to understand the phenomena of intelligence, control and power has led to simulations of his brain, of himself and of organizational and group structures in which he most often finds himself. In the last 20 years he has made extensive use of the COMPUTER for these simulations.

Man's attempts to provide artifacts that will help him have led to many important inventions. Some of the more significant include telescopes, cameras, the printing press, the gun, television and the COMPUTER.

Man's attempts to produce artifacts in his own image that themselves possess intelligence, power and the capabilities to control have resulted in prosthetic sensors, mechanical and electronic limbs and eyes, robots, automatons and the COMPUTER.

Thus, man has attempted to use the COMPUTER to help him understand himself, to help him gain more intelligence and power and to replace himself in performing tasks demanding intelligence and the capability to control. It is this varying and contradictory role that we have ourselves assigned to COMPUTERS that results in a great deal of the honest confusion, mistrust and fear surrounding computers. There is presently no balance between man and computer that possesses any permanence. The changing balance reflects the changing roles man is assigning both to himself and to COMPUTERS.

Two positive predictions can be made which promise a more comfortable balance between man and computer:

1. Computers will make possible the realization of intelligent behavior that is essentially limitless, transcending man and computer taken separately.

2. Computers will confer on the individual more control over his personal environment than he has ever before been able to exercise.

The Manifestations of Power

The manifestations of power are many and varied, and can be seen in group, institutional, national and international actions and interactions.

1. Group Manifestations of Power

Perhaps, the group is one of the most basic manifestations of power. We see this most often and graphically in the activities of political groups. We hardly need to recount the number of times that a small group, bulging with its ideological power and undaunted zeal, have toppled established governments and created a new social and political order. But there are other attractive examples. In the United States today, a small group of aircraft machinists have gone on strike and brought about the total shut-down of a major airline. Or consider womens' groups who have wielded "soft power" to change an entire nation's attitudes and laws regarding sex discrimination in employment. Consider also the power manifested in such groups as medical specialty certification boards, labor unions, trade associations and professional societies.

2. Institutional Manifestations of Power

Man's institutions provide some of the most interesting manifestations of power. Our colleges and universities wield the power of knowledge and intellect which are at the root of nearly all forms of power and control. As nations, we sometimes share our power by agreeing to set up special institutions, such as the United Nations or the Organization for Economic Cooperation and Development, which grow to have great strength and influence. In some cases, these institutions, such as the

United Nations, become important factors in preventing the ultimate manifestation of power -- war. Religious institutions are yet another manifestation of power. Finally, consider the staggering power both economic and technological, that is in the hands of the mammoth national and multinational manufacturing companies.

3. National Manifestations of Power

National power takes many forms. Military power is so obvious that it needs no mention. Economic power is almost as obvious but still deserves some note. Economically powerful nations have the capability to extend massive aid to help less developed countries build industry and improve society; such was the case with the Marshall Plan following World War II. Or they help another nation overcome a natural disaster, such as happened in Nicaragua and Peru recently. Power is not the exclusive property of large, industrialized nations. We had a most unforgettable demonstration of this last winter during the energy crises: small, non-industralized nations can indeed be very powerful if they control a critical resource. The Soviet Union and the United States have both demonstrated great economic and technological power in their accomplishments in space exploration.

4. International Manifestations of Power

Some of the more interesting contemporary manifestations of international power are focused more on special interest communities than on nations per se. The banking and retailing communities are prime examples. Within national boundaries, both communities are introducing computers and automation to handle business transactions: the banks are using Electronic Funds Transfer Systems (EFTS) and the retailers are using Electronic Point of Sale (POS) systems. Both EFTS and POS technology is crossing national boundaries through the banking and retail communities, and, in the process, is changing international business operations. Multinational corporations, one of the biggest of which is a computer manufacturer, are contemporary manifestations of international power. The health care community is yet another example of power crossing national boundaries. One manifestation of this power is the international transfer of medical knowledge through the computer-based MEDLARS made available by the U.S. National Library of Medicine.

Technology, Power and the International Scene

Historians and contemporary observers have established rather direct relationships between technology and power. While we do not really have a complete or satisfying understanding of the exact degree to which technology produces or influences the building of power, we are probably safe in saying that technology is currently a very major factor in the international balance of power. Technology has played an important role in the development of national power among industrialized countries. In turn, reasonably balanced national power and technology has served, in part at least, to avoid war between the large powers. The approximate balancing of technology between the U.S. and the USSR, at least in those areas that contribute toward military power, may have helped avoid a Twentieth Century confrontation between Toynbee's Lower and Upper Paleolithic tool-makers.

Todays' International Computer Scenario

We have seen that computers can effect a dramatic extension of a nation's power and its ability to produce and accomplish social and economic progress. The computer is a unique tool in the numerous functional activities that are integral to the development process.

The usefulness of computer technology in international development has been widely recognized. As Benjamin Barg of the United Nation's Office of Science and Technology stated at the Jerusalem Conference on Information Technology: "From the point of view of the developing countries, computer technology epitomizes much of the modern technology which they wish to utilize for accelerating the process of their development."

International Distribution of Computers

The world today, particularly the industrialized world, is becoming saturated with computers. The United States has 134,000 computers with 100,000 computers in the rest of the world. In 1972 the United Kingdom had 18,000 computers; Japan had 16,000; France had 8,000; the USSR had 7,000; and Canada had 4,000, followed by Australia, The Netherlands and Switzerland with over 1,000 each.

Although we find a dearth of computer statistics concerning developing countries, several facts do emerge. South Africa, which has more computers than the rest of Africa put together, had 500 computers in 1972. South Africa's computer population is 13 times as great as that of the Republic of China, Korea and Thailand, which have 44, 34, and 32 computers, respectively.

Computer use in Latin America ranged from no operational computers in Haiti to 490 computers in Brazil and 245 computers in Mexico in 1972.

The total value of the 234,000 computer systems around the world is estimated to be about $63 billion. Although 88% of these systems were produced by the United States, other countries, such as the USSR, Japan, United Kingdom and West Germany, have been strengthening their production and will probably be assuming larger and larger shares of the computer market. Then, too, the Commission of the European Economic Community is drafting plans to integrate the computer industry of their nine member nations into one united computer industry by 1980, promising an increased computer production effort in this sector.

The Computer Networking Boom

Networking became inevitable with the advent of computers. Just as the existence of automobiles led to highways, and the invention of the telephone led to long distance voice communication, so computers have brought us to networking.

Computer networking is fast becoming the dominant way of using computers.

Commercial network services providing computational and, more recently, data base services have proliferated. Beginning as small, regional single-computer time-sharing networks, they have grown until several of them are national and even international in scope. In the United States government, for instance, 27% of the computers are connected to networks today. The world's largest international commercial network is the General Electric Information Service which covers 18 countries, including 400 cities through Western Europe, Japan, Australia and Puerto Rico. G.E.'s service can accommodate 2,000 users simultaneously. Tymeshare's TYMNET

covers 53 cities and can accommodate 900 users simultaneously. Then, too, the commercial airlines have CITA, a world-wide network covering even Katmandu, Nepal, and Berjumbura, Burundi. Then there is Cost 11 network of the Cooperation Europeenne dans le Domain de La Recherche Scientifique et Technique and ARPA of the United States which has recently been linked to the United Kingdom.

Transplanting Computer Technology

Computer technology has been accomplished vertically in most developed countries. That is, basic research has led to the development of prototype computer applications and then to full-scale production. However, computer technology can be transplanted or horizontally transferred which enables developing countries to skip the development process and to immediately gain the advantages of computers.

Most of us believe that this infusion of computer technology is a means to positive, rapid progress. We are accustomed now to hearing that computers are the contemporary counterpart of the steam engine that brought on the industrial revolution or that computers represent an advance in man's thinking process as radical as the invention of writing. In fact, most of us probably concur with Herman Kahn who mentions that he is not irritated by the grandiosity of such claims but rather by their obviousness.

We know that computers are the most dynamic of our technologies and that their presence in a country both opens up and speeds up untold development opportunities. In fact, patching computers in a pre-industrial society may enable that society to leapfrog some of the educational problems of evolving a work force and to rapidly industrialize without disturbing the life style of all citizens. The accomplishment of such progress would ultimately exemplify Alvin Toffler's definition of change as the "process by which the future invades our lives."

Implications of a Nation's Computer Population

The computer population of the United States has snowballed concurrent with its evolution from an industrial economy to a service economy. By the mid-1950's, more than half the American labor force were not making things to eat or use, but were gainfully employed doing something for other people. Thus, the United States became a service economy and the first post-industrial nation. By 1980, two out of three American workers will be part of the service sector. Whether this evolution ensued from increasing reliance on computers and automation or whether instead the use of computers ensued from this evolution is not certain -- computers and industrial progress might well represent a chicken-and-egg phenomenon. Nevertheless, it can be stated that computers have been integral to the U.S.'s greatly expanded gross national product, its increased per capita income, and the foreseeable reductions in its working hours.

Computer Combat Instead of Human Combat

Computer technology, hurried along by war, has turned around and in turn has hurried along the pace of war. World War I was fought with chemistry. World War II was fought with physics. World War III is being fought with computer science. The first battles of World War III may well have occurred when mathematical formulations of strategies and counter-strategies of realistic proportions were able to be tried out as war games on computers. With realistic wars being able to be fought in 20 minutes or 20 hours on computers, decisions to engage in such encounters have been nil. No statistical correlations are needed to validate the fact that no major encounters have occurred between "large computer-processing" nations.

The wars that we are witnessing appear to be characterized by human behavior -- a behavior we still understand too little to simulate. Thus, wars of this type do not yet permit human combat to be replaced by "computer-combat."

Computer Applications

If we look at the principal applications of computers in the United States, we find them spread throughout all sectors of its economy. We find nearly 20% of the computers being used in manufacturing; about 15% each in the process industries, financial and insurance industries, service industries, and in government; with the remaining computers scattered through transportation and communications, wholesale and retail operations, and education.

There is presently no reason to assume that computer applications are substantially different in other industrial or post-industrial nations, although it would be interesting to learn if this were true.

Computers and World-Wide Technologies

1. Earth Resources Technology Satellites (ERTS)

One prime computer-monitored, international system is the Earth Resources Technology Satellite, called ERTS. It consists of a spacecraft and a complex ground operation. The spacecraft -- ERTS -- carries sensors which measure and image sunlight reflected by the earth. ERTS captures 1350 photographic images, each representing approximately 6-1/2 million square kilometers of the earth's surface, each day. These images are transmitted to the five receiving stations located through North and South America (a sixth is being built in Italy) or, when the satellite is outside their receiving range, the readings are recorded on videotape recorders.

Although ERTS is the property of the United States, the photographic images are internationally studied and analyzed. In fact, there are 310 principal ERTS investigators, including citizens of 35 different countries. ERTS imagery is used to detect and monitor air quality, plan land use, explore mineral deposits, and even to detect marijuana fields.

Computers control ERTS' path and timing so precisely that it overflies each point on the earth's surface at the same local time at each location; namely, between 9:30 and 10:00 in the morning. Computers are, of course, further used to synthesize the ERTS readings along with the reports of the 310 investigators.

2. The International Telecommunications Satellite (INTELSAT)

Another international computer monitored satellite system is the International Telecommunications Satellite. INTELSAT, as it is commonly referred to, relays communications rather than collecting earth resource data. It is a global commercial system of satellites owned by a consortium of 79 nations. In 1970, INTELSAT completed its global system of satel-

lites with the capability of relaying communications across all parts of the world, between the nearly 100 earth stations. INTELSAT enables instantaneous economical, high quality communication between continents via transmission of voice, data, teletype, facsimile, or television pictures.

3. Retail Trade World-Wide

The application of computer technology to the international marketing of merchandise is on the horizon. Goods produced in cooperating countries may be labelled in a standard way so that descriptive information can be electronically read as the goods flow from manufacturer, to exporter, to importer, to supplier, to retailer, and, finally, to consumer.

The National Retail Merchants Association (NRMA) in the United States has developed a uniform labeling code consisting of electronically readable characters (OCR-A font, size 1) with a label format providing complete information on the merchandise.

Members of the NRMA are beginning to label their merchandise in accordance with this standard and cash registers are being replaced with electronic point of sale (POS) terminals. The purchase of POS terminals has become one of the most rapidly growing sectors of the computer industry. Several U.S. large department store chains are routinely placing orders for 15,000 terminals at one time. In fact, there will be over 200,000 POS terminals installed in our general merchandise stores by the end of this year. Supermarkets are projected to account for another 100,000 automated check-stand terminals by 1980.

Germany, France and Switzerland have been installing POS terminals at a spectacular rate also.

The Common Market Countries are seeking agreement with the National Retail Merchants Association for a uniform merchandise identification system to promote trade and the expeditious flow of merchandise. Also, the Japanese Retail Association in Tokyo is talking about reaching a similar agreement. Thus, the retail trade industry is rapidly becoming more cohesive and more uniform in its behavior and transcending the artificialities of national boundaries in the process.

Views of National Leaders on Computers

1. The Pacing of Computer Growth

The computer has been singled out frequently by national leaders as an important element in pacing technological and national growth and development. There has been national concern expressed about pacing the development and application of computer technology so as to keep it in step with the need to protect individual and societal rights. On February 23, 1974, President Nixon underscored this concern in his address to the nation on the subject of the American Right of Privacy. Mr. Nixon said:

> No modern industrial society can survive without computers and data processing -- and especially a society with high living standards and even higher expectations such as ours ... But until the day comes when science finds a way of installing a conscience in every computer, we must develop human, personal safeguards that prevent computers from becoming huge, mechanical, impersonal robots that deprive us of our essential liberties.

Of all the situations in the Soviet Union, for example, which hinder scientific-technological progress, the shortcomings in computer production and usage have probably received the greatest attention. Chairman Brezhnev, in his speech to the 23rd Communist Party Congress in March-April 1966, was critical of the slowness with which new scientific ideas were introduced into the economy and cited computers as a special example. He said:

> Mention should ... be made of the deficiencies that hold up its (Soviet science's) development. The gravest of these is the slow introduction of completed scientific research into production. There is an unjustifiable gap between theoretical research and its technological and design development. Often, years pass before a discovery is applied in production -- a fact damaging the national economy and science itself. Poor use of electronic computer techniques is one example of this.

Chairman Brezhnev again returned to the computer in his address to the 24th Party Congress. He remarked that "in the coming Five-Year Plan ... special significance is accorded to the organization of wide-scale output of contemporary computer machines." Mr. Kosygin followed by emphasizing that the "improvement of the system of planning and management of the national economy in current conditions requires wide application of economic-mathematical methods and the use of computer technology."

Although we have not researched the point carefully, it seems unlikely that Chairman Brezhnev and Mr. Kosygin may be the only national leaders who have recognized the value of the computer in national growth and development.

2. The Potential of Computers

President Lyndon Johnson had a very business-like view of the potential of computers. In June 1966, he sent a memorandum to all Federal departments and agencies that said:

> I want the head of every Federal agency to explore and apply all possible means to
>
> - use the electronic computer to do a better job.
>
> - manage computer activity at the lowest possible cost.
>
> The electronic computer is having a greater impact on what the government does and how it does it than any other product of modern technology.
>
> In short, computers are enabling us to achieve progress and benefits which a decade ago were beyond our grasp.
>
> The technology is available. Its potential for good has been amply demonstrated, but it remains to be tapped in fuller measure.
>
> I am determined that we take advantage of this technology by using it imaginatively to accomplish worthwhile purposes.

President Johnson again returned to the theme of the potential of computers in an address at Williamsburg, Virginia in 1967. He noted that computers could not only handle information and knowledge but that they could be tied together by communications

into networks. He tied those two ideas together in a call for development of a NETWORK FOR KNOWLEDGE which would use computers to effect a more equitable distribution of knowledge and information for all.

The actions of the United Nations over the last six years seem to bear out the hypothesis that computers have considerable potential for good in the international environment. In response to General Assembly resolution 2458 (XXIII) of December 20, 1968, the Secretary-General prepared a report on the Application of Computer Technology for Development. At the direction of the General Assembly (XXVI Session), the Secretary-General undertook an updating of the report and in 1973 produced the second report on the Application of Computer Technology for Development. The second report states that:

> Computers together with their accompanying technology and systematization, can be effectively used for the promotion of national developments in many fields of human endeavor. In almost every sector of activity as well as in the more important management functions of government, institutions and corporations, the computer -- once its advantages and its limitations are fully appreciated -- can be a most helpful tool.

3. Recognition of Economic and Strategic Value of Computers

An excellent example of the recognition of the economic and strategic value of computers occurred in 1971 when the British wanted to sell two ICL 1906A computers to the Soviet Union. The sale received the direct attention of the President of the United States and the British Prime Minister. This was a case in which two computers were considered to have the potential to measurably improve the strategic position of a world power.

The export of computers is a cause of national concern for economic as well as strategic reasons. If care is not exercised, a nation can lose valuable technology. The "lost" technology can adversely affect the exporting nation's computer technology lead and/or enable the gaining country to accelerate development or production in areas that will be competitive with the losing country.

Problems and Potentials: Computers and the International Balance of Power

There are some significant characteristics today which highlight the impact as well as the problems of computer technology as it interacts with other forces in the international scene. Some have been explicitly dealt with in preceding paragraphs, others follow implicitly while others are still just hypotheses. For example:

- Computer technology is one of the strongest forces acting to enlarge institutional domains of control across national boundaries. The banking community with its Electronic Funds Transfer System (EFTS) and its Society for World-Wide Information Funds Transfer (SWIFT) epitomizes an expansion of control of a special-interest community across national boundaries. Multinational corporations either dependent on computers for their international sphere of influence or marketing computer products and services are another example.

- Computer products and technology, which figure with increasing prominence in military matters, are far less susceptible to rigid military control than the more typical military technologies such as weapons systems and military delivery systems.

- Most scientific and technical spokesmen providing advice to national or multinational leaders today are insufficiently versed in the new computer-dependent technologies to be accorded credibility. These scientific and technical spokesmen are principally the product of the World War II scientific ethic and are out-of-touch with newer technologies.

- Computer combat may have replaced human combat in the real World War III which could have already been fought via the computer-played nuclear war games of the 1960's.

- Computer and its allied technologies such as automation, information and communications technology are more intensely interactive with individuals and society than sciences and technologies of prior times (with the exception of medicine). The types of controls needed and the problems introduced by these newer technologies cannot be built on the base of experience with the more traditional sciences and technologies such as physics, mathematics and chemistry.

- There is as yet no permanent balance between individual man and computer in the differentation of intellectual-like functions which can best be assigned to each.

- Computer technology is a most effective technology for upsetting balances of power and status quos without the catastrophic or dangerous effects characteristic of military technologies.

- Those communities, power groups or nations using computer technology as an agent for change may be the most effective in achieving their objectives today and in the future.

- The importance of computer technology in the international scene makes it imperative that computer scientists and technologists become far more active spokesmen in providing advice to leading policy-makers world-wide. Reluctance of scientists of the older scientific ethics to augment their ranks with spokesmen from the newer sciences and technologies should no longer be condoned.

In view of the rapidly changing international scene accompanied by the importance and "newness" of computer science and technology, it is most important that progress be made with all deliberate speed on the international front by spokesmen for computer science and technology. □

MORRIS — *Continued from page 14*

Better Correlation and Coordination

- Second, it is apparent that we need far more effective techniques of correlating the numerous efforts now in progress or being contemplated. Without a focal point of knowledge, we may unknowingly duplicate our efforts, fail to establish logical priorities, and allow gaps to exist in our attention to the key problems. I commend Bob Marik of OMB for his continuing attention to this need.

Better Imagination and Innovation

- Third, we need to foster imagination and encourage innovation. □

What Happened to the Computer Revolution?

John D. DeButts
Chairman of the Board
American Telephone and Telegraph
195 Broadway
New York, NY 10007

"That we have thinking machines these days hasn't in my observation reduced the need for human thinking. Somehow each passing day we need not less but more of that painful practice."

Any Difference?

What difference has the computer made?

Casting my mind back 20 to 25 years and the predictions that were current then that the computer would, as some alleged, lift from mankind those vestiges of work of which the Industrial Revolution had not already relieved him or, as others argued with equal passion, that it would drain society of all humanity, I cannot help wonder what the fuss was all about. In terms of the way I live and do my job, what difference has it made? In the context of those drastic predictions, I am tempted to say -- initially -- "not much."

The Automatic Factory?

Our factories have not been depopulated, their workers supplanted entirely by automatic and utterly tireless production systems that take their orders from a computer program and detect their own eccentricities -- and correct them -- with no need for human intervention between start button and shipping platform. For the most part we have learned that automation on so comprehensive a scale introduces so many rigidities, involves such enormous capital expenditures that, far from abetting, they actually impede the change and innovation that is characteristic of our age.

Centralization?

A quarter century ago, it was freely predicted that the computer would represent an enormous force for centralization, that it would remove not only the need but the occasion for decision-making from the grass roots manager and reserve it to a headquarters elite that would be constantly apprised -- in real time -- of every significant aspect of the business requiring their intervention. That hasn't happened in my business nor has it in any business that I know about. That we have thinking machines these days hasn't in my observation reduced the need for human thinking. Somehow with each passing day we need not less but more of that painful practice.

Push Button Control of the Bell System?

And my own job, had the predictions of a quarter century ago come true, would long since have been transformed and I would be spending my days seated at a console in a dimly lit room lined with displays of data that capture minute by minute the throbbing flow of the Bell System's transactions from coast to coast -- the status of our trunks, the traffic offered to each of our central offices, the number of phones we connect and disconnect in every district as well as the trend of uncollectibles in every business office and the incidence of absenteeism among our one million employees. Had this dream come true, it would take no more than the push of a button for me to undertake whatever interventions, not previously programmed for self-corrective action, may have been reserved to provide me some sense of residual authority.

But -- for better or worse -- life isn't like that at all. Instead I occupy today the same office that the first head of AT&T, Theodore N. Vail, occupied 60 years ago. Only my telephone is different and only my Picturephone is new. But the desk is the same and the panelled walls are the same. And much the same, I imagine, is the way I spend my days -- conferring and corresponding and in whatever time remains pondering and somehow trying to cope with the maddeningly diverse interests and concerns of that defiantly unprogrammable species, my fellow man.

Clearly -- at least from the limited perspective I have outlined -- neither the dire consequences or the utopian promise of the computer's application has come to pass.

What, then, happened to the revolution?

The Revolution Did Happen, But Quietly

The answer to that question is that it has already taken place -- so quietly though, so utterly without the catastrophic disruptions so many prophets thought would accompany it, that most people go about their lives and work as if today's world were the same world they grew up in -- a little more complicated perhaps and a little faster-paced, but in all of its essentials the same.

But the fact of the matter is that you and your colleagues in the computer arts have changed our world. Today your systems of hardware and software affect -- for the most part benignly -- how nearly all of us carry out our daily tasks and influence the way we see the world around us. That it has

Based on an address at the National Computer Conference, Chicago, Ill. 1974

been such a quiet revolution -- what the newspapers would insist on calling a "bloodless coup" -- is in large measure a tribute to the good sense of your profession, the poise and patience of a calling that knows itself to be in league with the future.

How pervasive a revolution it has been comes clear from an examination of the role of the computer in my own business.

Census of Computers in the Bell System

Every year we take a census of data processing machines in the Bell System. At last look -- at the end of last year -- we employed 2,311 computers, 811 of them large general purpose machines and 1,500 of them minicomputers, fully half of which we had acquired within the last two years.

Twenty-five thousand Bell System employees are directly involved in programming or operating computers and our total bill for data processing services runs to about $450 million a year. We do not yet, however, confront a balance of payments problem between your business and ours. The Bell System's revenues from data transmission services, as near as we can estimate them, are running pretty close to a billion dollars a year. You are a MOST valued customer, let me assure you.

The Telephone Network

Long before there was a computer there was a telephone -- and yet more and more we find ourselves using your language to describe what we do. Today we think of the nationwide telephone network as a single mechanism, a large data processing machine operable on demand from any one of 110 million input-output terminals, any one of which is capable at any moment of selecting one of the seven million billion possible connections it takes to reach any other.

Interconnectedness

The unique characteristic of the nationwide telephone network, then, is the "interconnectedness" of its trillions of parts, all of which must operate compatibly and reliably 24 hours a day -- without provision for "down time" -- even while it is being constantly reconfigured to meet changing demand and to accommodate new generations of technology.

While I am on the subject of down time, may I remark in passing what many of you may already know -- namely, that we are in the process of converting the nationwide network to all-electronic switching, a goal we hope to reach by the year 2000.

Since 1965, we have placed in service 455 electronic switching systems. We are currently adding them to the network at the rate of one every two days.

These electronic central offices are the most complex, real time data processing systems in operation -- anywhere in the world.

Reliability Goal

We have set for their performance a reliability "bogey" that still strikes me as an outrageous defiance of the second law of thermodynamics. Our electronic call-processing machines are engineered to operate trouble-free -- 24 hours a day, 365 days a year, while additions are being made and preventive maintenance performed -- for all but two hours in 40 years of continuous operation.

And that bogey was established before the first electronic switching system came on line.

We are not there yet. Last year, Bell System electronic switching machines experienced 81 outages for a predictable down time of 8.9 hours in 40 years. Put another way, the machines achieved an "up time" of 99.9973 per cent in 3.3 million hours of service.

Perhaps, after all, we will be able to meet our bogey.

Formidable Intricacy

Actually, we have no other option. The nationwide network already is a machine of formidable intricacy. The number of connections it must provide grows geometrically with each terminal we add. Small wonder, then, that a few years ago when -- for the first time in generations -- we began to experience severe service difficulties in a few major metropolitan centers. A number of journalists, more imaginative than informed, were quick to see our troubles as the first signs of an irreversible disorder that, as our operations grew more and more complex, would eventually overwhelm us. I haven't seen much "fine writing" of this sort in some time.

That is not to say that the issue is not a real one. "Can complexity be managed?" is a very real question confronting not only our business and a great many others but our whole society as well.

That my answer to that question is an unequivocal "Yes" I owe very largely to my observation of the accomplishment of computer-based technology in my business.

Let me give you some samples.

Some Computer Based Systems in the Telephone Network

We use computers to help us size and locate central offices, to optimize the timing of additions to our facilities and to "write" the specifications for them.

When high-capacity transmission facilities are damaged by storm or other causes, computerized systems at restoration control centers throughout the country select alternate paths for rerouting service around the trouble. Some 11,000 restoration plans have been programmed into the memories of these systems and, in the most modern toll switching offices, the rerouting occurs automatically.

A new system, completed last year, will automatically and continuously check the status of trunks connecting a group of central offices and, when it spots trouble, will automatically print out its diagnosis for use by our maintenance forces.

Another new system will monitor from a single location the pressurization of our cable throughout an entire state -- as much as 15,000 miles of it.

Like just about everybody else, we use computers for inventory control. Today we are installing a system that will provide us a running census of the prewired plug-in units that are coming to play a more and more important part in our plant. Currently our inventory of plug-ins runs to about $3.5 billion. It will take us until 1980 to complete conversion to the new system on a nationwide scale, but by that time we expect it will already have

saved us upwards of $750 million.

To generalize for a moment, computer-based systems of this sort -- and we have a half-dozen more of like scale currently under development -- will enable us to know vastly more about ourselves and the very large machine we run than we have ever known before. What the computer can tell us about our own plant -- indeed what it has already told us -- will, I am confident, have a profound effect on the efficiency with which we utilize its capacity. Already computerized information systems have enabled us to increase the utilization of our interstate long distance trunks -- and thereby the revenues we derive from them -- by some 75 per cent in the past five years.

Today the Bell System's investment in plant stands at some $67 billion. Over the years that plant has steadily grown in efficiency with the introduction of new technology that can do more for less -- faster switching machines, higher capacity transmission systems. Whether and when this effort will reach a point of diminishing returns I don't know. What I think I do know is that in the years ahead our application of computer-based information systems will achieve improvements in plant efficiency quite as dramatic as those we've achieved through advances in telephone technology in the past.

Goal: Not Efficiency but Freedom ....

But our main aim in seeking to apply the computer to our operations is not efficiency; it is freedom. That has been the guiding principle governing all the projects that taken together we call -- with singular lack of imagination -- B.I.S. for Business Information System. B.I.S. is actually a "system of systems" that, beginning with the service order process, encompasses a spectrum of subsystems, each compatible with all the others, for all the major activities that the service order puts in train -- the customer premise facilities it calls for, the assignment of cable pairs, the directory changes, the billing information and so on.

B.I.S. has been under development since 1967 -- and already we have invested some $200 million in it. That large number may explain why from time to time I have been heard to observe that what most characterizes computerization projects is that inevitably they always seem to cost more and take longer than their sponsors promise at the outset. You may take that, however, as a measure of my confidence in the promised benefits of these projects and my impatience for the day when those benefits will be realized.

... To Personalize Service

The brightest promise B.I.S. offers is the freedom of managers to manage, of engineers to engineer and -- the greatest freedom of all -- the freedom of people to deal WITH people AS people. The Bell System has long recognized that, while it numbers its customers in the millions and millions, it serves them one at a time. It is to that need that the entire B.I.S. program is addressed. Far from dehumanizing our operations, its aim is to scale them to the unique requirements of each individual we serve.

It will be a decade yet before out B.I.S. programs are completely deployed across the Bell System. But our experience of them thus far and our sense of their benefits to come provides a sufficient basis for my conviction that far from depersonalizing our society, the computer can exert an enormously civilizing influence on the management of our affairs, the opportunity to personalize our society and its institutions in ways hitherto beyond our scope.

Decision Making

I told you at the beginning that I would undertake to appraise your science and its accomplishments entirely from the perspective of my own job. That job calls -- occasionally -- for decision-making, a function that the prophets said the computer would one day preempt but that experience tells us will remain forever beyond its reach.

I say that because it is in the nature of decisions, if they are in fact decisions, that the requirement to make them always precedes the availability of sufficient information to provide assurance that among available alternatives we are choosing the right one. In short, decisions are choices made under conditions of uncertainty. It is this uncertainty that gives the art of management its zest -- and I for one hope that technology will never limit our choice to one trajectory. Indeed, I am confident it never can.

All of which is not to say that information technology cannot serve as a very powerful adjunct to the decision-making process.

Extension of Corporate Planning

Example: a few years ago I sought the help of our own management scientists in the hope that they might help us find ways to extend our corporate planning horizon and thereby give us greater lead-time for decision-making. What I hoped they might do -- and what they have since done -- is to provide a means for tracking the complex interactions of policy and organization with the realities of supply and demand for our services, the cost and availability of capital and all the other major factors bearing on our future.

As interesting as what they have done is the way they did it. What they did NOT do is to return to their own cubicles to develop a model that, however elegant it might be, could in the final analysis do no more than extend old trends and impose the patterns of history on a trackless future.

Instead they designed a PARTICIPATIVE process that joined the power of the most advanced management technology to the expertise and insights of their colleagues in general management. In the process they took as much account of the value judgements that affect the future as they did of the inexorabilities of established trends. In effect, what they sought to do is join their science to our art.

It is too soon to say what good will come out of this effort. I for one have high hopes for it, admitting at the same time to some bias for having set it afoot in the first place. At the very least, we are now better equipped than ever before to appraise the integrated economic effects of a wide range of management options, all of them presented to us in language to which we are accustomed and in forms appropriate to our decision style.

In short, when we ask "What if...?" we may now look for an answer that takes account, not only of immediate consequences but of second, third and fourth order effects as well.

(please turn to page 26)

"COMPUTER TERMINALS AS TEACHING TOOLS FOR EDUCATIONALLY DEPRIVED URBAN CHILDREN ... SPECIFICALLY AND MEASURABLY RAISE ACHIEVEMENT LEVELS."

Computers In Inner City Classrooms

Amelia R. Carter-Wooby
Box 98, R.D. #1
New Providence, PA 17560

Given an inner-city classroom, as I was from 1967 to the spring of 1974, where many students are lacking the basic skills necessary to function, I was constantly on the lookout for more and better classroom aids to help get across the most fundamental arithmetic processes. Accidentally I happened on a mini-computer demonstration, and learned to use basic programming as a technique for teaching step-by-step processes.

FIRST MINICOMPUTER

The mini-computer originally used was the Olivetti-PROGRAMMA 101, which had been purchased for the Principal's use and for the Commerce Department of the high school. It was quite difficult, with almost forty students in the classroom, to give them all extensive hands-on experience, but they were quite able to grasp the elements, for instance, of the solution to a subtraction problem, learning once and for all the importance of order of elements in subtraction as opposed to the commutativity of addition, and, subsequently, the same discoveries about division and multiplication.

Students who were not offered the alternative of programming had great difficulty remembering which operations were commutative and which were not, because, astounding as it may seem, students in inner-city schools, even high schools, lack the ability to subtract simple problems, and for 10-6 will say "six take away ten".

TERMINAL TO TIME-SHARED COMPUTER

During the subsequent year we were able to secure a teletype terminal which was connected by telephone ties to an IBM 1130 for basic programming interaction between student and computer. Again, one keyboard was inadequate access for entire mathematics classes, but the advantages of the more sophisticated BASIC language over the machine language needed for the mini-computers and the shared-time interactive potential made the teletype interesting as a mechanical device for classes in computer programming and mathematics classes in general. Students were able to program arithmetic processes and check answers, and also to solve formulas in algebra.

Many students learned the mechanics of coding very quickly, and they were anxious to use the terminals. Again, one keyboard is not sufficient access for a normal-sized (25-30) class of students, and the teacher was faced with what to do with the remainder of the class while offering keyboard advice and instruction to the others. Even the 15 to 1 ratio suggested by many computer manufacturers who sell computers as an educational aid is quite high.

EIGHT TERMINALS

Fortunately, through Title III of the ESEA, we were able to secure the funding for eight terminals to be utilized for remedial mathematics and reading. Putting students "on-line" on a rotating group basis, where the canned program supplied by Hewlett-Packard kept records, pre-tested, post-tested and computed statistics, enabled the teacher to help individually those students who were not on-line, and was a significant motivational tool for the students on-line to be completely engrossed for twenty minute time segments. Generally, it seems that the use of computer terminals as teaching tools for educationally deprived urban children is a largely untapped area. The largest drawback is funding, in my experience, but the achievement levels are specifically and measurably raised for the vast majority of remedial students.

SPORADIC ATTENDANCE

Specifically, one finds problems in teaching peculiar to urban deprived students that are not apparent or prevalent in other situations. For instance, one finds sporadic attendance patterns as the rule rather than the exception. Some students attend as infrequently as 50% or even 25% of the total time. Ordinarily, when they return to class, they are so far behind the material being taught that they are easily overwhelmed and give up, with the result that they fail to achieve anything. With the use of the computer, the student picks up learning material where he stopped, which is what educators call "individual learning" or "individual prescription". The student is immediately reinforced or corrected as he proceeds through the material, and, because he is interacting, his attention is focused.

LOW ATTENTION SPAN

Attention span and attention focus are two very serious problems for inner-city youngsters. They are ordinarily quite immature, and the computer can be adjusted to give each student smaller time blocks

or longer answer time if the teacher feels that it is necessary.

In education in general, the following three methods of computer-aided instruction have been attempted. First is CAI, Computer-assisted instruction, which is the method I have described above. A second system, called CMI, is computer-managed instruction: the computer prescribes individually for a child according to his learning rate and progress. The material may be partially computerized, wholly, or not at all. The third system is totally computerized instruction, with no teacher present. This has been mostly attempted with college classes on an undergraduate level, with some success.

COMPUTER-ASSISTED INSTRUCTION

Until a satisfactory and inexpensive audio component is devised, it seems that CAI is the most effective tool of computer-aided instruction in the innter-city classroom. CMI requires a higher reading ability than is normally found in inner-city classrooms, and a higher degree of self-motivation and follow-through. Totally computerized instruction requires personal self-motivation and a high degree of concentration as well as a functional reading level.

In the CAI mode, however, the development of an educational system, whereby audio and visual components could be included, would enable the expansion of computer-aided instruction into the fields of the humanities, foreign languages, etc. Up to now, the most successful fields have been mathematics, science, reading, economics, history.

"ENEMIES" . . .

Inner-city students have great difficulty relating interpersonally, teachers being enemies and even other students. So the complete absorption and guaranteed progress ensured by the machine seem almost a last-ditch educational measure in the bleak inner-city educational picture.

When the student interacts with the computer terminal, either through a teletype keyboard or through a cathode ray tube and light pen, or otherwise, he is affectively, cognitively, and, what is most important, totally involved in what he is doing.

. . . vs. SUCCESS IN LEARNING

In this way he realizes immediate reinforcement for what he learns as he learns. He is able to see and notice his progress, and become more satisfied and learn.

With all the problems inherent in an inner-city situation the computer in the classroom evidently is an important aid to the teacher and the student.□

DeBUTTS — *Continued from page 24*

Merging of Art of Management and Science of Management

This planning effort has produced a side benefit that may be as important as the effort itself. It has breached the barriers that have hitherto divided the art of management and the science of management in our business. The wariness of your "black arts" that some in general management may have entertained in the past and the matching wariness with which some management scientists view men of affairs have altogether dissolved in the course of joining our separate but mutually dependent skills in a common effort. We are merely at the beginning of this new road -- far enough along, however, for me to commend it to you with enthusiasm.

Let me conclude with the question I raised at the outset: What has happened to the computer revolution?

Well, it's happened. It has happened so quietly that only by taking thought do we come to realize how pervasive its effects have been.

And those effects, contradicting the doomsayers, have been for the most part benign.

A Larger Freedom May Lie Ahead

To be sure, questions remain that we neglect at our peril. How safeguard personal privacy from malicious or inadvertent misuse of the enormous and uncommonly retentive memory your technology affords? And how -- in the face of the computer's capacity for classification -- can we assure that the individual remains what he has been from its founding, the basic unit of our free society?

I for one am confident that we shall find sensible answers to these vexing questions and that the uneasiness they inspire in so many of our fellow citizens will in time subside. My confidence is based on what seems to me a fact -- and that is that nowhere in our society do I sense a greater sensitivity to these matters and a stronger determination to resolve them in keeping with our traditions of freedom than I do in the computer community itself.

In the meantime you have already provided the answer to one of the most vexing questions overhanging these times. To the question "Can complexity be managed?" you have answered with a profoundly reassuring "Yes." Conjoined, the arts of communication and computation provide a promise that not things but man will shape the future and that, if we will it so, a larger freedom lies ahead than we have ever known before. □

The Assassination of the Reverend Martin Luther King, Jr., and Possible Links With the Kennedy Murders — Part 10

Wayne Chastain, Jr.
810 Washington Ave., Apt. 408
Memphis, Tenn. 38105

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.

Ray's Lawyer Denies a Conspiracy

Foreman, who declared in open court at Ray's trial that there had been no murder conspiracy behind Dr. King's death, later told Huie that he had represented many Mafia members in his time — from the very highest to the very lowest of the echelons of the syndicate. The methods of operation described by Ray had convinced him that Raoul not only existed, but that Raoul was a runner for the Mafia (remember J. Christ Bonnevecche's fantastic story to the two ministers?) and had worked for him. (Through sources this writer contacted in Dallas and Houston, Foreman had repeated this story to others and these sources even said Foreman had represented a man he believed to be Raoul on at least one occasion.)

Foreman, however, said the existence of Raoul did not indicate or implicate Raoul in the King assassination.

Foreman was reported to have earned a $75,000 fee shortly before the Ray trial in February 1969. At a special press conference at that time, Foreman would neither confirm nor deny that he had earned such a fee. One reporter asked if the Ku Klux Klan had paid him the $75,000 — or a comparable sum — for his representation of Ray. In the presence of at least eight reporters, Foreman emphatically denied the KKK was paying his fee. Because the press conference took place in the morning, this was front page news for the afternoon dailies. The St. Louis "Post Dispatch" and the Memphis "Press-Scimitar" both carried streamer headlines: "Foreman Denies KKK Paying Ray's Fee." Foreman was furious and called the editors of both papers, saying he never denied that the KKK was paying his fee. When one editor asked him if his complaint meant that the KKK had paid Ray's fee, Foreman abruptly hung up. Foreman's behavor was highly erratic during this period. This writer had known Foreman very well in the early 1960's when he had worked on two Houston dailies. Foreman then always dealt with the reporters themselves rather than calling their editors. He was always accessible and usually encouraged his clients to talk to reporters for feature stories. Foreman had standing instructions to his secretary that when reporters called, to put them on his line. If Foreman was out for lunch, the secretary would always tell the reporter where he was dining and Foreman would even answer calls at the restaurant if the reporter needed to talk to him.

During the Ray trial, it was obvious that Foreman was under a strain. He was hostile to reporters, especially if the conspiracy theory was broached. He denied several times to the press that there was any evidence that Raoul ever existed — the

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.

*Parts 1 through 9 were published in the February through October issues of *Computers and People*, and are available from the publisher as back copies at $2 each.

official FBI line — despite the contradictory belief that he held, according to Huie.

If one is to accept the lone assassin theory, however, the official theory and the assumptions it is predicated upon is more palatable than Huie's. The logic of the FBI and police non-conspiracy theory is more exacting. They categorically deny Raoul's existence. They realize that a syllogistic momentum is generated in the direction of a conspiracy conclusion once you accept that fatal first premise — the existence of Raoul.

King's Death Ray's Goal

Huie, however, eludes this inexorable logic by a quantum leap backward. Huie contends that it wasn't Raoul who influenced Ray to kill King. Any influence on Ray to kill King came long before Ray met Raoul, Huie argues. He cited an incident at the Missouri State Prison about the time President Kennedy was assassinated in 1963. Huie said a prisoner remarked at the time that someone other than Lee Harvey Oswald killed Kennedy and that someone probably got a million dollars for the job. He then added that the man who would kill Martin Luther King Jr. would get another million. Ray supposedly responded: "Yeah, and I am going to be that man."

Thus, Huie would have us believe that a casual conversation in 1963 set into motion a one-man force that would kill Dr. King five years later. Huie would have us believe that the momentum of this force drove King to leave the relative security he enjoyed in Canada after he had escaped from the Missouri penitentiary and go back to the U.S. where he faced the dangers of recapture. To believe that this chance conversation in 1963 provided the impetus that inexorably drove Ray to kill King five years later — a force that continued to gather momentum without an intervening influence by someone who could provide tangible rewards and the actual million dollar payoff — strains the most credulous of minds.

Why would Ray actively pursue and ultimately achieve the goal of killing King without any overt offer from someone offering to make the payoff — the "quid pro quo" Ray bragged he would collect, if one is to accept the prisoner's story?

Pro-conspiracy proponents could plausibly argue that status consciousness provided the very component in a prospective fall guy that Raoul was looking for. Perhaps Raoul realized he could manipulate and massage Ray's ego and enmesh him into a murder conspiracy in which Ray would serve as both decoy and fall guy. Ray would be the man leaving a trail of clues — the kind that Sam Spade said was needed to set up an ideal fall guy. Thus, it was Ray who bought the rifle under Raoul's instruction. It was Ray who returned the rifle the next day. Perhaps Raoul did not tell Ray what he actually wanted in the way of a weapon until after Ray bought the rifle, because he wanted Ray to make a second trip. Perhaps he wanted to firmly implant a mental picture of Ray in the mind or minds of the store clerks at the sporting goods store. Raoul, with the second set of keys, could have easily gotten access to the bundle in the back of Ray's car and placed it on the sidewalk.

Final Version of the Assassination

And the final version of the assassination as told to Huie by Ray namely, is that Raoul was in the rooming house and asked Ray to leave and walk downtown. Ray complied, but as he noticed a low front tire, he decided to drive the car over to a nearby service station. Here, Ray filled the tire, and then drove the car back in the direction of the rooming house. Ray said Raoul had told him he was going to receive a visit by a "gun buyer". Ray was taking the car back because he thought Raoul and his guest needed the car to go out. When Ray got within one block of the rooming house, police squad cars had blocked off the street. Something had happened. Then he, Raoul, ran up to his car and jumped in. Raoul said: "Let's get out of here." Ray drove away, and after he drove five blocks, Raoul jumped out of the car at a red light and he never saw Raoul again.

When Ray told this story to Huie, he certainly must have had enough intelligence to have known Huie was going to print the story. If the story were printed, would not the fabricated Raoul be plausible enough that some of his cellmates might believe that Raoul was indeed the mastermind behind King's death? How would this enhance Ray's image with his fellow cellmates? Besides, telling the police — and the world through a writer — about Raoul would be a way of "stooling" on a fellow criminal.

By fabricating the story about Raoul, wouldn't Ray be weaving a tale with enough plausible elements that it might be accepted? And if Raoul actually did exist, but was not a co-conspiring confederate in the King murder, would Ray violate the code of the underworld and stool on a pal? Also, wouldn't this be rather dangerous for Ray, especially if Huie and the FBI are correct in the assumption that Ray wanted to be caught and be returned to prison because this is the only life he has ever enjoyed? If Raoul were a runner for the Mafia — be he implicated in King's murder or not — would he not have some way of setting up a murder contract on Ray in prison? Or the FBI, Huie, and Frank want the world to also believe that Ray is suicidally inclined?

By admitting to the world that he — James Earl Ray — had been "had" by Raoul, wouldn't Ray be admitting he was "patsy?" Wouldn't this deny Ray the high esteem of his fellow underworld cellmates? Huie's status consciousness thesis — also used by Frank and the FBI — cuts both ways. If craving for recognition unleashed the long repressed dash and daring of Ray's hidden personality — the motive force which supposedly drove him to kill King — then the non-conspiracy proponents cannot conveniently ignore the other implications of status consciousness when they try to explain away Raoul's role as explained by Ray.

The pro-conspiracy proponents could argue that the idea of associating with such a character as Raoul must have buoyed Ray's self-esteem. Could this not have filled Ray with confidence that he had now arrived at the stage of his criminal career where he could command the big money — especially after receiving $750 for such an effortless chore as crossing an international border?

And what made Ray give up this security in Canada to return to the precarious existence of a convict on the lam in the U.S.? Would there not have to be countervailing advantages that outweighed the risks?

Perhaps Raoul made the big pitch all at once — perhaps he urged Ray to return to the U.S., and for a large sum of money, enter into a conspiracy scheme to kill King. The magnitude of such an enterprise might have electrified Ray's self-image. The fact that someone thought Ray was capable of participating in such an undertaking must have fed his undernourished ego. (Maybe it was a national secur-

ity pitch, similar to the one made to the four Miami Cuban refugees to participate in the burglaries of Dr. Ellsberg's psychiatrist in Los Angeles and the National Democratic Headquarters in Washington D.C. at the Watergate Hotel.)

Perhaps an association with a dynamic doer like Raoul — assuming Raoul might be the man with the code name of Jack Armstrong or someone like him — Ray would feel more secure living in the U.S. At least, Ray would be more secure than the average escaped convict without a patron and a protector.

Other Motivations

Huie said Ray moved to George Wallace's home state of Alabama because he believed Wallace was going to be elected President. Where did Ray get this idea? From reading "The Chicago Tribune", which Huie said was Ray's favorite reading matter?[1]

Could Raoul have convinced Ray of Wallace's impending success at the polls, explaining to him that powerful forces were behind Wallace within the federal power structure? If Raoul made his pitch all at once, might not he have explained that these same powerful forces wer plotting the assassination of King; that King's death would result in an upsurge of violence and turmoil, that the people then would be favorably disposed to accept Wallace as the man on the White horse?

In order to influence Ray to return to the states where he might more readily be re-captured as a fugitive, perhaps Raoul hinted these same official sources would protect him. Raoul was supposed to be fluent in Spanish (according to Huie's first version). If he were French Canadian, he must have spoken French. In Ray's unsophisticated and credulous mind, could Raoul have been a special agent of some kind? An international intelligence agent? Perhaps, Raoul convinced Ray he was on a mission planned by the Central Intellegence Agency!

Thus, Huie lays the foundations for these inquiries when he evoked the theory — one that Frank and the FBI cite — that Ray was convinced he would be pardoned for killing King once Wallace had taken the oath of President.

Huie rightly ridicules the notion that King's murder could have been planned and executed by the FBI. However, the more one learns about the convoluted conduits employed by the CIA, a CIA conspiracy becomes less and less implausible.

Huie, however, doesn't spend any time exploring the mythological origins of the CIA conspiracy theories. After all, Huie's own associate, Arthur Hanes, hinted at a federal conspiracy of some sort.

Ray's desire of making the "The Ten Most Wanted" (a list compiled by the FBI and published each week) might have served as a minor spin-off gain, but could this have been Ray's motivation?

Both Huie and Frank attach much significance to this desire to be one of the FBI's 10 most wanted, but wouldn't a more reasonable explanation be that Ray only comforted himself with this spin-off gain? Yet he was deprived of the big prize — the million dollar payoff and a convincing cover-up of his participation in conspiracy.

After all, if Ray's version of how King was killed is true, Raoul abandoned him after the assassination. Raoul also left an abundance of evidence implicating Ray at the doorstep of the rooming house.

The arguments Huie uses to counter this obvious objection to the non-conspiracy version is that Ray wanted to be caught. How convincing can this argument be for a man who expeditiously left the U.S. after the slaying, slyly connived a method of getting a passport to Europe and after a brief period in England, escaped to Portugal?

Thus, Ray — betrayed and sans the million dollar payoff — would hardly tell Huie how Raoul beguiled him into participating in the conspiracy and then set him up as fall guy if Ray's sole motivation was to gain status among his criminal peers.

If this were Ray's sole motivation, then would Ray have given to Huie, as he did in the smuggled documents from the Shelby County jail, a license to publish the story that he was the most disingenuous criminal of all time — a sap that allowed himself to be used as a "decoy"? What would this do to Ray's image among his criminal peers?

Why Would Ray Talk With Raoul?

It couldn't have been money that prompted Ray to tell Huie about Raoul while he was in the county jail, if Huie's theory is true, because Ray was already where he wanted to be — jail. By telling Huie about the mysterious Raoul, wouldn't he be subjecting himself to the jeers and ridicule of his fellow cellmates?

If hunger for status and recognition from his criminal comrades in prison explain the complex and contradictory dynamics of Ray's actions, why would Ray weave a fictional figure — such as Raoul — out of the conspiracy cloth? Why would Ray rob himself of the credit for the crime he so ingeniously planned and carried out by himself?

And today, realizing there will never be a million dollar payoff, whould one wonder why Ray has never said anything more about the mysterious Raoul? If that part of Huie's theory concerning Ray's hopes for a pardon if Wallace became President is true, could it not be that Raoul — at least in the mind of Ray — holds the threads of that hope in his hands?

And if Raoul exists and does provide sustenance to Ray's hope of a future pardon, does this not by itself suggest conspiracy?

And the question that nags skeptics of the official lone assassin theory remains unanswered: If there had been no conspiring confederates, who had induced Ray to kill King because they supposedly had connections with the Wallace people to win him a pardon?

And last, but not least, where and how did Huie learn that Ray had nourished expectations of a pardon, and had hoped for a successful Wallace candidacy?

As related in Part 1, Solomon Jones, the chauffeur for Dr. King during his stay in Memphis, told this writer less than 30 minutes after King was shot that he was looking directly into King's face as the civil rights leader was hunched over the railing of the second story balcony of the Lorraine Motel. King had asked Jones if he thought it was cool enough for him to wear a top coat. The shot was fired as Jones was responding to the question.

Jones said he turned and saw a man with a white sheet on his face and a rifle in a clump of bushes in back of Jim's Cafe, across Mulberry Street from the Lorraine Motel. Jones said he thought he saw the man throw something from the bushes and then duck down

(please turn to page 35)

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.*

SIXWORDO

In this puzzle, the problem is to paraphrase a passage (a series of connected 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. Usually, the number of sentences in the paraphrase is 4 or 5 times the number of sentences in the original passage.

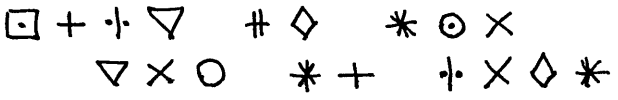
SIXWORDO PUZZLE 7411

Consider the machines, equipment, and supplies – the technology – for informing people in general about what is going on in the world. That technology becomes more and more expensive, more and more powerful. Along the road of development and progress of that technology, there is a place where all that technology has become so expensive and so powerful that it is monopolized and controlled by the establishment. When that place is reached, it produces the predictable end of the rights of an ordinary citizen to be informed, to know the truth, to hear conflicting sides to the news and to arguments. (Hint: One solution contains 17 sentences.)

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 CS or KS for X or vice versa, etc. But the spaces between words are kept.

MAXIMDIJ PUZZLE 7411



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 7411

```
          M O N E Y
      x S T E A L S
      -------------
        O E N U Y L
      E S N Y L T      A = H
    N M U Y T S
  S S S H N N
Y L U S M A
O E N U Y L
-------------------
= S N S U T N O U T E L
    44276    6508
```

NAYMANDIJ

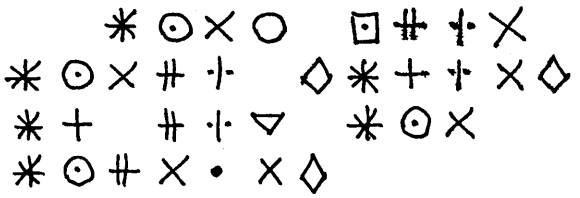
In this kind of puzzle an array of random or pseudorandom digits ("produced by Nature") has been subjected to a "definite systematic operation" (chosen by Nature") and the problem ("which Man is faced with") is to figure out what was Nature's operation.

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 7411

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



GIZZMO

1. From Lawrence M. Clark, Framingham, Mass.

In May you published GIZZMO PUZZLE 745. I would like to know the solution to it – or at least to have a further hint for solving it.

2. From the Editor

What we published in the May issue was:

GIZZMO

The problem is to grasp relations between things that are not identified in the usual way – their names cannot be looked up in the dictionary – and then solve a problem involving them. A case could be argued that this is an extension of Lewis Carroll's poem, "Jabberwocky".

For the following puzzle, we hope to publish in the July issue the best solution received before June 10 from a reader of *Computers and People.*

GIZZMO PUZZLE 745

Problem: A DULONG is solid and has isometric symmetry. It has 14 sides of two kinds. Take 8 of the sides all of the same size and shape, and assemble them into a solid KIFIT. Take the other 6 sides of the DULONG which are also all of the same size and shape, and make them into a solid DRIST. Rest the KIFIT on top of the DRIST. Measure or calculate the combined height. How much higher is the resulting height than the height of the original DULONG? (*Hint:* A rectangular room 9 feet long, 9 feet wide, and 9 feet high has isometric symmetry.)

COMMENT

You will observe that we only undertook to publish "the best solution received before June 10". And no solutions have been received to date.

But, aside from this dodge, the given information leads at once towards a solution. The only isometric solid with 8 sides of the same size and shape is an octahedron, which is bounded by 8 equilateral triangles. So a KIFIT is an octahedron. The only isometric solid with 6 sides of the same size and shape is a cube, which is bounded by 6 squares. So a DRIST is a cube. And a DULONG is therefore a cubo-octahedron, having 8 equilateral triangles and 6 squares as its sides. A picture of this solid is shown in many good dictionaries. It can be thought of as a cube with its 8 corners cut off flat in such a way that each of the 12 edges of the cube is reduced to its mid-point. The problem is now reduced to a little figuring in solid analytic geometry.

How is this for Hint No. 2?

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

CORRECTION

On page 22 of the October issue, in Algorithmo 7410, in the example, in two places, substitute "C" for "B". We regret the error.

SOLUTIONS

NUMBLE 7410: The easiest path is failure.

MAXIMDIJ 7410: Even a lean elevant is valuable. (v/ph)

ZOONAYMAN 7410: Align 3's diagonally.

NAYMANDIJ 7410: Make row 5 even.

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

Our thanks to the following individuals for sending us their solutions to – **Maximdij 749:** C. B. A. Peck, State College, Pa. – **Numble 749:** T. P. Finn, Indianapolis, Ind.; John F. Gugel, Arlington, Va.

ACROSS THE EDITOR'S DESK
Computing and Data Processing Newsletter

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APPLICATIONS

ENVIRONMENT-ORIENTED TASKS PERFORMED BY STEEL PLANT'S COMPUTER

Ameron, Inc.
Communications Dept.
Monterey Park, CA 91754

A steel products company has found that a computer can help reduce air pollution significantly and save electricity at the same time. Ameron Steel Producing Division receives reports from its IBM 1800 that enable the company to estimate how well it is meeting state air-quality standards. The reports are used as information on compliance by air-quality agencies. The procedure has an added benefit — profits.

"We have found that by limiting how long our furnace roofs are open we can lower pollution levels and improve productivity," said Jack Miller, vice president and general manager. "Naturally, the lower the heat losses through the roof, the less electricity we need to operate those furnaces."

Sensors attached to the computer automatically report each opening and closing. It was believed that the roofs were staying open only long enough for scrap metal to be dropped into the furnace, a procedure that takes only a few seconds. However, it was found that they were actually staying open longer than necessary. With regular reports from the computer, open time is being held to a bare minimum.

The IBM system performs other environment-oriented tasks at the Ameron mill in Etiwanda 40 miles east of downtown Los Angeles. For the furnaces themselves, the computer monitors and reports the usage of electricity. Preset limits of power demand are observed for every 30-minute interval around the clock. The computer notifies the melter and suggests curtailment if a problem exists. If he fails to take action, the computer will cut the power. Savings in electricity alone more than equal the monthly cost of the data processing system. "We've found that we can use power more effectively without any sacrifice in production or quality."

At Ameron, scrap metal is melted down at temperatures as high as 3,000 degrees and continually cast into billets 4-1/2 inches square. Eventually these are hot rolled into rod and bar for use in various finished products, including cold-drawn wire and welded steel fabric for manufacturing and construction. This process of recycling scrap fits in well with regional ecology efforts.

But each batch of scrap metal is different. So after a spectrograph analyzes a sample of the batch for 15 basic trace elements, the computer assigns a quality value to the batch and recommends a particular use for each billet. Thus one batch might be of sufficient quality to be made into coil for plating-quality wire, while another one might meet the requirements for reinforcing rods or tie wire. The billets are then identified and stored until needed.

If the basic ingredients supplied to the furnace don't blend into a proper mix, the computer prints out which additives — and how much of each — are needed. In addition, it monitors the amount of oxygen used to aid refining in the big furnaces.

"The computer helps us follow the best possible practices throughout our plant," Mr. Miller said. "It's a tool that almost every one of us can use to get the job done more efficiently."

PATROL CAR COMPUTER UNCOVERS ORGANIZED CAR THEFTS

Jim Furlong
Computer Sciences Corp.
650 North Sepulveda Blvd.
El Segundo, CA 90245

A patrol car computer, operated like a simple hand-held calculator, has helped Michigan police break up a stolen car ring. When city and state police at Wayne, Mich., raided a junkyard believed to be the ring's headquarters, they were confronted with the task of laboriously checking vehicle identification numbers of more than 500 automobiles to find stolen cars among them.

To follow their usual check-out procedure would have tied up manpower and communications circuits for hours. So, to solve the problem, Wayne police called for help from the nearby Dearborn Heights police department. Each of the 15 Dearborn Heights patrol cars carries a newly installed two-way portable computer manufactured by Atlantic Research Corp. of Alexandria, Va.

As workmen pulled each car from the junkyard stacks, a policeman relayed the car's vehicle identification number to a Dearborn Heights patrol car stationed in the junkyard. The driver punched the number into the computer terminal in his car and pushed the computer's "transmit" key. Computer programs (developed for the Arcom system by CSC) automatically used the police car's radio to send the I.D. number to a minicomputer at police headquarters. The minicomputer's programs then flashed the number to State Law Enforcement Information Network computers in Lansing. These computers checked the number against a list of stolen cars, and sent the answer back to the patrol car.

(more)

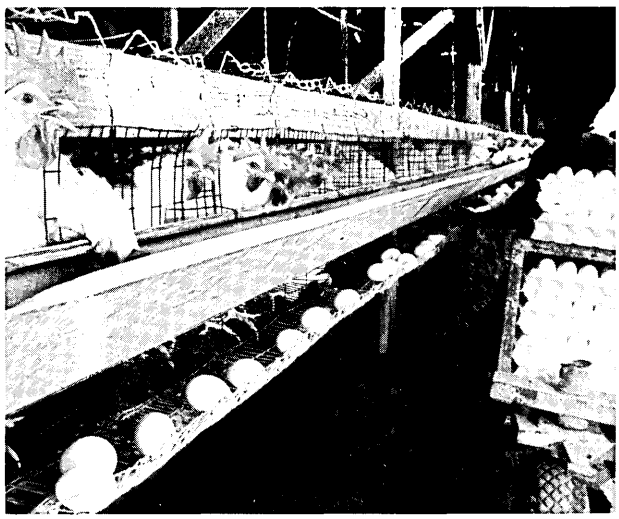
With the three computers talking electronically to each other, policemen in the junkyard usually knew within three or four seconds whether they had a "hit" (stolen car) or a "no-hit". More than a dozen stolen vehicles were found among the first 80 cars checked out. "All I can do is praise the computer operation of the Dearborn Heights police cars," said Wayne Police Chief Walter McGregor. "This was the perfect opportunity to use the computers because of the great number of cars to be processed."

Dearborn Heights police are making greater use of the State Law Enforcement Information Network with the new system, and consequently getting more results from their queries on suspect vehicles and outstanding arrest warrants. Detective Robert Salem said patrolmen scored 130 "hits" in August, compared with the 20 to 25 customary before the system was installed earlier in the summer.

A MILLION-PLUS HENS DINE ON COMPUTER-BLENDED FEED

Prohoroff Poultry Farms
380 So. Twin Oaks Valley Rd.
San Marcos, CA 92069

Agricultural science and the latest in computer technology are being applied to enhance the food value of eggs produced at Prohoroff Poultry Farm. Prohoroff, which produces an average of one million marketable eggs a day on its 600-acre farm north of San Diego, uses two computers to insure that its hens receive the most nutritious diet possible.



— A Prohoroff worker gathers freshly laid eggs to be sized, graded and rushed to markets all over the West.

An IBM 1130 computing system helps determine recipes used in blending feed for the firm's 1.2 million hens. Another computer, an IBM System/7, controls the actual feed mixing operation to make sure that the amounts of ingredients used correspond to the formulas prescribed by the first computer.

According to John Prohoroff, general manager, "The nutritional value of eggs is a direct result of the hens' diet — the quality of feed blends they receive." To maintain this high standard, Prohoroff blends its own feed mixes and changes them frequently. Formulas are recalculated as often as six times a week for each flock (70,000 hens each).

(more)

The best diet for each flock varies constantly. As weather changes and the hens grow, their dietary needs change. To maintain an egg-a-day rate, each hen must be fed hefty doses of high-energy food. If a flock's production rate drops, feed blends must be quickly bolstered.

Fluctuating commodity prices are another reason for frequent feed changes. The 1130 computing system takes the ups and downs of commodity prices into account. For example, if the price of a particular ingredient, like soybeans or corn, increases substantially, the computer may select a less costly alternative that fulfills the same dietary need.

Formulas generated by the computer include ingredients from four basic categories: cereal grains like corn and millet; high-protein foods, soy beans and meat by-products, for example; minerals such as calcium and phosphorous; and concentrated vitamin supplements. More than 1,000 tons of feed are mixed each week in the farm's computer-controlled mill. To insure that actual blends correspond to amounts specified in the formula, conveyor belt "load cells" weigh the ingredients as they move toward the mixing chutes.

The System/7 compares real weights with the target weights that were set in the blend formula, and it operates mill chute doors, which automatically open and close to control the flow of grain that pours into the mixing mechanism.

The Prohoroff farm, begun 30 years ago with a few hens housed in a garage, is now one of the nation's largest egg producers, serving many market chains in Southern California, and also shipping its eggs to points east such as Denver, Colorado.

FOREST MANAGEMENT MODEL FOR WISCONSIN'S JACK PINE RESOURCES

Hannah Pavlik
University of Wisconsin-Madison
610 Walnut St., Rm. 1215
Madison, WI 53706

When the jack pine budworm attacks, pine needles fall, timber production declines, and the already tight supply of pulp and paper decreases.

The potential for extensive budworm damage to Wisconsin's jack pine resources should not be disregarded, says John Brodie, Ph.D., forester at the University of Wisconsin-Madison. Brodie has evaluated alternative management and control approaches to the budworm problem. The study was undertaken with the Wisconsin Department of Natural Resources, and the result is a regional forest management model for Wisconsin's jack pine resources. The model demonstrated need for intensified jack pine management and definite harvesting priorities. It also calls for considerably reduced rotation periods.

The study focuses on 300,000 acres of forest in northwestern Wisconsin. The region is an important contributor to the state's total production of pulpwood and has a long history of budworm infestation. Pressures on the jack pine resource have been steadily increasing during the last decade because of reduced imports and rising demands for pulp and paper.

Brodie feels that existing management approaches are incapable of meeting future demands and often unnecessarily contribute to the budworm problem. Intensified management could result in higher cut-

ting levels, he says. This would accelerate growth, increase yields, reduce insect damage, and reduce insect control costs. Brodie's analysis of alternative budworm control strategies was accomplished by computer simulation. His model is structured into three major segments which simulate the forest over a period of 50 years. The segments include: information on forest growth and harvest; insect attacks; and forest management.

Current management practices in Wisconsin apply a 50-year average rotation to jack pine. Every year the allowable cut is determined by dividing the size of a site by its rotation period. The simulation model revealed an alternative management possibility. With the rotation period reduced to 35 years, and with the best sites harvested first, results showed that current management policies were by no means the most efficient. The shorter rotation spurred jack pine growth, raised yields, and increased harvest volumes.

Some experiments simulated environments free from insect attack, others simulated infestation. Several combinations of chemical and silvicultural control measures were applied. The experiments suggested that shorter rotations produce higher yields in infested areas. (Further information may be obtained by contacting John Brodie at the above address.)

GLOBAL TEMPERATURE DROP STUDIED WITH COMPUTER MODEL OF EARTH'S ATMOSPHERE

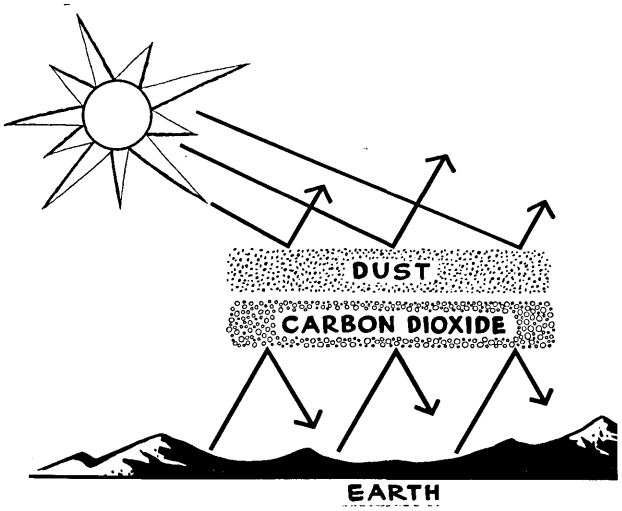
E. D. Okun
IBM Data Processing Division
3424 Wilshire Blvd.
Los Angeles, CA 90005

Two IBM scientists are creating mathematical simulations of the atmosphere with a computer to investigate a climatic process that may be contributing to the global cooling trend of the past three decades. The mean annual temperature near the surface of the earth has decreased by about one-half of one degree Fahrenheit since the 1940s, according to observations by the world network of weather stations. The decline marks the end of a warming cycle that began in the late 1800s following the "Little Ice Age" of the previous three centuries.

The earth's temperature depends upon how much of the sun's radiation penetrates the atmosphere to the surface and remains there in the form of heat, and also upon how much radiation is returned by the planet to space as heat. This process of radiation "transfer" in the atmosphere is being studied with the aid of an IBM System/360 Model 91 by Dr. Norman Braslau of IBM's Thomas J. Watson Research Center in Yorktown Heights, N.Y., and Dr. J. V. Dave of the company's Scientific Center, Los Angeles.

Of particular interest to the atmospheric physicists are two byproducts of the industrial age which may affect the long term climate of the earth: carbon dioxide from the combustion of fossil fuels, and dust particles from both natural and man-made sources. Carbon dioxide acts like the glass in a greenhouse to trap heat at the surface of the earth. Dust, on the other hand, makes the atmosphere less transparent to incoming solar radiation and can produce a cooling effect under certain conditions.

The "greenhouse effect" of carbon dioxide was cited to explain some of the increase in the mean temperature of about one degree F between 1880 and 1940, a period of expanding industrialization and stepped-up burning of fossil fuel.



The recent cooling trend was attributed by some scientists to a hypothetical layer of dust that was bouncing an increasing amount of solar radiation back into space, thereby intensifying the planet's "albedo", or the measure of its overall reflectivity. Supporters of the dust theory noted that suspended particles were associated with temporary global temperature decreases during periods of major volcanic activity between 1882 and 1890 and between 1900 and 1915 when tons of matter were spewed into the upper atmosphere.

As a practical matter, the atmosphere cannot be enclosed in a laboratory for controlled experiments to evaluate such a hypothesis. But scientists using a computer can mathematically manipulate a model "atmosphere" to see how the alteration of one component — such as dust — might affect the total system. This is what Dr. Braslau and Dr. Dave are doing. Their initial results indicate that the effect of dust on the earth's albedo, or reflective power, has been overestimated.

The computer simulations are being carried out in several stages. The initial models took into account the reflection of some radiation by the ground, and the partial absorption of radiation by gases such as ozone and carbon dioxide, and by water vapor and dust. "We varied the amount of dust in the computer model to see how it affected the radiation transfer process," Dr. Dave said. "We found that increasing the dust could lead either to heating or cooling, depending on the type of dust, its location in the atmosphere and the position of the sun."

Clouds are now being introduced into the model, which makes the computer simulation more realistic but vastly complicates the calculations. Much of the work of Dr. Braslau and Dr. Dave involves adapting mathematical techniques to simplify the computations without sacrificing accuracy.

They say that any meaningful or reliable prediction of the course of the earth's climate over the next 100 years would require numerical simulation of a much more sophisticated model. It must include not only the processes of solar and terrestrial radiation transfer with absorbing substances such as ozone, water vapor and carbon dioxide, but also incorporate the processes of cloud formation, evaporation, and general circulation of the atmosphere.

"Such complex systems, in which each element is dependent on the other to a greater or lesser extent, are uniquely suited to the computer modeling technique," Dr. Braslau said.

CHASTAIN — *Continued from page 29*

again. Jones said he then "hunkered down" because he was afraid the man was going to fire a second shot. When he rose up again, he saw the man again — sans white sheet on his face and rifle — and that the man casually walked out of the bushes and joined several excited firemen running toward the motel. He then walked onto the Lorraine property and got within 25 feet of Jones, but then "sorta disappeared in the mob," Jones said. Pandomonium prevailed. Persons were running onto the motel property from every direction, so Jones and at least 40 other witnesses have said.

Credibility of State's Witnesses

Jones' statements were partially substantiated by Chauncey Eskridge, Chicago counsel for the SCLC and legal advisor to Dr. King. Eskridge said he was standing below the second floor balcony near Jones when the shot was fired. Unlike Jones, however, Eskridge said he did not notice the man that Jones supposedly saw in the bushes, because he immediately ran to the stairway so he could go up and see if Dr. King was still alive.

Eskridge, however, confirmed Jones' statement that the shot caused an upward motion of Dr. King's body — evidence that suggested that the bullet traveled an upward trajectory and therefore was fired from the ground level with the first floor rather than from the second story of the rooming house.

Under the "res gestae" — a legal term denoting and describing events that occur so close to the time a crime was committed that they bear special relevance — Jones' testimony at Ray's trial would have cast doubt on the prosecution's entire theory as to who, and how King was killed.

Under the "res gestae" rule, statements made by witnesses in response to a shocking or traumatic event — an explosion, a car wreck, a murder, etc. — are generally admissible. They can even include hearsay testimony, because "res gestae" provides one of the well-known exceptions to the general rule that bars hearsay testimony from a trial.

The metaphysical presumption at law is that "res gestae" statements are not prompted by the minds of the speakers, but spurred by the spontaneity of the event itself. It is the event itself that is speaking, through the medium of the witnesses.

A more modern and less abstruse rationale for admitting "res gestae" testimony is that if the statements are uttered as spontaneous responses to the event, common sense suggests that the witnesses are speaking before they have had time to re-construct the event in their minds. Or, the witnesses spoke so spontaneously that they did not have time to think up an elaborate lie.

Jones told me this story about 6:15 p.m. Thus, Jones' statement to me and even statements made by myself confirming Jones' statement— clearly hearsay — might have been admissible at the trial under the "res gestae" rule.

Part 11 — Conclusion

Footnotes

1. The Tribune, of course, is a strong Republican paper and feared Wallace as cutting into the strength of the 1968 GOP nominee. □

FORUM — *Continued from page 3*

Swedish commerce made considerable preparations for a financial computer data complex linking banks, de= department stores, and other large money users.

If the public had allowed the completion of these developments, it might now be too late for the country to turn back from an unintended tyranny of information technology.

"THE ALMOST INVISIBLE MOUNTAIN" — SOME COMMENTS

1. From J. E. Sands
Manager, Business Systems Development
Carpenter Technology Corp.
P.O. Box 662
Reading, PA 19603

I was very much impressed with your excellent editorial "The Almost Invisible Mountain" in the September issue of "Computers and People". So much so in fact that I hope to make a copy of it available to the membership of our local DPMA chapter. May I reproduce the entire editorial in the monthly newsletter of our chapter? Of course, credit to you and to "Computers and People" would be shown.

2. From the Editor

We are glad to give you permission to reproduce the editorial in your newsletter. Would you please include the enclosed reprinting clause?

APPLICATIONS OF COMPUTERS FOR LOCAL GOVERNMENTS

From: Philip C. Howard, Publisher
Applied Computer Research
Post Office Box 9280
Phoenix, AZ 85068

To: Thomas J. Downey, Legislator
County of Suffolk
4 Udall Rd.
West Islip, NY 11795

I read with interest your letter in the September issue of "Computers and People". Like Mr. Berkeley, I don't have the answers you are seeking, but I thought you might be interested in knowing about our publication, the "Quarterly Bibliography of Computers and Data Processing".

The bibliography is organized by subject and covers many areas in which you expressed some interest. For example, applications in government, politics, law enforcement, urban planning, etc.; computers and the law; security; privacy; social implications, etc. The answers you are seeking may not be here, but I think you would find it a valuable research tool.

I've enclosed a sample issue for your information.

A fabulous gift:

18 illustrations in pen and ink

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

by Edmund C. Berkeley, Author and Anthologist

Published by Quadrangle/The New York Times Book Co., 1974, 224 pp, $6.95

Table of Contents

The Fox of Mt. Etna and the Grapes

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

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

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